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NIST Special Publication 500
NIST SP 500-290e4-upd1

Information Technology: Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information

ANSI/NIST-ITL 1-2025
Revision of ANSI/NIST-ITL 1-2011 Update 2015

Jennifer Stathakis
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https://doi.org/10.6028/NIST.SP.500-290e4-upd1

NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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October 2026

Includes updates as of 10-16-2026; see Appendix A



U.S. Department of Commerce
Howard Lutnick, Secretary

National Institute of Standards and Technology
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NIST SP 500-290e4-upd1
October 2026

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Publication History

Approved by the NIST Editorial Review Board on October 16, 2026
Supersedes NIST Series 500-290 Edition 4 (March 2026) https://doi.org/10.6028/NIST.SP.500-290e4
Supersedes NIST Series 500-290 Edition 3 (July 2016) http://dx.doi.org/10.6028/NIST.SP.500-290e3

How to Cite this NIST Technical Series Publication

NIST (2026), Information Technology: American National Standard for Information Systems -Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) 500-290e4-upd1. https://doi.org/10.6028/NIST.SP.500-290e4-upd1

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Abstract

This document is an open voluntary consensus standard governing the transmission of biometric data and metadata to and from biometric systems. It is produced using the Canvassee method. This standard promotes interoperability in the exchange of such data.

Keywords

automated biometric identification systems; biometrics; biometrics exchange; biometrics transmission; border control; criminal justice; dental records; face, fingerprint; forensics; friction ridge; identification; interoperability; iris; latents; law enforcement; minutiae; needle marks; scars; SMT; tattoos; verification; voice; WSQ.

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Acknowledgments

Work on a proposed update for the ANSI/NIST-ITL standard began with a virtual Workshop on February 21, 2023. The workshop participants voted to create eight working groups. Stakeholders involved in the ANSI/NIST-ITL process were invited to submit comments on the standard, with the resulting issues being assigned to the appropriate working groups. The discussions and consensus of these groups have led to the revisions in this document. The following people contributed to the standard though direct participation in the following roles and topic-specific working groups.

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August 24-29, 2025

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The conformance testing methodology and test assertions for the 2011 version are documented in NIST SP 500-296 R.1 and were developed by the following team: Fernando Podio, Christofer J. McGinnis and Dylan Yaga.

The conformance testing methodology framework and assertions for the 2013 version area documented in NIST SP 500-304, and were developed by Christofer J. McGinnis, Dylan Yaga and Fernando Podio.

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Executive Summary

Information compiled and formatted in accordance with this standard may be recorded using machine-readable media and may be transmitted by data communication facilities. Law enforcement, criminal justice agencies, border control, and other organizations that process biometric data use the standard to exchange identity data such as images of fingerprints, palm prints, plantars, faces, iris, DNA, and other body parts including scars, (needle) marks and tattoos (SMT).

Introduction

The first version of this standard, ANSI/NBS-ICST 1-1986, was published by NIST (formerly the National Bureau of Standards) in 1986. It was a fingerprint minutiae-based standard. Revisions to the standard were made in 1993, 1997, 2000, and 2007, 2008, 2011, 2013 and 2015. Updates to the standard are designed to be backward compatible, with new versions including additional information. All of these versions use "Traditional" encoding except for 2008, in which a "NIEM-conformant encoding" using eXtensible Markup Language (XML) was adopted. NIEMOpen is an OASIS Open community located at https://niemopen.org/. NIEM is designed to improve data quality by providing a common semantic approach in XML/JSON applications. With some minor exceptions, the 2007 and 2008 versions of the standard are equivalent except for the encoding format. In 2009, an amendment to the 2007 and 2008 versions was approved that extended codes to handle multiple finger capture.

The 2011 version of the standard does not restrict encoding to any particular format. However, in cases where an alternative encoding (i.e., other than Traditional or NIEM-conformant XML) is used, the sending and receiving parties shall document encoding rules and assumptions.

This standard defines the structure and format of the records contained in a transaction that may be transmitted to another site or agency. An ANSI/NIST-ITL transaction is called a file in Traditional encoding and an exchange package in XML/JSON encoding. Encoding-specific is given in each field definition, and in the respective Appendix.

A transaction is comprised of records. Each Record Type is defined in this standard. Certain portions of the transaction may be in accordance with definitions provided by the receiving agency, as described in the standard.

1. Scope

This standard defines the content, format, and units of measurement for the electronic exchange of fingerprint, palm print, plantar, facial/mugshot, scar, mark & tattoo (SMT), iris, deoxyribonucleic acid (DNA), and other biometric sample and forensic information that may be used in the identification or verification process of a subject. The information consists of a variety of mandatory and optional items. This information is primarily intended for interchange among criminal justice administrations or organizations that rely on automated identification systems or use other biometric and image data for identification purposes.

One transaction may pertain to a specific subject or contain information for multiple subjects. The definition for a given transaction should specify clearly whether all records apply to a single subject (such as in a criminal arrest transaction), have multiple records each of which applies to a different subject (such as a search result transaction), or have records that themselves contain multiple subjects (such as a Type- 11 recording with multiple speakers).

2. Conformance to the Standard

2.1. Verbal Forms for the Expression of Provisions

The following terms are used in this standard to indicate mandatory requirements, recommended options, or permissible actions.

The terms “shall” and “shall not” indicate requirements to be followed strictly in order to conform to this standard and from which no deviation is permitted.

The terms “should” and “should not” indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is discouraged but not prohibited.

The terms “may” and “need not” indicate a course of action permissible within the limits of this standard.

A system is conformant to this standard if it is capable of generating or using transactions that are morphologically, syntactically and semantically conformant to the requirements of this standard. Transactions shall consist of one Type-1 record and one or more of the Type- 2 to Type-99 records. For the structure of a transaction, see Section 5.4. For a description of the Record Types, see Section 6. Prior versions of the standard only required a Type-1 record.

2.2. Morphological (Level 1) conformance

Morphological conformance deals with the form and structure of the internal content and verifies that data structures exist and have allowable values. Specifically, it checks for the structure and value of each field, subfield and information item in a transaction.

A transaction conforms morphologically to this standard if it satisfies all of the normative morphological requirements related to its data structure and data values, as specified throughout Section 5 Data Conventions and Section 6 Record Types Data Dictionary specifications. If the system claims conformance with a particular encoding, then it shall satisfy the requirements of either Appendix B: Traditional encoding or Appendix C: NIEM-conformant encoding rules, as appropriate.

The following example, taken from the Type-9 Friction Ridge Metadata Record (see Section 6 Record Types Data Dictionary), illustrates data value conformance. This excerpt illustrates a field with a single subfield that contains one mandatory and one optional information item. (See Section 5.4 Structure of a Transaction for information about fields, subfields and information items). Note the “Value Constraints” fields, valid values for Field 9.301 ORT / EFS Orientation and its information items are shown there.

9.301	ORT / EFS Orientation
This field allows the orientation (deviation from upright) and its uncertainty to be specified. See Appendix F.5.1.1, Field 9.301: ORT / EFS Orientation instructions for more information about this field. If this field is omitted, the direction shall default to	

0 (upright) and uncertainty shall default to 15, indicating that the image is rotated 0±15°. If orientation cannot be determined, the uncertainty value shall be set to 180.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) EOD EFS Orientation Direction

The first information item shall contain the deviation of the region of interest from upright (fingertip up) in integer degrees. Positive angles are counterclockwise, negative angles are clockwise. A value of '0' indicates an upright direction. The allowed special character is the negative sign.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	-179 ≤ integer ≤ 180. (1-4 NS)

2) EUC EFS Uncertainty

The second information item contains the uncertainty of the orientation direction, in non-negative integer degrees; the resulting orientation is Direction± Uncertainty°.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 180. (1-3 N)

Testing this type of conformance for Field 9.301 requires verifying that if ORT exists, it occurs once only, and has only one Subfield, followed by verifying that the value for the mandatory information item EOD exists and is an integer value between -179 and 180, inclusive. The notation "1-4 NS" in the Value Constraints field indicates that 1 to 4 numeric (N) and special (S) characters are allowed, i.e., not alphabetic (A) ones. If the optional information item EUV exists, it must occur once only, and the value must conform to the Value Constraints as listed.

2.3. Syntactical (Level 2) conformance

Syntactical conformance deals with explicit requirements that check for internal consistency and ensure that values are compatible with this standard. Specifically, syntactical conformance

checks for the relationships between fields, subfields, or information items within a transaction to other values within the same transaction as specified in this standard.

Transactions that claim syntactical conformance to this standard shall satisfy all of the normative requirements related to the relationships between fields, subfields, or information items as described in Sections 5 and 6 for each implemented record type. If the system claims conformance with a particular encoding, then it shall satisfy the syntactical requirements of either Appendix B: Traditional encoding or Appendix C: NIEM-conformant encoding rules, as appropriate.

An example of this type of conformance is:

Field 17.026 IRD / Iris Diameter is restricted to values between 10 and 9999, inclusive. A value of 200 for Field 17.026 is in the allowable range for IRD and would therefore be morphologically conformant. However, if Field 17.031 IAP / Subject Acquisition Profile – Iris is 40, then Field 17.026 IRD / Iris Diameter shall be greater than or equal to 210. (See Section 5.14.3 IAP / Subject Acquisition Profile for Iris . Testing for syntactical conformance involves comparing values within a transaction, therefore, if IAP is 40, an IRD value of 200 is not syntactically conformant.

2.4. Semantic (Level 3) conformance

Semantic conformance checks determine if the biometric transaction is a faithful representation of the parent biometric data and ensures requirements are satisfied that are not merely syntactical or morphological. Individual fields may have explicit semantic requirements in addition to syntactic requirements.

Transactions that claim semantic conformance to this standard shall satisfy the semantic requirements as described in Sections 5 and Record Types Data Dictionary (Normative)6 of this standard for each implemented record type.

Some examples of semantic conformance are:

For a Type-9 friction ridge metadata record, there is a minutia corresponding to each set of coordinates (x, y, t) of the location encoded in the record.

For a Type-10 record, a subject acquisition profile (SAP) Level 50 image shall comply with semantic requirements including the position and size of the face within the image, angle of view, and lighting. See Section 5.14.1 for more information about the SAP specifications for face.

3. Normative References

The following referenced documents are useful for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. All standards are subject to revision, and parties using this American National Standard are encouraged to investigate the possibility of applying the most recent versions of the standards indicated below.

AAMVA International Specification – DL/ID Card Design. https://www.aamva.org/publications-news/best-practices-standards

American Board of Forensic Odontology, Diplomates Reference Manual. http://abfo.org/resources/abfo-manual/

ANSI/ADA Standard No. 1058, Forensic Dental Data Set. http://webstore.ansi.org

ANSI/ADA Specification No. 1067 Standard Functional Requirements for an Electronic Dental Record System. http://webstore.ansi.org

ANSI/ADA Specification No. 3950, Designation System for Teeth and Areas of the Oral Cavity. It is available at http:webstore.ansi.org This contains the same information as: ISO 3950:2016 Dentistry – Designation system for teeth and areas of the oral cavity. http://www.iso.org/

ANSI/ASB (2024), *Best Practice Recommendation 165, Best Practice Recommendation for Analysis of Friction Ridge Impressions*. https://www.aafs.org/asb-standard/best-practice-recommendation-analysis-friction-ridge-impressions

ANSI/ASB (2024), *Best Practice Recommendation 166, Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions*. https://www.aafs.org/asb-standard/best-practice-recommendation-comparison-and-evaluation-friction-ridge-impressions

ANSI/ASB (2025), *Standard 013, Standard for Friction Ridge Examination Conclusions.* https://www.aafs.org/asb-standard/standard-friction-ridge-examination-conclusions

ANSI/INCITS 385-2004, *Information technology - Face Recognition Format for Data Interchange.* https://webstore.ansi.org

ANSI/NIST-ITL 1-2011 Update: 2015, NIST Special Publication 500-290e3, *Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information*. http://dx.doi.org/10.6028/NIST.SP.500-290e3

ANSI/NIST ITL 1-2011 NIEM IEPD Exchange and Subset Schemas. https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references

ANSI/NIST ITL 1-2011 Update:2013 NIEM IEPD Exchange and Subset Schemas. https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references

ANSI/NIST ITL 1-2011 Update:2015 NIEM IEPD Exchange and Subset Schemas. https://www.nist.gov/itl/iad/image-group/ansinist-itl-standard-references

ANSI X3.4-1986 (R2022), Information Systems --- Coded Character Sets --- 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII). https://webstore.ansi.org

Department of Defense, DISA, *Universal Grids and Grid Reference Systems, Version 2.0.0, 28 February* 2014 (DISR, ESB) OR *The Universal Grids and the Transverse Mercator and Polar Stereographic Map Projections* OR *Time-Space-Position Information (TSPI), Version 2.0.1, 3 August 2020* (DISR, ESB) AND *Time-Space-Position Information - XML Exchange Schema*, Version 2.0.1 https://nsgreg.nga.mil/registries/search/index.jsp?registryType=doc

Federal Bureau of Investigation; *The Science of Fingerprints*; Rev 12-84; ISBN 9780160760785. http://www.gutenberg.org/ebooks/19022 and http://bookstore.gpo.gov/

FBI CJIS, Personal Identity Verification (PIV): *Image Quality Specifications for Single Finger Capture Devices*. 10 July 2006. https://fbibiospecs.fbi.gov/file-repository/specifications/pivspec.pdf

FBI CJIS, *National Crime Information Center (NCIC) Code Manual*. https://wsp.wa.gov/wp-content/uploads/2025/04/NCIC-Code-Manual-March-2025.pdf

Federal Information Processing Standards Publication, FIPS PUB 180-4, Secure Hash Standard (SHS), August 2015. https://doi.org/10.6028/NIST.FIPS.180-4

242-HQ-A6687913-SYSDOCU *Criminal Justice Information Services (CJIS) Electronic Biometric Transmission Specification (EBTS)*. Version 11.2, September 20, 2023. https://fbibiospecs.fbi.gov

IAFIS-IC-0110 (V3.1) *WSQ Gray-scale Fingerprint Image Compression Specification*, October 4, 2010. https://fbibiospecs.fbi.gov

IEC 61966-2-1, *Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space - sRGB*. https://webstore.iec.ch/

INCITS 378:2009/AM 1:2010 (R2025), Information Technology - Finger Minutiae Format for Data Interchange. https://webstore.ansi.org/standards/incits/incits3782009am2010r2025

INCITS 398-2008 (R2023) *Information technology - Common Biometric Exchange Formats Framework (CBEFF).* http://webstore.ansi.org/standards/incits/incits3982008r2023

International Biometrics & Identification Association, CBEFF Registry. http://www.ibia.org/cbeff/

International Civil Aviation Organization, Document 9303, Machine Readable Travel Documents. https://www.icao.int/publications/doc-series/doc-9303

Internet Society, Internet Engineering Task Force, The Base16, Base32, and Base64 Data Encodings. http://tools.ietf.org/html/rfc4648

ISO 639-3:2023, *Codes for the representation of names of languages – Part 3: Alpha3 code for comprehensive coverage of languages.* https://www.iso.org/iso-639-language-code

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*. https://www.iso.org/iso-3166-country-codes.html

JPEG (Joint Photographic Experts Group), *JPEG File Interchange Format*, Version 1.02. http://www.w3.org/Graphics/JPEG/jfif3.pdf

ISO/IEC 646, *Information technology – ISO 7-bit coded character set for information exchange*. https://www.iso.org/standard/4777.html

ISO/IEC 10918, *Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines*. https://www.iso.org/standard/18902.html

ISO 12052:2006 *Health informatics – Digital imaging and communication in medicine (DICOM) including workflow and data management.* http://www.iso.org/. This is also known as National Electrical Manufacturers Association (NEMA) *PS3 Digital Imaging and Communications in Medicine (DICOM)*. https://www.dicomstandard.org/current/

ISO/IEC 14496-2, *MPEG4 Feature Points*, Annex C. https://www.iso.org/standard/39259.html

ISO/IEC 15444-1, *JPEG 2000, Information Technology - Digital Compression and Coding of Continuous-Tone Still Images Part 1: Requirements and Guidelines*. https://www.iso.org/standard/87632.html

ISO/IEC 15444-2, Information technology — *JPEG 2000 image coding system: Extension*, https://www.iso.org/standard/84573.html

ISO/IEC 15948:2004 *Information Technology -- Computer graphics and image processing -- Portable Network Graphics (PNG): Functional specification*. https://www.iso.org/standard/29581.html

ISO/IEC 19794-5, *Information technology—Biometric data interchange formats—Part 5: Face image data.* https://www.iso.org/

ITU-T G.711 *Pulse code modulation (PCM) of voice frequencies; with Amendment 1, Amendment 2, Appendix 1, and Appendix 2*. https://www.itu.int/rec/T-REC-G.711/e

MTR 04B0000022 (Mitre Technical Report), Margaret Lepley, *Profile for 1000 ppi Fingerprint Compression*, Version 1.1, April 2004. https://www.mitre.org/sites/default/files/pdf/lepley_fingerprint.pdf

National Geospatial Intelligence Agency, *World Geodetic System 1984, WGS 84*. The latest version is applicable. https://earth-info.nga.mil/php/download.php?file=coord-wgs84

NIEM, *Normative Specifications.* https://niem.github.io/reference/specifications/

National Institute of Standards and Technology, NIST Special Publication NIST SP500-334 Revision 1, *Contactless Fingerprint Capture and Data Interchange Best Practice Recommendation*. https://doi.org/10.6028/NIST.SP.500-334r1

NIST Fingerprint Image Quality 2, NIST Interagency/Internal Report (NISTIR), National Institute of Standards and Technology, Gaithersburg, MD. https://doi.org/10.6028/NIST.IR.8382

NIST Fingerprint Image Quality (NFIQ) 2, Optical live-scan and ink fingerprint image quality assessment tool. https://www.nist.gov/services-resources/software/nfiq-2

National Institute of Standards and Technology, *NIST Special Publication 800-76-2, Biometric Data Specification for Personal Identity Verification*, 2013. https://dx.doi.org/10.6028/NIST.SP.800-76-2

National Institute of Standards and Technology, *NIST Special Publication 500-289, Compression Guidance for 1000 ppi Friction Ridge Imagery*. https://doi.org/10.6028/NIST.SP.500-289

National Institute of Standards and Technology, *NIST Special Publication 1134, EFS Profile Specification.* https://doi.org/10.6028/NIST.SP.1134

World Wide Web Consortium, *W3C Extensible Markup (XML)* 1.0 (Fifth Edition), http://www.w3.org/TR/REC-xml/

World Wide Web Consortium, *W3C XML Schema* (Second Edition), http://www.w3.org/TR/xmlschema-1/ and http://www.w3.org/TR/xmlschema-2

4. Terms and Definitions

The following definitions apply to this standard.

ƛ

Unit of measure equal to 10 micrometers. One ƛ is equivalent to 1/100 mm, 1/1000 cm, or 1/2540 in. When converting between ƛ and pixels, this exact ratio shall be used in the conversion. The decimal approximation of the ratio (0.00039 inches, as indicated in previous versions of this standard) shall not be used.

µ-law

A companding algorithm used in North America and Japan that optimizes an analog telephone band signal while digitizing.

AAMVA

The American Association of Motor Vehicle Administrators.

ABFO

The American Board of Forensic Odontology

ABFO # 2 Reference Scale

A right-angle ruler designed by the ABFO that is used for patterned injury imagery. It includes three circles that are useful to determine distortion due to photography at different angles. The ruler itself is manufactured by several different sources. The correct name is the ABFO #2 Reference Scale, but it is commonly known as the ABFO # 2 ruler.

ABO

The American Board of Orthodontics

acoustic signal

Pressure waves in a media that have information content.

ADA

The American Dental Association

AFIS

Automated Fingerprint Identification System.

AGC

Automatic gain control is an adaptive system that effectively reduces the amplitude or energy of an audio signal if it is strong and raises it when it is weaker.

AIFF

The Audio Interchange File Format stores audio data in uncompressed pulse-code modulation (PCM). The file extensions commonly used are ‘.aiff’ and ‘aif’. See https://mmsp.ece.mcgill.ca/Documents/AudioFormats/AIFF/Docs/AIFF-1.3.pdf

A-law

A companding algorithm used outside of North America and Japan that optimizes an analog telephone band signal while digitizing.

allele

One member of a series of possible alternative forms of a DNA sequence found at a particular genetic location.

allele call

The value identified for the allele, either via expert system or by an analyst.

ANSI

The American National Standards Institute

antemortem

Prior to death.

Appendix F certified devices

This refers to devices that have successfully completed a test of fingerprint capture devices that is performed in accordance with procedures established by the FBI in *EBTS Appendix F*. See https://fbibiospecs.fbi.gov for *EBTS Appendix F* and the Certified Product List (CPL).

ASCII

The American National Standard Code for Information Interchange.

ASCLD

The American Association of Crime Lab Directors.

assigned voice

A voice to which an identifier has been attached. The identifier may or may not point to the person with that voice. For instance, the voice of an unknown speaker that has been previously encountered can be considered an “assigned voice” by attaching an identifier to it in earlier transactions.

aspect ratio

The width-to-height ratio of a captured image.

audio signal

Information in analog or digital form that contains acoustic content (voice or otherwise)

audio recording

A stored audio signal capable of being transduced into an acoustic signal.

automatic speech recognition

The process or technology which accepts speech as input and determines what was spoken.

BDB

Biometric Data Block used in CBEFF.

C-216C

Form C-216C is a fingerprint form used in Canada for background record checks.

CBEFF

Common Biometric Exchange Formats Framework. It provides a set of definitions used to exchange biometric data in a standardized manner. It forms the basis for Type-99 records.

CDEFFS

Committee to Define an Extended Fingerprint Feature Set.

CIE

The International Commission on Illumination (https://cie.co.at/). The color space that they defined is called CIELab. They have also developed a metric for color distance called ΔE_{1976} (Delta E) with 1976 indicating the version of the formula.

CJIS

The Criminal Justice Information Services Division of the FBI.

class resolution

The value of resolution (scanning or nominal) used to name (or identify) an acquisition process or image, where the resolution is within a specified tolerance around that value. Example: A scanner is referred to as “500 ppi” (class resolution) if the native scanning resolution is within 1% (5 ppi).

codec

A codec is a computer program that encodes and decodes a data signal, usually in a compressed format.

codec format

A codec format is the data structure produced by a codec.

companding algorithm

An algorithm that allows signals with a large dynamic range to be transmitted over facilities with a smaller dynamic range. It is used in telephony (see μ-law and A-law) and some other types of communications.

contactless fingerprint capture (n) (syn: touchless fingerprint capture)

The method of acquiring a finger characteristic without physical contact between the captured finger characteristic (i.e., the friction ridge structures) and the capture device. Minimal contact may be required to aid in positioning or steadying capture subject. Contactless fingerprint may refer to fingerprint impression type (akin to roll, slap); where a contactless fingerprint image type is one captured with a contactless capture method.

container

A format that describes how the data and metadata are stored in a computer file.

context data

Additional related image, audio, or waveform data in support of a biometric record.

COTS Software

The term “Commercial Off the Shelf Software” refers to ready-made commercially available software products that can be used to meet requirements.

CT scan

Computerized tomography scan.

current data

Data for the individual in his/her current state, not necessarily data recorded or created on the current date. For instance, current data on a subject may be a radiograph of a decedent taken at the time of burial several years ago that is now being compared to radiographs that had been provided for a missing person prior to the assumed date of death of the subject.

deprecated

The record type / field / subfield / information item / value / file shall not be used when claiming conformance to this version of the standard. (different than “legacy”)

derived representation

Biometric type record derived from a Type-20 source representation record, which may be another Type-20 record from which other biometric type records are derived.

diary

A list giving the start and stop times of speech segments within the voice signal, pertaining to the subject of the record. Diarization of segments from multiple speakers requires multiple Type-11 records, one for each speaker. These multiple Type-11 records may be contained in a single transaction, as long as the transaction is focused upon a single subject.

DICOM

The standard “Digital Imaging and Communications in Medicine” published by the National Electrical Manufacturers Association (NEMA).

DICOS

The standard “Digital Imaging and Communications in Security” published by the National Electrical Manufacturers Association (NEMA)

digital sample (n)

A representative value of a signal at a chosen instant, derived from a portion of that signal. From the Vocabulary of Digital Transmission and Multiplexing, and Pulse Code Modulation (PCM) Terms, ITU-T Recommendation G.701 (March 1993)

digitally sample (v)

Obtain the values of a function for regularly or irregularly spaced distinct values from its domain. From: ISO 2382-2-1976, Information technology – Vocabulary – Part 2: Arithmetic and logic operations

DNA

Deoxyribonucleic Acid. This is a chemical that forms a double helix that is unique to all but identical siblings.

domain

Implementation domain refers to the group of organizations or agencies that have agreed to use a specified set of user-defined fields in a particular format. This is the domain encoded in Field 1.013 DOM / Domain Name.

EBTS

Electronic Biometric Transmission Specification. Both FBI and the US Department of Defense use this name for their different application profiles of the ANSI/NIST-ITL standard.

EFTS

The FBI's earlier application profile of the ANSI/NIST-ITL standard: Electronic Fingerprint Transmission Specification. It has been superseded by EBTS.

EFS

Extended Feature Set for markup of friction ridge metadata, as specified in this standard, in fields within the range 9.300-9.399

EJI - entire joint image

An exemplar containing all segments over four *full finger* views for a single finger: one rolled; left, center, and right plain. See **full finger view**.

electropherogram

A plot of fluorescence units over time showing the measured peaks of a DNA molecule at various genetic locations.

endian (big or little)

The order of significance in a number. Big endian places the most significant byte (or digit) first. Little endian places the most significant byte (or digit) last. Humans tend to represent numbers as big-endian, with 10 representing ten and not one.

exemplar

The friction ridge prints of an individual, associated with a known or claimed identity, and deliberately recorded (also called 'known prints').

FastID

A European Union-funded project designed to develop an operational commonality of identification data between INTERPOL member countries in the event of a disaster. See http://www.interpol.int/contentinterpol/search?SearchText=FASTID&x=0&y=0

FD-249

The FD-249 is an Arrest and Institution Fingerprint card used for criminal submissions to the FBI and certain other law enforcement organizations. See http://www.fbi.gov/about-us/cjis/forms/description-fd249

FD-258

The FD-258 is the Applicant Fingerprint Card used for submission to the FBI and certain other law enforcement organizations as part of a background check. See http://www.fbi.gov/about-us/cjis/forms/description-fd258

fingerprint

Result (typically an image) of a successful capture attempt of a distinct anatomical structure or region containing friction ridge biometric characteristics.

fingerprint, flat (syn: plain fingerprint; plain finger impression)

A fingerprint resulting from the touching of a single finger parallel to a capture device without any rolling motion.

fingerprint, rolled

A fingerprint that contains surface area containing friction ridge skin from one edge of the finger's nailbed to the other.

FAP

Acronym for Fingerprint Acquisition Profile. It is a series of sets of progressively more stringent parameters and requirements relevant to fingerprint acquisition.

forensic

Pertaining to the use of analytic scientific techniques to establish or verify identity - in this standard, it applies to the examination and mark-up of images (sometimes manually).

Frankfurt horizon

The plane determined by the lowest point of the left eye socket and the tragions of the ears.

friction ridge image

still, two-dimensional *digital image* of *friction ridge skin*

(digital image defined in ISO/IEC 39794-4)

friction ridge skin

skin from volar surfaces of hands or feet

friction ridge mark (syn: latent print)

representation of *friction ridge skin* as a result of contact with a substrate

Note 1 to entry: Need not be a complete or uninterrupted reproduction of volar skin surfaces (i.e., may include areas of smudged, omitted, and/or overlapping volar skin).

Note 2 to entry: could be existing but not yet developed (latent).

(Source CD ISO/IEC 2382-37:2025)

full finger view

friction ridge image of a finger showing all segments.

GENC

Acronym for Geopolitical Entities, Names and Codes, which is the United States Government profile of the ISO 3166 standards. https://nsgreg.nga.mil/genc/registers.jsp

genotype

The entire genetic constitution of an individual; also, the alleles present at one or more specific loci.

GLP

Good Laboratory Practice. The United States has rules for GLP in 21CFR58. The Organization for Economic Co-operation and Development (OECD) has stated principles of GLP.

GMT

Greenwich Mean Time.

GPS

Global Positioning System.

Hz

Abbreviation for Hertz, which is the measure of the frequency of oscillations. It is the fundamental property of sound that determines pitch.

IAFIS

Acronym for the Integrated Automated Fingerprint Identification System of the FBI, now decommissioned.

IAP

Acronym for Iris Acquisition Profile. It is a series of sets of progressively more stringent parameters and requirements relevant to iris acquisition.

IBIA

International Biometric Industry Association.

ICAO

The International Civil Aviation Organization.

ICC

International Color Consortium.

IEC

The International Electrotechnical Commission.

ILAC

International Laboratory Accreditation Cooperation.

INCITS

The InterNational Committee for Information Technology Standards.

interdigital area

The portion of the palm along the base of the fingers.

interlocutor

A person who takes part in a dialog (Oxford English Dictionary Thumb Edition, 10th Edition, 2002). In Record Type-11, an interlocutor is any speaker in the recording who is not the subject of the ANSI/NIST-ITL transaction. An interlocutor may be the subject of the record, within the transaction, however.

INTERPOL

International Criminal Police Organization.

INT-I

The INTERPOL application profile of the ANSI/NIST-ITL standard, developed by the INTERPOL NIST Standard Implementation Working Group (INSIWG).

IREX

Iris Exchange Program. This is a program at NIST in support of iris-based applications based on standardized interoperable iris imagery. See http://www.nist.gov/itl/iad/ig/irex.cfm

iris

A thin, colored, approximately circular structure surrounding the pupil of the eye that contains features used for identification of individuals.

ISO

International Organization for Standardization.

ITL

Acronym for the Information Technology Laboratory of NIST. See http://www.nist.gov/itl/

JavaScript Object Notation (JSON)

A data format for exchange of information. This standard will use a JSON model consistent with NIEM-conformant schemas and information exchange package documentation (IEPD) specifications. See https://github.com/NIEM/NIEM-JSON-Spec for additional information.

JFIF

JPEG File Interchange Format. See http://www.jpeg.org

JPEG

Image compression and storage format specified by the Joint Photographic Experts Group. It is discrete cosine transform-based.

JPEG 2000

Image compression and storage format specified by the Joint Photographic Experts Group. It is a wavelet-based method.

known voice signal

A voice signal from an individual who has been "identified" or individuated in a way that allows linking to additional, available information about that individual.

(allelic) ladder

A composition of DNA fragments that represents common alleles at a locus.

latent print

An impression or image of friction ridge skin left on a surface.

legacy

Indicates that a transaction element was valid in previous versions of the standard. Systems claiming conformance to this version of the standard shall only use the element when transmitting information created prior to the adoption of this version of the standard.

linear PCM

Linear pulse code modulation is a digital encoding methodology for audio waveforms based upon amplitudes of the signal.

locus (plural: loci)

A unique physical location on the DNA molecule.

lux

The unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is equal to one lumen per square meter

MAC address

Media Access Control address, a unique identifier assigned to network interfaces.

mark

The point where a needle has pierced the skin, usually associated with drug use.

metadata

Documentation relevant to the biometric data, but not the biometric data itself. Metadata may include both signal/sample-related and content-related information. Examples are the format of the data file, such as WAV and the scope of accreditation of a DNA processing laboratory.

MGRS

Military Grid Reference System.

minutia

The point where a *ridge* begins, terminates, or splits into two or more ridges. Minutiae are friction ridge characteristics that are used to individualize a friction ridge image (fingerprint, palm print, plantar). This is also known as Level 2 detail.

mitochondrial DNA

Small circular DNA molecules located in structures used to provide energy to the cell (mitochondria). Their small size and abundant nature make them particularly useful when examining small or much damaged biological material. It can be used to trace maternal lineages.

modality

This is a type or class of biometric system. Any measurable biological or behavioral characteristic can be a biometric modality.

morphological conformance

Conformance with the form and structure of the internal content, and verification that the data structures exist and have correct values

morphological tooth numbering

Assignment of tooth numbers based upon the shape of the teeth. This is in contrast to positional tooth numbering, which assigns a tooth number based solely upon position, and does not consider the shape of the tooth. For most cases, the tooth number assignment would be the same. Differences arise only in unusual cases.

MRI

Magnetic resonance imaging.

mugshot

A facial image composed of a subject’s head and shoulders, typically captured during a criminal booking.

native scanning resolution

The scanning resolution used by a specific AFIS, live-scan reader, or other image capture device and supported by the originator of the transmission.

NamUs

The National Missing and Unidentified Persons System, which is a national repository for missing persons and unidentified decedent records. It is operated by the National Institute of Justice. See www.namus.gov.

NCIC

National Crime Information Center of the FBI. See https://le.fbi.gov/informational-tools/ncic

NFIQ

NIST Fingerprint Image Quality. See www.nist.gov/itl/iad/ig/bio_quality.cfm.

NGI

The FBI's Next Generation Identification AFIS, which replaced the older IAFIS in 2014.

NIST

National Institute of Standards and Technology.

nominal resolution

The number of pixels per unit distance (ppmm or ppi) of the image. The nominal resolution may be the same as the scanning resolution for a particular image. On the other hand, the nominal resolution may be less than the scanning resolution if the scanned image was subsampled, scaled, or interpolated down.

non-photographic image

For purposes of this standard, it is any image or model that is other than defined as a photographic image. A photographic image is conveyed in a Type-10 record. A non-photographic image is conveyed in a Type-22 record. Non-photographic images can include (but are not limited to) such diverse items as 3D point cloud representations of the face, radiographs, sonograms, PET scans and 3D orthodontic models. Note that 2D iris images are handled in Type-17 records and 2D friction ridge images in Type-4, Type-13, Type-14, Type-15 and Type-19 records; they should not be included in a Type-22 record.

odontology

Forensic dentistry – a specialized discipline in dentistry to identify individuals based upon characteristics of their dentition and oral region.

OSAC

The Organization of Scientific Area Committees is part of an initiative by NIST and the Department of Justice to strengthen forensic science in the US. The organization is a collaborative body of more than 500 forensic science practitioners and other experts. NIST established OSAC to support the development and promulgation of forensic science consensus documentary standards and guidelines, and to ensure that a sufficient scientific basis exists for each discipline. https://www.nist.gov/adlp/spo/organization-scientific-area-committees-forensic-science

palm print

A friction ridge image that contains regions from below the proximal segment to above the wrist. A full palm print includes the area from the wrist to the tips of the fingers.

PAP

Acronym for Palm print Acquisition Profile. It is a series of sets of progressively more stringent parameters and requirements relevant to palm print acquisition.

pedigree

A family tree or a structure depicting relatedness and position of known and unknown persons.

PET

Positron emission tomography.

physical audio object (syn: physical medium)

Any external storage material of the voice signal and content information in either analog or digital form. Examples include reel-to-reel recording tape, cassette tape, Compact Disc, and phonograph record.

photographic image

A standard two-dimensional image illuminated and captured in the visible wave lengths (380 to 780 nm). This definition is specific to this standard – other references may refer to images captured using non-visible wavelengths converted to visible wavelengths as photographic images, but they are not so classified for purposes of this standard. A photographic image is conveyed in a Type-10 record (unless it is an iris image conveyed in Type-17, or a friction ridge image conveyed in one of Types 4, 13, 14, 15, or 19). A non-photographic image is conveyed in a Type-22 record. Original source images are conveyed in Type-20 records and non-biometric associated context images are conveyed in Type-21 records, regardless of the format or source of the image.

PIV

Personal Identity Verification.

plantar

The friction ridge skin on the feet (soles and toes).

PNG

Portable Network Graphics.

positional tooth numbering

Assignment of tooth numbers based upon the location of the teeth. This is in contrast to morphological tooth numbering, which assigns a tooth number based upon position, the shape of the tooth. For most cases, the tooth number assignment would be the same. Differences arise only in unusual cases.

postmortem

After death

ppi

Pixels per inch.

ppmm

Pixels per millimeter.

prior data

data collected when the subject was in a different, previous state/condition than the current state. Examples are antemortem data, when postmortem data exists or facial images of a missing person that are compared to those of the person being interviewed.

quality

An ordinal estimate of the usefulness of biometric data for the purpose of automated recognition.

questioned voice signal

A voice signal from an individual who is unknown and has not yet been linked to any previously encountered individual. Note: The task of speaker identification is to link a questioned voice signal to a known voice signal through determination of a common speaker.

RAW audio format

A format that stores uncompressed audio without header information. The most common file extensions for RAW audio format are '.raw' and '.pcm'.

RAW image format

A family of file formats, often specific to different models of digital imagery equipment, that are not yet processed for storage in a "printable" image format such as JPEG or TIFF. The file extension '.raw' is only one such format.

RCMP

Royal Canadian Mounted Police.

record (n)

A defined set of fields that contain data as defined in this standard.

record (v)

The act of converting an acoustic voice signal directly from an individual into a storage media, perhaps through contemporaneous, intermediate (transient) signal types. Note: This definition is retained because of its entrenchment in natural language use. Consequently, a record (n) is not recorded, it is created. Transcoding is the term used for further processing of the voice signal and any digital or analog representation of that signal.

record creation

The act of creating a record contained in an ANSI/NIST-ITL transaction.

recording (n)

A stored acoustic signal in either analog or digital form.

redaction

Over-writing of segments of a voice signal for the purpose of masking speech content in a way that does not disrupt the time record of the original recording.

RGB

Red, Green, Blue. Used to represent color pixels comprised of a specified number of bits to represent each of these primary color components.

ridge

A raised portion of the epidermis on friction ridge skin

ridge segment

A section of a ridge that connects two minutiae; a single non-intersecting portion of a skeletonized image.

ROI

Region of interest.

sample (v)

Obtain the values of a function for regularly or irregularly spaced distinct values from its domain. From: ISO 2382-2:1976.

SAP

Subject Acquisition Profile. With the exception of mobile device SAP levels, they are a series of sets of progressively more stringent parameters and requirements relevant to face acquisition.

scanning resolution

The number of pixels per unit distance at which an image is captured (ppmm or ppi).

scar

Healed fibrous tissue resulting from an injury to the skin.

segment, distal

The region of a finger or thumb above the interphalangeal crease that is farthest from the palm,.

segment, medial

The middle region of a finger between the interphalangeal creases furthest from and closest to the palm.

Note: The thumb does not have a medial segment.

segment, proximal

The region of the finger or thumb below the interphalangeal crease closest to the palm.

semantic conformance

Conformance to ensure that the biometric transaction is a faithful representation of the parent biometric data and thereby ensuring that the requirements are satisfied that are not merely syntactic or morphological.

simultaneous capture

The acquisition of images of a single biometric modality from a subject at the same time. Sequential capture over a time scale (< 1 second) that prevents confounding of body parts (e.g., substituting left iris for right iris) can also be considered simultaneous capture in this context.

skeletonized image (syn: ridge tracing)

A representation of a friction skin image in which all pixels are white except for a 1- pixel-wide black skeleton following the midpoint of each ridge.

slap image (syn: identification flats; slaps)

Plain fingerprint impressions captured simultaneously as a single image. A “full” set of slaps contains all four fingers of both hands (if present) and both thumbs (captured together or individually, e.g., for ergonomic reasons).

SMT

Scar, (needle) mark, and tattoo information.

snip (v)

Extraction of an audio signal from an original recording in a way that disrupts the continuity and time record of the original recording.

source representation

The image, recording, or other signal from which a biometric record (see derived representation) is derived. A source representation may be included as a Type-20 record in a transaction.

speaker

A vocalizing human, whether or not the vocalizations contain speech. An interlocutor might be a synthesized voice, which can be considered a “speaker” within the context of this standard.

speech

Audible vocalizations made with the intent of communicating information through linguistic content. Nonsensical vocalizations with linguistic content will be considered as speech (including singing and chanting). Speech can be made by humans, by machine synthesizers, or by other means.

stitched image

A friction ridge image created by combining images that were separately captured.

substrate

Surface upon which a friction ridge impression is deposited.

STR - Short Tandem Repeat

Short sequences of DNA that are repeated numerous times in direct succession. The number of repeated units may vary widely between individuals, and this high level of variation makes STRs particularly useful for discriminating between people.

subject of the record

The person to whom the data in the record applies. The subject of the record need not be the subject of the transaction.

subject of the transaction

The person to whom the transaction applies. The subject of a record need not be the subject of the transaction.

syntactical conformance

Conformance to the relationships between fields, subfields, or information items within a transaction to other values within the same transaction as specified in this standard.

TAP

Acronym for Toe and footprint Acquisition Profile. It is a series of sets of progressively more stringent parameters and requirements relevant to plantar print acquisition.

tattoo

An indelible image on the skin that was applied. A common tattoo results from picking of the skin with a coloring matter. A subclass of tattoo is chemical, which indicates that the image was created by the use of chemicals to burn the image into the skin. Another subclass of tattoo is branded, which indicates that the pattern was caused by using a branding iron or other form of applied heat. A third subclass of tattoo is cut, which indicates that the image was caused by incision of the skin.

tolerance

The allowable range of deviation from the class resolution, symmetric around the class resolution value. For example, PIV single fingerprint scanners with the class resolution of 500 ppi, the tolerance is 2%.

track

A path associated with a single read/write head on a data medium.

traditional encoding

The format of transactions used in all versions of this standard prior to and including that of 2007. It is also included in this standard and is specified in Appendix B: Traditional encoding.

transaction

A group of records with information and biometric data concerning a particular individual that is transmitted and / or stored as a complete unit.

transcoding

Any transfer, compression, manipulation, re-formatting or re-storage of the original data. Transcoding can be lossless or lossy.

transillumination

Imaging technique with light transmitted through an excised specimen.

turn

A conversation is a sequence of conversational turns. A turn is when an individual speaks for a continuous period of time. Individual turns from different people may overlap when they speak simultaneously. However, typically a turn is referred to in a question / response environment.

URI

Uniform Resource Identifier.

URL

Uniform Resource Locator.

UTC

Coordinated Universal Time.

UTF

Unicode Consortium Standard Transmission Format.

UVIS / UDIM

The Unified Victim Identification System developed by the Office of the Chief Medical Examiner of New York City and its built-in Dental Identification Model.

valley

A lowered portion of the epidermis on the palmar or plantar skin, consisting of those areas between ridges.

voice data file

The digital, encoded file primarily containing the sounds of vocalizations of both speech and non-speech content, convertible to an acoustic signal replicating the original acoustic signal. A voice data file is extracted from an audio recording, but not all audio recordings contain voice signals, and not all voice data is speech. A physical medium, such as a phonograph record, contains a voice signal but is not a voice data file.

voice recording

A signal, stored on a digital or analog medium, of vocalizations containing both speech and non-speech content.

voice signal

Any audible vocalizations emanating from the human mouth, throat and nasal cavity with or without speech content.

WAV

Waveform Audio File Format.

WSQ

Acronym for Wavelet Scalar Quantization, a compression algorithm used for 500 ppi friction ridge prints.

W3C

World Wide Web Consortium. It is an international community that develops standards for web development.

WGS 84 (G873)

WGS 84 is the World Geodetic System of 1984. At 0000 GMT September 30, 1996 (the start of GPS Week 873), WGS 84 was redefined and was more closely aligned with International Earth Rotation Service (IERS) Terrestrial Reference Frame (ITRF) 94. It is now formally called WGS 84 (G873). WGS 84 (G873) was adopted as the reference frame for broadcast orbits on January 29, 1997.

WinID

A computer system that uses dental and anthropometric characteristics to rank possible matches for missing persons and unidentified human remains.

XML

Extensible Markup Language. A convention for marking up and tagging data for electronic transmission. These tags describe the type of content they contain rather than formatting or layout information. The types of tags allowed in an XML file are typically defined and constrained by a specification such as an XML Schema Definition (XSD).

5. Data Conventions (Normative)

5.1. Dates

Dates in ANSI/NIST-ITL transactions fall into one of these categories: local date; *partial* local date; local datetime; and Zulu/UTC datetime. Different implementation encodings will also have specific formats for each category of date.

5.1.1. Local Date

Local dates consist of the year, month, and day of the local area (time zone) in which the described activity occurs. The representation of this varies by encoding:

- Traditional encoding – provide date in YYYYMMDD format
- NIEM conformant XML or JSON encoding – use a specified DateType, e.g., nc:Date

5.1.2. Partial Local Date

Partial local dates, when allowed, provide the known portion of the date in the local area (time zone) in which the described activity occurs if the exact date is not known. The representation of this varies by encoding:

- Traditional encoding – provide all known portions (YYYYMMDD) of the date, and use zeroes for the unknown portion, e.g., 20241200
- NIEM conformant XML or JSON encoding – use a date type that expresses the correct granularity, e.g., nc:YearMonthDate consists of a year and a month only

5.1.3. Local Datetime

Local datetime consists of the year, month, day, and time in hours, minutes, and seconds of the local area (time zone) in which the described activity occurs including variations, such as Daylight Savings Time. The representation of this varies by encoding:

- Traditional encoding – provide date and time in YYYYMMDDhhmmss format, for example 20240301115322
- NIEM conformant XML or JSON encoding – use a specified DateType, e.g., nc:DateTime. Although it is permissible to use a DateType that includes time zone, if used it must be dropped when converting to traditional encoding

5.1.4. Zulu Datetime / UTC Datetime

Zulu datetime consists of the year, month, day, hours, minutes, and seconds in which the described activity occurs, fixed with respect to the Zero Meridian “Z” (i.e., UTC+0) rather than the actual time zone where the time and date is recorded. This is sometimes referred to as Greenwich Mean Time or GMT. The representation of this varies by encoding:

- Traditional encoding – provide date and time in YYYYMMDDhhmmssZ format, for example 20240301115322Z
- NIEM conformant XML or JSON encoding – use a specified DateType, e.g., nc:ZuluDateTime

5.2. Character encoding

To ensure that the transaction description information can be read by all systems, data for all fields in Record Type-1 shall always be recorded exclusively using the characters that can be represented by the 7-bit American National Standard Code for Information Interchange (ASCII), except for the reserved values. Base-64 shall be used for converting non-ASCII text into ASCII form, where required and noted in the standard.

The default character encoding for all encodings is 7-bit ASCII. However, for fields with "Value Constraints" marked as '**U**' (user-specified), alternate character sets may be used for the data. If used, the alternate character set shall be specified in Field 1.015 DCS / Character Encoding from the values in Table 1 Character encoding. Users are encouraged to choose the option of UTF-8 for these 'user-specified' character types. It is not possible to switch character encodings within a transaction in XML, but all users are encouraged to state the character encoding and version used and shall observe the default of 7-bit ASCII for all fields that are not user-specified.

Table 1 Character encoding

Character encoding index	Character encoding name	Description
0	ASCII	7-bit (Default) with zero added in high bit position
1	8-bit ASCII	***Legacy only*** *- Latin-1 character set* *(See ISO/IEC 8859-1)*
2	UTF-16	16-bit (See ISO/IEC 10646-1 and The Unicode standard)
3	UTF-8	8-bit (See NWG 3629 and The Unicode standard)
4	UTF-32	32-bit (See The Unicode standard)
5-127	----------	Reserved for future use
128-999	----------	User-defined character encoding sets

The 2007 version of the standard allowed users to switch any data (except that contained in the Type-1 record) to an alternative character encoding using a mechanism employing special control characters. This capability is **deprecated**, and transactions shall instead use Field 1.015 to communicate the employed character set.

5.2.1. 7-bit ASCII

7-bit ASCII, with the leftmost (eighth) bit padded with zero, is required for all fields in **Record Type-1: Transaction information record.** Unless Field 1.015 DCS / Character Encoding is

included in the transaction, the default character set encoding for fields marked as 'U' (user-specified) is also 7-bit ASCII. ASCII is defined in *ANSI X3.4-1986 (R2022).* See Section 3 Normative References.

5.2.2. UTF Encodings

1.015 DCS / Character Encoding allows the user to select an alternate character encoding listed in Table 1 Character encoding. UTF-8 and UTF-16 allow for much larger character sets, including characters with no representation in ASCII or the Latin alphabet. When using these extended character sets, they shall only appear where this document specifies 'U' (user-specified) for the character type. If Field 1.015 is not used in a transaction, the default for such data is 7-bit ASCII.

UTF-8 encoding is variable width. The first 128 characters use one byte and are equivalent to US-ASCII. The next 1,920 characters require two bytes to encode. Three and four bytes are also possible for certain, more rare characters. Note that the UTF-8 and UTF-16 encodings are substantially different. It is recommended that UTF-8 be used rather than UTF-16 or UTF-32.

5.2.3. Base-64 Encoding

The Base-64 Content-Transfer-Encoding is designed to represent arbitrary sequences of octets in a form that need not be humanly readable. A 65-character set is used, enabling 6 bits to be represented per printable character. The characters are the 26 letters of the English alphabet (upper and lower case), the digits '**0'** through '**9'**, the special characters '**/'** and '**+'** and '**='**. See https://datatracker.ietf.org/doc/html/rfc4648 for Base-64 technical specifications.

5.2.4. Hexadecimal

Hexadecimal refers to a Base-16 representation of numbers. It is represented by the digits '0' through '9' and the case-insensitive letters 'A'-'F' ('a'-'f'). For fields with "Value Constraints" marked as 'H', hexadecimal representation shall be used, as in Fields x.996 HAS / Data Hash for example.

5.3. Transformations Between Encodings

Transactions conforming to this standard may be represented using different encodings, which shall be equivalent and bi-directionally transformable to provide interoperability between systems accepting different encodings. These encodings have specific requirements which are addressed in Appendices B and C. When transforming data between these representations, there are important differences to bear in mind to ensure the equivalence and validity of the data in the resulting transactions.

5.3.1. Character Types and Datatypes

While Traditional encoding treats all data as either text strings or binary strings and is therefore primarily concerned with "character types." XML and JSON encodings use "datatypes" to specify more precisely what the data may include and how it is structured.

The abbreviations for "character types" are:

A	Alphabetic: 26 English letters (both upper and lower case)
N	Numeric (digits 0-9, i.e., no decimals or negative numbers)
S	Special characters that are specifically stated in the description of the data (such as period, space, or negative sign)
B	Binary for Traditional encoding or Base64 for XML
Base64	Base64 encoded (exclusively)
H	Hexadecimal representation
U	User-defined character set, specified in Field 1.015 DCS if present; otherwise, the default is 7-bit ASCII.

"Datatypes" on the other hand, represent data concepts such as "decimal", "integer", and "date." These differences between the encodings require alternate methods of expressing validity constraints and structure. In this document, these are expressed as follows:

Value Constraints: -50000 ≤ integer ≤ 50000. (1-6 NS)

This value constraint describes the value as an integer value range "-50000 ≤ integer ≤ 50000," but a traditional implementation regards this a text string "(1-6 NS)" that is only allowed to contain numbers (N) and special (S) characters (i.e., the '-' sign). This also requires the field to add an extra character to the maximum length to accommodate the negative sign (1-6) for traditional encoding. The character count does not include separator characters.

When '*' or '+' appears as an upper bound, it means that the limit is undefined in this standard but may be restricted by the application profile. When 0 is included as a valid value, a zero shall be entered as data. This shall not be interpreted as a null (empty) value.

5.3.2. Leading Zeroes in Field Values

Because of the differences in data representations, data with significant leading zeros (such as version number '0600') require special care when converting transactions between encodings. The following fields contain such leading zeros:

- Field 1.002: VER / Version Number
- Field x.002: IDC / Information Designation Character
- Field 1.003: IDC / Transaction Content

- Field 1.011: NSR / Native Scanning Resolution
- Field 1.012: NTR / Nominal Resolution
- Field 9.360: CIR / EFS Area of Correspondence
- Field 9.362: EDC / EFS Examiner Comparison Determination
- Field 9.363: RIR / EFS Relative Rotation of Corresponding Print
- Field 10.992: T2C / Type-2 Record Cross Reference
- Field 11.037: SCC / Vocal Segment Speaker Characteristics / T2C
- Field 12.990: T10C / Type-10 Record Cross Reference
- Field 12.991: T22C / Type-22 Record Cross Reference
- Field 12.992: T2C / Type-2 Record Cross Reference
- Field 18.992: T2C / Type-2 Record Cross Reference
- Field 22.992: T2C / Type-2 Record Cross Reference
- Field 99.100: HDV / CBEFF Header Version
- Field 99.101: BTY / Biometric Type

For all encodings, these significant leading zero(s) shall be shown when displaying the data in printed format or converting to traditional encoding but may be internally represented as numeric datatypes to XML or JSON transactions.

Numeric values (including traditional values contained in fields with a numeric character type (N) should not contain leading zeros, other than those listed above. Application profiles may permit or require leading zeros in user-defined fields.

5.4. Structure of a Transaction

This standard defines the composition of the records comprising a transaction that may be transmitted to another site or agency. The receiving agency shall set the requirements for scanning resolution, number and type of records, and other user-specific data in order to consider the transaction valid. For most record types, an individual record generally contains biometric and/or forensic data for a single subject. However, in some cases a record may pertain to multiple subjects, such as a Type-11 recording with multiple speakers, or a Type-20 image of evidence with fingerprints from various people. A given transaction may require that all records apply to a single subject, or may contain records from different subjects. Thus, there is a difference between the subject of the transaction and the subject of the record.

A transaction is comprised of records, the types of which are described in detail in Section 6 of this document. All of the records belonging to a single transaction shall be transmitted together. There may be multiple records in a transaction of each record type other than Type-1.

The only required record type is Type-1, which is used to describe the transaction. There shall be at least one other record of another type accompanying a Record Type-1.

A record is comprised of fields. Within the standard, each field is assigned a number, a description and a mnemonic, for example: Field 10.020 POS / Subject Pose. A field is used to transmit a particular datum or group of closely related data. A Subfield is described as single or multiple types of data that may have multiple entries in a field. Single or multiple types of data in a field that do not repeat are described as information items. The handling of subfields varies by encoding. See Appendix B:Traditional Encoding - Normative and Appendix C: NIEM-conformant encoding rules.

5.5. Backward Compatibility

Backward compatibility is important, since organizations adhering to earlier versions of the standard may create transactions according to that version, and these transactions may still be received by organizations that have updated to a newer version of the standard and vice versa.

There is a special category called '***legacy***' for a record type, field, subfield, information item or value that was valid in previous versions of the standard but shall not be used for new data. '***Legacy***' indicates that if there is existing data using this record type, field, information item or value it may still be transmitted in a transaction conformant to this version of the standard. For example, '***legacy***' applies to Fields 9.005 through 9.012, Field 10.022, Field 14.022, and the Type-4 Record.

Type-1 records are required in all transactions. Since a receiving agency may have software installed that is based upon a previous version of the ANSI/NIST-ITL standard, the only modifications allowed to Type-1 are new fields that may be added to the end of the record. Systems should be designed to ignore information items, subfields, fields and records that they were not designed to recognize and process.

The fields and format of Type-4 (fingerprint images) and Type-8 (signature) records cannot change between versions of the standard due to restrictions in the Traditional encoding format. (In Traditional encoding, they are "binary" data with a fixed structure.) Since the time when these record types were defined, users have needed more flexibility in defining the metadata associated with the fingerprint image data. Thus, Type-14 was developed to replace Type-4 fingerprint image records. However, since many systems exist that use Type-4 to transmit fingerprint images, that record type is retained as ***legacy*** in the standard. Type-2 (user-defined descriptive text entries), Type-7 (user-defined image) and Type-16 (user- defined testing image) records are further defined in application profile-specific documentation (See Section 5.6 Implementation Domain and Application Profiles).

Record Types 9 through 99 may be updated, expanded or introduced with new versions of the standard. New fields in existing records may be added, as well as new data record types.

If it is determined by the canvassees that a record type, field, subfield, information item or value is not used or needed, it may be declared "***deprecated***." The deprecated record type, field, or information item is not included in the updated version of the standard. This version of

the standard deprecates Fields 9.031-9.125, Fields 9.151-9.175, Field 10.048: PID / Suspected Patterned Injury Detail and Field 10.049: CID / Cheiloscopic Image Description. Deprecated fields and code values are indicated as such in this document.

When a data definition is introduced that causes potential problems with backward compatibility, it is noted in the standard. NIEM-conformant encodings have inherent backward compatibility issues due to the need to develop new schemas. Normally, the rule is that once an item is mandatory, it remains mandatory. However, there have been some exceptions made in order to respond to the operational needs of the canvassees. All such cases are clearly highlighted in the text of the standard.

5.6. Implementation Domain and Application Profiles

An implementation domain, recorded in Field 1.013 DOM / Transaction Domain Name of a Type-1 record as an optional field, is a group of agencies or organizations that have agreed to use pre-assigned data fields with specific meanings (typically in Record Type-2 and/or in the User-Defined Fields distributed throughout this standard) for exchanging information unique to their installations. The implementation domain is usually understood to be the primary application profile of the standard. Field 1.016 APS / Application Profile Specifications allows multiple application profiles to be referenced. The organization responsible for the profile, the profile name and its version are all mandatory for each application profile specified. A transaction must conform to each profile that is included in this field. It is possible to use Field 1.016 and / or Field 1.013. It is recommended that when only one profile is applicable, that Field 1.013 be used, and it be called the implementation domain.

An example of an implementation domain is the one maintained by the Criminal Justice Information Services (CJIS) Division of the Federal Bureau of Investigation (FBI). It is the North American Domain subscribed to by the Royal Canadian Mounted Police (RCMP), the FBI, and several state and Federal agencies in North America. The default value for this field shall be the North American Domain implementation and shall appear as ‘NORAM’.

An application profile may also specify a narrower interpretation of this standard to satisfy its own use cases, for example by limiting which biometric record types (other than Type-1) it will accept from contributors. Any application profile restrictions shall produce transactions that conform to this standard. Optional aspects of the standard may be excluded; allowed values of code lists may be restricted to smaller subsets; and the upper bounds of field sizes or field occurrences may be reduced. Fields that are optional in the standard may also be required if necessary for the uses of the application profile. However, Application Profiles shall not loosen the stated requirements of this standard. For example, loosening a “mandatory” field in this standard to “optional” in an application profile would result in a non-conformant implementation; tightening a requirement by changing an “optional” field to “mandatory” would be conformant in an application profile.

A transaction may include user-defined fields that are not described in any specified application profile or the specified domain. However, when any part of a transaction is defined by one or

more application profiles, it must conform to the requirements of each of those application profiles.

5.7. DATA Field

Field x.999 is reserved in Record Types 10 and above for data associated with the record that is described in the other fields of the record. It does not appear in the DNA or Information Assurance Records. In many record types it is possible for Field x.999 to be optional if other conditions are met. Application profiles may restrict this behavior to require the DATA field be included as they find necessary, see Section 5.6 Implementation Domain and Application Profiles.

5.8. External Data File References

Record types 10-17 and 19-22 all provide for including data (usually an image) within the record in field x.999 / DATA, or in an external file, as indicated in the External file reference field (x.994 / EFR). EFR allows the storage location of the image to be referenced rather than being required to be transmitted in the record, if permitted by the receiving system. EFR contains the URL/URI or other unique reference to a storage location for the image. The use, restrictions, and content of EFR fields is the responsibility of the application profile, which shall define the specifics of whether use of EFR is permitted, how EFR refers to and describes the external data, and the conditions under which EFR may be used.
The DATA and EFR fields are exclusionary; if DATA is present, EFR shall not be used, and vice versa. The same metadata fields within a record are used to describe the data regardless of whether EFR or DATA is used. Either EFR or DATA shall always be present in record types 10, 13, 16, 20, 21, 22. In record types 11, 12, 14, 15, 17, and 19 there are specific conditions in which both EFR and DATA should be omitted, such as for amputations; see those record descriptions for details.

5.9. Geographic Sample Acquisition Location Field

This field specifies the coordinated universal time (UTC+0) and the location where a data sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) UTE Universal Time Entry

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

Geographic Coordinate Latitude and Longitude

Geographic coordinate **latitude** is measurement of the angular distance between a point on the earth and the equator. Geographic coordinate **longitude** is a measurement of the angular distance between a point on the earth and the prime meridian. If a decimal value is used in a particular information item below, the more granular information item shall be empty (e.g., if Longitude minutes value is 45.27, Longitude seconds shall be empty). The next six information items (items 2-9) comprise an **optional group**. However, LTD / Latitude Degree Value and LGD / Longitude Degree Value are co-conditional, so they shall both be present if either is present. Further, "minutes" values LTM and LGM can only be present if their corresponding "degrees" values are present. Also, "seconds" values LTS and LGS can only be present if their corresponding "minutes" value is present. The other entries are optional.

2) LTD Latitude Degree Value

This information item specifies the degree of latitude. The degrees may be expressed as an integer or a real number. If decimals are present, then minutes and seconds shall be empty. For example: NIST, Gaithersburg, Maryland: 39.137627 (no LTM or LTS); or Buenos Aires, Argentina: -34 (with minutes LTM = 36). The allowed special characters are the negative sign and the period.

Condition:	Mandatory when **LGD** occurs below, otherwise omitted.
Occurrence:	1
Value Constraints:	-90 ≤ number ≤ 90 (1-9 NS). Occurs only when **LGD** occurs below; both or neither shall be present.

3) LTM Latitude Minute Value

This information item specifies the minute of a degree. The minute value may be expressed as an integer or as a real number. If decimals are present, then seconds shall be empty. The minute value can be empty, even if the degree value is an integer. The allowed special character is a period.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ number < 60 (1-8 NS). Occurs only when **LGM** occurs below; both or neither shall be present.

4) LTS Latitude Second Value

This information item specifies the second of a minute. The special character is a period, since LTS may be expressed as an integer or as a real number including decimals. The LTS value can be empty, even if the minute value is an integer.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ real number < 60 (1-8 NS). Occurs only when **LGS** occurs below; both or neither shall be present.

5) LGD Longitude Degree Value

This information item specifies the degree of a longitude. The degrees may be expressed as an integer or a real number. If decimals are present, then minutes and seconds shall be empty. For example: NIST, Gaithersburg, Maryland: -77.216032 (no LGM or LGS); or Buenos Aires, Argentina: -58 (with minutes LGM = 22). The allowed special characters are the negative sign and the period.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	-180 ≤ real number ≤ 180 (1-10 NS). Occurs only when **LTD** occurs above; both or neither shall be present.

6) LGM Longitude Minute Value

This information item specifies the minute of a degree. The minute value may be expressed as an integer or as a real number. If decimals are present, then seconds shall not appear. The minute value can be empty, even if the degree value is an integer. The allowed special character is a period.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ real number < 60 (1-8 NS). Occurs only when **LTM** occurs above; both or neither shall be present.

7) LGS Longitude Second Value

This information item specifies the second of a minute. LGS may be expressed as an integer or as a real number. The LGS value can be empty, even if the minute value is an integer.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ real number < 60 (1-8 NS). Occurs only when **LTS** occurs above; both or neither shall be present.

8) ELE Elevation

This information item is elevation expressed in meters. Allowed special characters are the negative sign and the period.

Condition: Optional

Occurrence: 0-1

Value Constraints: -422.000 ≤ real number (1+ NS)

9) GDC Geodetic Datum Code

This information item indicates which coordinate system was used to represent the values in the latitude and longitude values described above. If no entry is made in this information item, then the basis for the values entered in the first eight information items shall be WGS84, the code for the World Geodetic Survey 1984 version - WGS 84 (G873).

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (3-6 ANS)

Table 2 Geodetic datum codes

Code	Geodetic Datum
AIRY	Airy
AUST	Australian National
BES	Bessel 1841
BESN	Bessel 1841 (Namibia)
CLK66	Clarke 1866
CLK80	Clarke 1880
EVER	Everest
FIS60	Fischer 1960 (Mercury)
FIS68	Fischer 1968
GRS67	GRS 1967
HELM	Helmert 1906
HOUG	Hough
INT	International
KRAS	Krassovsky
AIRYM	Modified Airy
EVERM	Modified Everest
FIS60M	Modified Fischer 1960
SA69	South American 1969
WGS60	WGS-60
WGS66	WGS-66
WGS72	WGS-72
WGS84	WGS-84 / NAD-83
<entry up to 6 characters>	Other

Universal Transverse Mercator (UTM) coordinate

The next three information items together comprise a coordinate which represents a location with a Universal Transverse Mercator (UTM) coordinate. **If any of these three information items is present, all shall be present.** The UTM system consists of 60 zones, each 6-degrees of longitude in width. The zones are numbered 1-60, beginning at 180-degrees longitude and increasing to the east. The military uses their own implementation of the UTM system, called the Military Grid Reference System (MGRS).[1]

[1] See https://www.usgs.gov/faqs/what-does-term-utm-mean-utm-better-or-more-accurate-latitudelongitude

10) GCM Geographic Coordinate Universal Transverse Mercator Zone

This information item is a one- or two-digit UTM zone number, followed by the 8-degree latitudinal band designator (which is a single letter). Valid latitudinal band designators include C through X, omitting I and O.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 60 and [C-H|J-N|P-X]. Occurs if and only if **GCE** and **GCN** occur below; either all or none shall be present. (2-3 AN)

11) GCE Geographic Coordinate Universal Transverse Mercator Easting

This information item is the geographic coordinate universal transverse Mercator easting value.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	160000 ≤ integer ≤ 833000. Occurs only when **GCM** occurs above and **GCN** occurs below; either all or none shall be present. (6 N)

12) GCN Geographic Coordinate Universal Transverse Mercator Northing

This information item is the geographic coordinate universal transverse Mercator northing value. It is an integer of 1 to 8 digits.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 10000000. Occurs only when **GCM** and **GCE** occur above; either all or none shall be present. (1-8 N)

13) GRT Geographic Reference Text

This information item is used for instances when GPS or other coordinate systems may not be readily available. It describes a street address or other physical location (such as ‘Corner of Washington and Madison, Geneva, NY’).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

Alternate Geographic Position System

The following two information items should be used when an alternate system is utilized for recording position:

14) OSI Geographic Coordinate Other System Identifier

This information item allows for other coordinate systems to be identified for use. Examples are:

- MGRS37 (Military Grid Reference System)
- USNG37 (United States National Grid)
- GARS37 (Global Area Reference System)
- GEOREF37 (World Geographic Reference)
- LANDMARK landmark and position relative to the landmark, for example:

Landmark: hydrant 143 sector 5 Position: 5.2 meters directly E

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 10 characters from user-specified character set as indicated in Field 1.015 DCS. (1-10 U)

15) OCV Geographic Coordinate Other System Value

This information item shall be present if OSI is present in the record and OSI is set to LANDMARK. OCV is free text and may be up to 126 characters. For details on the formatting of OCV for the other coordinate systems shown in OSI as examples, see Table 2 Geodetic Datum Codes.

Condition:	Mandatory when OSI = LANDMARK, otherwise Optional
Occurrence:	1 when Condition above is met, 0-1 otherwise
Value Constraints:	1 to 126 characters from user-specified character set as indicated in Field 1.015 DCS. (1-126 U).

5.10. Friction Ridge Positions

5.10.1. Friction Ridge Generalized Positions

FGP is used in Record types dealing with friction ridges. It specifies which friction ridge biometric sample was collected. Note that for codes 1 - 40 and 60 - 84, the table below specifies recommended **maximum** width and height. (Individual implementation domains and application profiles may use smaller values).

If the type of friction skin is unknown, each of the possible positions shall be included as separate data entries. Codes 0 (Unknown fingerprint) and 20 (Unknown palm) together address all friction ridge areas on the hands; codes 60 (Unknown sole of foot) and 63 (Unknown toe) together address all friction ridge areas on the feet. Code 18 denotes an unknown friction ridge, from hand **or** foot.

The terms “slaps” or “identification flats” are frequently used to indicate plain impressions captured simultaneously as a single image. A “full” set of slaps contains all four fingers of both hands (if present) and both thumbs (captured together or individually, e.g., for ergonomic reasons). FGP codes 11 – 15 and 40 – 55 fall into the category of “slaps.”

Codes 11-15 and 40-55 do not apply to latent prints. Code 19 does not apply to the Extended Feature Set of Record Type-9. Only Codes 1-10 apply to Field 9.134: FGP / M1 Friction Ridge Generalized Position, which does not allow multiple fingers, unknown print, extra digit, palm or plantar codes to maintain consistency with INCITS 378.

These rules shall be used in dealing with subjects with cojoined fingers for extra fingers or thumbs:

- *Cojoined* - the image of the entire conjoined finger shall be included using the finger position closest to the thumb, and the next finger position shall be used for the next fully separable finger;
- *Extra fingers* - the four fingers closest to the thumb shall be labeled with the index/middle/ring/little position codes;
- *Extra thumbs* – the thumb closest to the fingers shall be labeled with the thumb position code;
- additional fingers shall be labeled with the extra finger position code for the appropriate hand. (16 or 17)

The comment field (Field 13.020: COM / Comment or Field 14.020: COM / Comment) should be used to describe specifics of the conjoined or extra fingers.

Table 3 Friction ridge generalized position codes

Finger Positions	**Finger Code**	**Max Width (mm)**	**(in)**	**Max Height (mm)**	**(in)**
Unknown finger	**0**	40.6	1.6	38.1	1.5
Right thumb	**1**	40.6	1.6	38.1	1.5
Right index finger	**2**	40.6	1.6	38.1	1.5
Right middle finger	**3**	40.6	1.6	38.1	1.5
Right ring finger	**4**	40.6	1.6	38.1	1.5
Right little finger	**5**	40.6	1.6	38.1	1.5
Left thumb	**6**	40.6	1.6	38.1	1.5
Left index finger	**7**	40.6	1.6	38.1	1.5
Left middle finger	**8**	40.6	1.6	38.1	1.5
Left ring finger	**9**	40.6	1.6	38.1	1.5
Left little finger	**10**	40.6	1.6	38.1	1.5

Plain right thumb	**11**	25.4	1.0	76.2	3.0
Plain left thumb	**12**	25.4	1.0	76.2	3.0
Plain right four fingers, simultaneously captured (may include extra digits)	**13**	81.3	3.2	76.2	3.0
Plain left four fingers, simultaneously captured (may include extra digits)	**14**	81.3	3.2	76.2	3.0
Plain Left & right thumbs, simultaneously captured	**15**	81.3	3.2	76.2	3.0
Right extra digit	**16**	40.6	1.6	38.1	1.5
Left extra digit	**17**	40.6	1.6	38.1	1.5
Unknown friction ridge	**18**	139.7	5.5	213.0	8.5
EJI or tip	**19**	114.3	4.5	127.0	5.0
Palm Positions	**Palm Code**	**Max Width (mm)**	**(in)**	**Max Height (mm)**	**(in)**
Unknown palm	**20**	139.7	5.5	213.0	8.5
Right full palm	**21**	139.7	5.5	213.0	8.5
Right writer's palm	**22**	44.5	1.8	127.0	5.0
Left full palm	**23**	139.7	5.5	213.0	8.5
Left writer's palm	**24**	44.5	1.8	127.0	5.0
Right lower palm	**25**	139.7	5.5	139.7	5.5
Right upper palm	**26**	139.7	5.5	139.7	5.5
Left lower palm	**27**	139.7	5.5	139.7	5.5
Left upper palm	**28**	139.7	5.5	139.7	5.5
Right other	**29**	139.7	5.5	213.0	8.5
Left other	**30**	139.7	5.5	213.0	8.5
Right interdigital	**31**	139.7	5.5	76.2	3.0
Right thenar	**32**	76.2	3.0	114.3	4.5
Right hypothenar	**33**	76.2	3.0	114.3	4.5
Left interdigital	**34**	139.7	5.5	76.2	3.0
Left thenar	**35**	76.2	3.0	114.3	4.5
Left hypothenar	**36**	76.2	3.0	114.3	4.5
Right grasp	**37**	139.7	5.5	213.0	8.5
Left grasp	**38**	139.7	5.5	213.0	8.5
Right carpal delta area	**81**	139.7	5.5	114.3	4.5
Left carpal delta area	**82**	139.7	5.5	114.3	4.5

Right full palm, rolled to include writer's palm	**83**	165.0	6.5	213.0	8.5
Left full palm, rolled to include writer's palm	**84**	165.0	6.5	213.0	8.5
Right wrist bracelet	**85**	165.0	6.5	213.0	8.5
Left wrist bracelet	**86**	165.0	6.5	213.0	8.5
Plantar Positions	**Plantar Code**	**Max Width (mm)**	**(in)**	**Max Height (mm)**	**(in)**
Unknown sole	**60**	139.7	5.5	330.2	13.0
Sole – right foot	**61**	139.7	5.5	330.2	13.0
Sole – left foot	**62**	139.7	5.5	330.2	13.0
Unknown toe	**63**	44.5	1.8	76.2	3.0
Right big toe	**64**	44.5	1.8	76.2	3.0
Right second toe	**65**	44.5	1.8	76.2	3.0
Right middle toe	**66**	44.5	1.8	76.2	3.0
Right fourth toe	**67**	44.5	1.8	76.2	3.0
Right little toe	**68**	44.5	1.8	76.2	3.0
Left big toe	**69**	44.5	1.8	76.2	3.0
Left second toe	**70**	44.5	1.8	76.2	3.0
Left middle toe	**71**	44.5	1.8	76.2	3.0
Left fourth toe	**72**	44.5	1.8	76.2	3.0
Left little toe	**73**	44.5	1.8	76.2	3.0
Front / ball of right foot	**74**	139.7	5.5	152.4	6.0
Back / heel of right foot	**75**	139.7	5.5	152.4	6.0
Front / ball of left foot	**76**	139.7	5.5	152.4	6.0
Back / heel of left foot	**77**	139.7	5.5	152.4	6.0
Right middle of foot (arch and/or outside (fibular hypothenar))	**78**	139.7	5.5	152.4	6.0
Left middle of foot (arch and/or outside (fibular hypothenar))	**79**	139.7	5.5	152.4	6.0
Multiple finger position codes	**Finger code**	**Min Width (mm)**	**(in)**	**Min Height (mm)**	**(in)**
2-Finger Combinations Note also FGP code **15**					
Right index/middle	**40**	40.6	1.6	38.1	1.5
Right middle/ring	**41**	40.6	1.6	38.1	1.5

Right ring/little	**42**	40.6	1.6	38.1	1.5
Left index/middle	**43**	40.6	1.6	38.1	1.5
Left middle/ring	**44**	40.6	1.6	38.1	1.5
Left ring/little	**45**	40.6	1.6	38.1	1.5
Right index / left index	**46**	40.6	1.6	38.1	1.5
3-Finger Combinations					
Right index/middle/ring	**47**	63.5	2.5	38.1	1.5
Right middle/ring/little	**48**	63.5	2.5	38.1	1.5
Left index/middle/ring	**49**	63.5	2.5	38.1	1.5
Left middle/ring/little	**50**	63.5	2.5	38.1	1.5
4-Finger Combinations Note also FGP codes **13** & **14**					
Fingertips (4 fingers simultaneously – no thumb – right hand - plain)	**51**	81.3	3.2	76.2	3.0
Fingertips (4 fingers simultaneously – no thumb – left hand - plain)	**52**	81.3	3.2	76.2	3.0
Right index/middle / Left index/middle (4 fingers simultaneously)	**55**	81.3	3.2	76.2	3.0
5-Finger Combinations					
Fingertips (4 fingers and thumb simultaneously – right hand - plain)	**53**	81.3	3.2	76.2	3.0
Fingertips (4 fingers and thumb simultaneously – left hand - plain)	**54**	81.3	3.2	76.2	3.0

5.10.2. Friction Ridge Segment Positions

5.10.2.1. Palm and finger segment positions

Upper palm and lower palm images shall include the interdigital area as overlap for verification. Therefore, the lower and upper palm locations have approximate boundaries in this illustration. The carpal delta area is at the base of the palm, at the wrist. The wrist bracelet is the series of lines/creases below and parallel to the carpal delta and thenar/hypothenar areas of the palm.

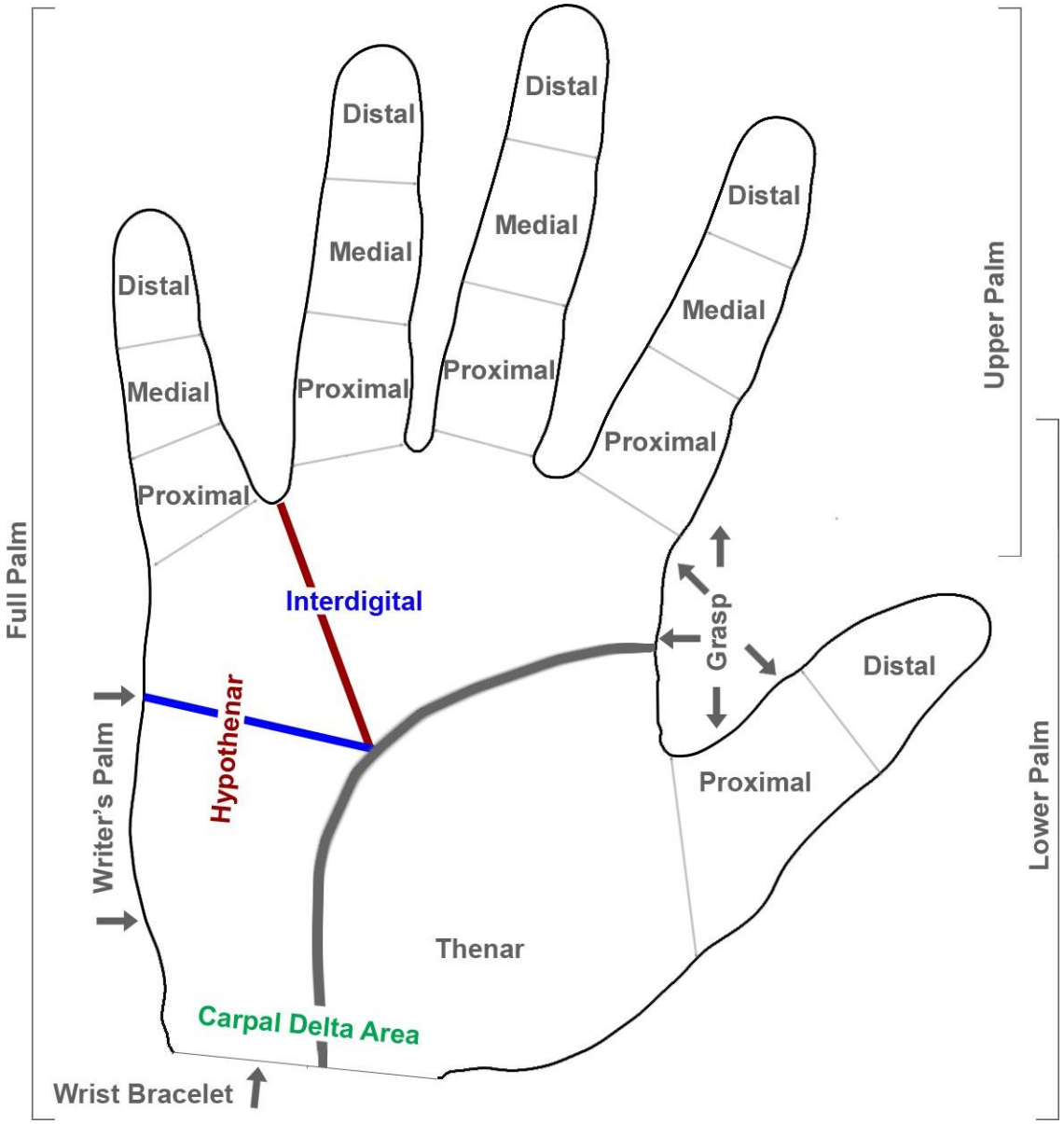


Figure 1 Palm and finger segment positions

5.10.2.2. Joint image segments, finger view codes, and tip codes

An entire joint image (EJI) is illustrated below. It contains finger views (FV1-FV4) and finger segments (DST, MED, PRX). EJIs may also include the fingertips (not pictured). These descriptions are used throughout the friction ridge records to describe more specific location information than the FGP alone provides.

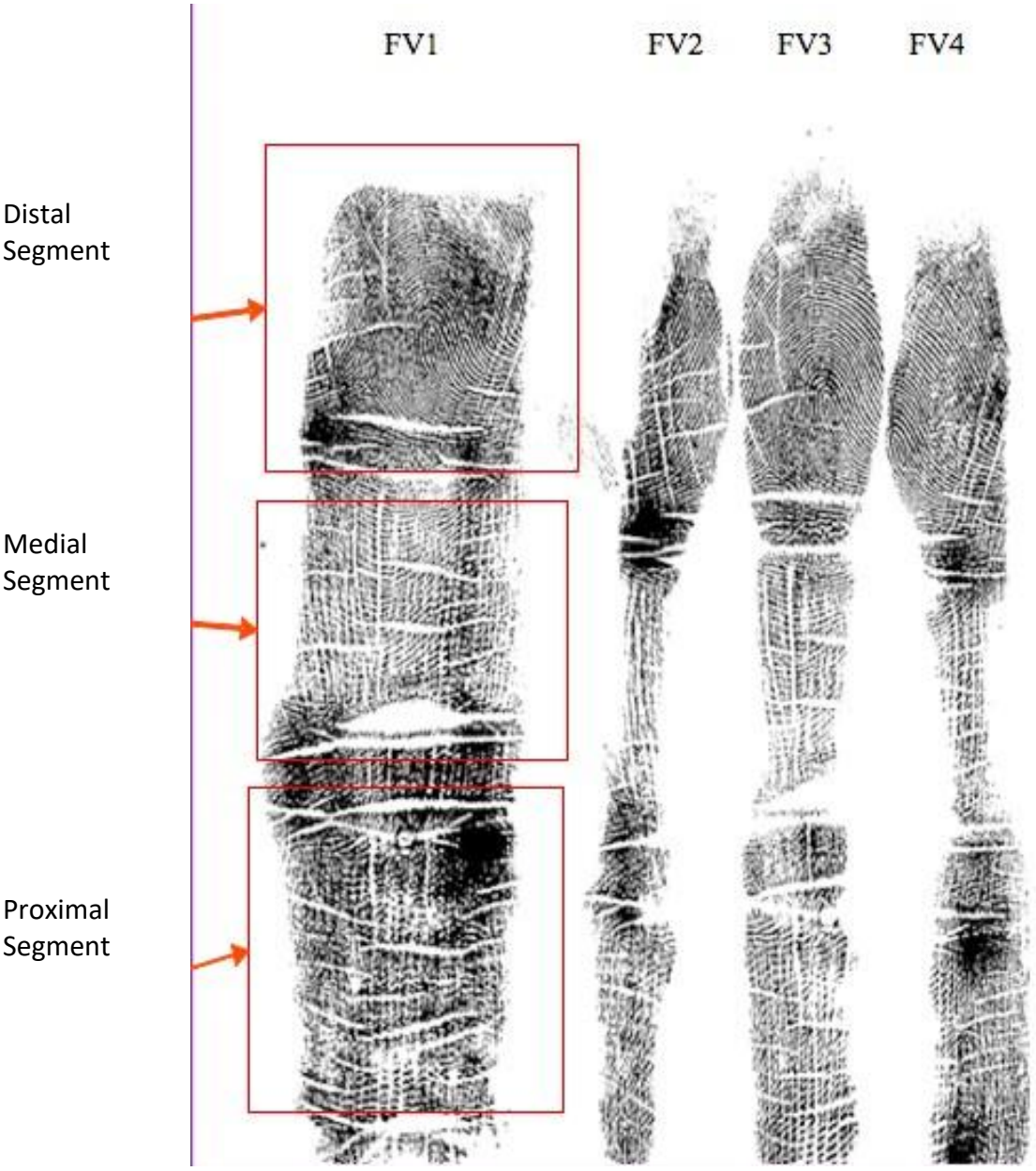


Figure 2 Finger views and finger segments

5.11. Indexes Used to Link Records

In order to track relationships among instances of records in a transaction, some special pointer indexes are used within the Record Types.

5.11.1. IDC / Information Designation Character

Each of the records present in a transaction, except for the Type-1 record, shall include a field (x.002) containing the IDC / Information Designation Character. The value of IDCs for each transaction shall be a sequentially assigned integer starting from zero and incremented by one up to a maximum of 99. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

IDC references are stated in Type-1 Field 1.003 CNT / Transaction Content and shall be used to relate information items in the CNT field of the Type-1 record to the other records in the transaction. The Type-1 record shall be the first record in the transaction, and the remaining records must appear in the order indicated in Field 1.003 CNT / Transaction Content.

Two or more records may be linked by sharing a single IDC when they refer to identical content. This primarily happens in two scenarios:

Most common: one or more sets of friction ridge metadata correspond to single friction ridge image. In this case, one or more 9.002 would be equivalent to a single 4.002, 14.002, 15.002, or 19.002.

Less common (not recommended): linkage between friction ridge image records of identical spatial content at identical resolutions and dimensions, encoded differently. The content of images with identical IDCs shall not be distorted with respect to others sharing the IDC (i.e., a fingerprint feature at a given absolute pixel location shall be present in all images with the same IDC). An example may be an uncompressed version of a 500 ppi fingerprint image stored in a Type-14 record and the WSQ compressed version of the same image content in a Type-4 record for use in a legacy receiving system. This use is not recommended, since many Type-9 EFS fields refer to information about a friction ridge image that does not correspond to feature locations. If only using legacy Type-9 features, this can be acceptable.

In some instances, Type-9 Records may also use IDC references within EFS fields to define the relationship between two different prints.

Multiple images of a face, encoded in Record Type-10, shall each have a unique IDC. SMT images also each have a unique IDC. See Field 10.039 T10 / Type-10 Reference Number for linking different images of the same SMT.

5.11.2. T2C / Type-2 Record Cross Reference

The Type-2 Cross Reference Fields (i.e., 10.992, 12.992, 18.992, 22.992) are used to link a specific Type-2 record to another record when multiple Type-2 records for different individuals are contained in a single transaction.

The value for T2C is the IDC of the appropriate Type-2 record. Similarly, in a Type-11 record this IDC value is placed within Field 11.037 SCC / Vocal Segment Speaker Characteristics to refer to the speakers in a specific segment of a recording. Because the IDC is a leading zero field, T2C inherits this property. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

5.11.3. Type-10 Reference

Field 10.039 T10 / Type-10 Reference Number explicitly links multiple Type-10 images that are of the same body part or SMT. For instance, one photograph of a tattoo may cover the entire tattoo. Another may be a close-up shot of a portion of the tattoo. In order to link these two images, the same index number is assigned to T10. Note that these images would have different IDC values. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

5.11.4. Simultaneous Capture

Field 14.026 SCF / Simultaneous Capture explicitly links multiple finger images that were captured simultaneously on non-contiguous platens or other image capture technologies that do not capture the finger images in a manner preserving full relative position of the fingers to each other, if placed in a single image. Field 14.026 allows the user to specify the same reference number for all images that were simultaneously captured on such a device. With this field included in a record, the transmitter states that sequencing errors definitively did not occur on the finger images.

Multi-finger images generated within a single device based upon **adjacent** platens that preserve the full relative position of the fingers to each other are considered a single capture and thus are not marked as simultaneous capture in this field.

5.11.5. SOR / Source Representation

Type-20 Source Representation Records contain the source from which one or more biometric samples in another record(s) was obtained. An example is a photograph of many people transmitted in a Type-20 Record, from which the image of the subject of the transaction has been segmented out and placed in a Type-10 Record.

The SOR / Source Representation Field (x.997) is an index used to link the biometric data sample in a biometric record to its corresponding source Type-20 Record. Records that do not contain SOR shall not be created from Type-20 Records. SOR contains a repeating subfield with two information items.

The first information item, the SRN Source Representation Number, indexes the specific Type-20 record containing the source representation from which the biometric data in the containing record was derived. This same index value appears in the appropriate instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

The second information item, RSP Reference Segment Position, contains the index to a particular set of image segmentation (x,y) coordinates within the Source Representation Record; therefore, this information item may not be applicable for all data sources. There may be more than one segment, each potentially yielding input for a separate biometric data record. This RSP index value in SOR is taken from the RSP in Field 20.016 SEG / Segments for the applicable Type-20 Source.

5.11.6. Associated Context / ASC

Type-21 Associated Context Records contain images or other media recordings that may be associated with the collection of a biometric sample but are NOT the actual source of the sample. For example, a general crime scene picture where latent prints were captured.

The first information item, ACN, for Field x.995 contains the ACN / Associated Context Number value from the linked instance of Record Type-21, Field 21.021 ACN / Associated Context Number.

The second information item, ASP / Associated Segment Position, contains the index to the segmentation (x,y) coordinates from the linked Type-21 context data record; therefore, this information item may not be applicable for all data sources. The segmentation index value is taken from the relevant ASP / Associated Segment Position in Field 21.016 SEG / Segments.

5.12. Black and White, Grayscale, and Color Image Data Requirements

This section is not applicable to imagery stored in a Type-22 record.

5.12.1. Black and White Image Data (No Grayscale)

Black and white (binary representation) image data may be transmitted in either compressed or uncompressed form. The uncompressed binary images shall consist of pixels, each of which shall be quantized to one of two levels (binary representation). A value of zero shall be used to represent a white pixel and a value of one shall be used to represent a black pixel. For uncompressed binary images, eight pixels shall be left justified and packed into a single unsigned byte; the most significant bit of the byte shall be the first of the eight pixels scanned. Compressed binary images use the ANSI/EIA-538-1988 facsimile standard, as explained in Section 6.8.
The Type-8 signature record is the only record that may use this data type for images, which was previously used by several deprecated record types in previous versions of this standard. The images stored in Field 9.372: SIM / EFS Skeletonized Image are PNG images quantized to a depth of 1 bit, therefore 0 = black and 1 = white. See also Appendix F: Field 9.372: SIM / EFS Skeletonized Image instructions.

5.12.2. Grayscale Image Data

Grayscale image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed grayscale images shall consist of pixels, each of which shall normally be quantized to eight bits (256 gray levels) and held in a single unsigned byte. Increased precision for pixel values greater than 255 shall use two unsigned bytes to hold sixteen-bit pixels with values in the range of 0-65535. For grayscale data, a zero shall represent a true black pixel. A true white pixel shall have all of its bits of precision set to '1'. Therefore, true white pixels quantized to eight bits shall have a value of '255', while a value of '1023' shall be used for pixels quantized to ten bits. Grayscale values requiring less than 8 or 16 bits shall be expressed as one or two bytes, right justified and zero padded on the left. For grayscale images in Record types with a mandatory occurrence of field CSP/ Color space, the value shall be 'GRAY' (See Table 4 Color Spaces).

The transmission of compressed grayscale images shall be the output of the appropriate grayscale compression algorithm specified in the Compression Algorithm field (CGA) of the record. Upon reconstruction of a compressed image the grayscale value for each pixel shall be the same (for lossless algorithms) or nearly the same (for lossy algorithms) as pixels in an uncompressed image.

5.12.3. Color Image Data

Scanned color images shall consist of nominal 24 to 48-bit **RGB** pixels. Color image data may be transmitted in either compressed or uncompressed form in certain record types. The transmission of uncompressed color images shall consist of **RGB** pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table lists the codes and their descriptions for each of the available color spaces used within this standard. Codes marked ***legacy*** shall not be used for new records. All other color spaces are to be marked as undefined.

5.12.4. Color Space

Several image record types have a field Color Space (CSP). If it appears in a record, it shall contain an entry from the Code column of the Color Spaces table, below. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. If the image is grayscale, an entry of 'GRAY' shall be used. These are the CSP fields:

Field 10.012: CSP / Color Space
Field 13.021: CSP / Color Space
Field 14.019: CSP / Color Space
Field 15.015: CSP / Color Space
Field 16.013: CSP / Color Space
Field 17.013: CSP / Color Space
Field 19.015: CSP / Color Space

Field 20.013: CSP / Color Space

To ensure that color images exchanged between differing systems can be correctly displayed or printed, images should be converted to the device-independent color space, sRGB, before compression or transmission to another system. As defined by IEC 61966-2-1, sRGB is a non-linear display profile that accommodates the voltage-to-color response characteristics of most high-quality CRT monitors. The colors of the red, green, and blue phosphors (primaries) and the white point setting of an sRGB-conformant monitor are specified in the IEC document. For uncompressed color images containing non-interleaved red, green and blue pixels in that order, the preferred color space is sRGB. Typically, modern digital cameras, desktop scanners, LCD monitors, and printers, although they do not inherently operate in sRGB space, are designed with circuitry or software to produce sRGB output or to accommodate sRGB as an input space. If an image acquisition device's color space is unknown, sRGB is usually a reasonable choice. If an acquisition device and its software cannot provide sRGB output, various color management products are available commercially that use its color profile, often available from its manufacturer, to convert images in its native color space to sRGB.

In versions of this standard prior to 2007, the term "color space" referred to device dependent color information with a particular sequence and range for the three color channels. The choice was either RGB or an RGB-derivative space known as YCC. Neither space provides an objective definition of a particular color nor relates to the way in which humans perceive color. For JPEG-compressed color images stored in the JFIF format, the preferred (external) color space is sRGB and an entry of 'SRGB' shall be used. Although sRGB is the preferred color space for compressed images for this version, for backward compatibility purposes, new systems shall accommodate JPEG images that have been labeled as using the YCC color space. Systems conforming to this standard shall accept an entry of YCC and interpret it as meaning a (device dependent) RGB color space.

For JPEG 2000 images stored in the JP2 file format, the available enumerated color spaces are sRGB, sYCC, and grayscale. The preferred (external) color space for color images is sRGB. If a photo acquisition device uses another International Color Consortium[2] (ICC) color profile, the acquisition system shall convert the image data to the sRGB, sYCC, or grayscale color space before the JP2 file may be embedded in a record.

Table 4 Color spaces

Code	Description
UNK	Undefined
GRAY	For use when describing a grayscale image in a record which requires CSP
RGB	Undetermined color space
SRGB	sRGB (IEC 61966-2-1)
YCC	***Legacy only***
SYCC	YCbCr (JPEG 2000 compressed)

[2] See http://www.color.org/

5.12.5. BPX / Bits Per Pixel

This field contains the number of bits used to represent a pixel when the CGA is NONE, although BPX should still be correctly populated regardless of CGA. For historical reasons, when this field contains an entry of '8', CSP is assumed to be GRAY. Any entry in this field greater than '8' requires the corresponding Color Space (CSP) field to also be used, as such values may represent either a grayscale pixel with increased proportion or an RGB color image. Other values of CSP are ambiguous and cannot be used. Application profiles may or may not accept images with **CSP**=RGB.

For color, BPX represents the total number of bits per pixel (not per color channel). For example, a 24-bit RGB image using 8 bits for each color would be represented as BPX=24, **CSP**=GRAY, and **CGA**=NONE. These are the BPX fields:

Field 13.012: BPX / Bits Per Pixel
Field 14.012: BPX / Bits Per Pixel
Field 15.012: BPX / Bits Per Pixel
Field 16.012: BPX / Bits Per Pixel
Field 17.012: BPX / Bits Per Pixel
Field 19.012: BPX / Bits Per Pixel
Field 20.012: BPX / Bits Per Pixel

5.13. Resolution

Many of the record types in this standard include images as the data field. Each image formatted in accordance with this standard shall appear to have been captured in an upright position and approximately centered horizontally in the field of view, except for Type-13 images. The scanning sequence (and recorded data) shall appear to have been from left-to-right, progressing from top-to-bottom. For the purpose of describing the position of each pixel within an image to be exchanged, a pair of reference axes shall be used. The origin of the axes, pixel location (0,0), shall be located at the upper left-hand corner of each image. The x-coordinate (horizontal) position shall increase positively from the origin to the right side of the image. The y-coordinate (vertical) position shall increase positively from the origin to the bottom of the image.

Many of the record types in this standard use the term "resolution", in the record type name, field names or in the text describing characteristics about the fields. Generally, the usage shares the commonality of describing pixels per unit of measure. In many cases, a qualifier is used before the term, such as "scanning" resolution or "transmitting" resolution.

This section does not apply to Type-22 imagery. All other record types containing images are variable resolution except for the *legacy* Type-4, which has a fixed resolution. Record Type-4 shall not be used for anything but 500 ppi class resolution images (see Section 5.13.1).

The scanner resolution is specified for Record Types 10, 13, 14, 15, 16, 17, 19 and 20 using SHPS / Scanned Horizontal Pixel Scale and SVPS / Scanned Vertical Pixel Scale. Record Type-7 does

not include a field to specify resolution. Since Type-7 records are user-defined, the sender and receiver must exchange information concerning the resolution of the data.

As used within this standard, and consistent with the definitions in Section 4 Terms and Definitions, the following categorization of terms related to resolution is provided to promote understanding and interpretation of these terms:

Terms relating to ***Acquisition*** – "scanning resolution", "native scanning resolution"

Terms relating to ***Images*** – "nominal resolution", "transmitting resolution"

Terms relating to either ***Acquisition*** or ***Images*** – "class resolution", "tolerance"

Most of the complexity related to resolution pertains to friction ridges (particularly fingerprints) as described in the following subclauses.

5.13.1. Friction Ridge Resolution Requirement

For EBTS Appendix F[3] certified devices, resolution accuracy shall not vary more than 1% from the class resolution. A class resolution of 19.69 ppmm (500 ppi) has a lower bound of 19.49 ppmm (495 ppi) and an upper bound of 19.89 ppmm (505 ppi). See Table 5 below. For Personal Identity Verification (PIV)[4] certified devices with fingerprint subject acquisition profile (FAP) levels 10 to 40 only (see Section 5.14.2), resolution accuracy shall not vary more than 2% from the class resolution. For example, a class resolution of 19.69 ppmm (500 ppi) has a lower bound of 19.30 ppmm (490 ppi) and an upper bound of 20.08 ppmm (510 ppi). The 2% tolerance for class resolution applies only to verification / authentication applications – not to identification applications. FAP 10 is a minimum requirement and any FAP level below 10 is not covered by this standard. See Table 8 Subject Acquisition Profiles for Fingerprint for a description of the FAP levels.

Table 5 Class resolution with defined tolerance

Certification	Maximum Tolerance	500ppi Class Resolution	1000ppi Class Resolution
Appendix F	±1%	±5 ppi	±10 ppi
PIV	±2%	±10 ppi	Not Applicable

Tolerance requirements shall apply to the class and nominal resolution requirements throughout this standard.

Palm print application profiles, PAP are shown in Table 10 Subject Acquisition Profiles for Palm Print and TAP profiles are shown in Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar). Both of them are subject to EBTS Appendix F testing.

[3] *242-HQ-A6687913-SYSDOCU* Criminal Justice Information Services (CJIS) *Electronic Biometric Transmission Specification (EBTS)* February 10, 2025 - *Appendix F - CJIS Image Quality Specifications*
[4] Personal Identity Verification (PIV): *Image Quality Specifications for Single Finger Capture Devices*.

Note that latent prints in Type-13 records are not subject to these tolerance restrictions, since they may be generated by several different means, including direct photography. There is no field corresponding to FAP, PAP or TAP for a Type-13 record.

5.13.2. Friction Ridge Scanner Resolution Requirement

The following clauses address the scanner or acquisition process requirements for friction ridge acquisition devices.

5.13.2.1. Exemplar Scanner Resolution Requirement

Exemplar images shall have a minimum scanning resolution of the 500 ppi class. If ***legacy*** Type-4 records are included in the transaction, Field 1.011 NSR / Native Scanning Resolution contains five characters specifying the native scanning resolution in pixels per millimeter. It is expressed as two numeric characters followed by a decimal point and two more numeric characters (e.g., 19.69). This field is set to '00.00' if no Type-4 records are present in the transaction. An implementation domain or application profile may specify that NSR may be used to apply to Type-7 records. Record Type-14 shall be used if scanning a fingerprint image at the 1000 ppi class or above, and is preferred for the 500 ppi class.

5.13.2.2. Latent Image Scanner Resolution Requirement

Latent images shall have a minimum scanning resolution of the 1000 ppi class.

5.13.2.3. Scanner Resolution Migration Path

The migration path to higher scanning resolutions for image capturing devices with a native scanning resolution of the 500 ppi class shall be at a rate of 100% of the current native scanning resolution. The recommended migration path progresses from 19.69 ppmm to 39.37 ppmm (500 ppi class to 1000 ppi class), from 39.37 ppmm to 78.74 ppmm (1000 ppi class to 2000 ppi class), etc.

Capture devices with native scanning resolutions not in step with this migration path shall provide (through subsampling, scaling, or interpolating downward) a nominal resolution that matches the next lower interval in the migration path. For example, a device with native scanning resolution of 47.24 ppmm (1200 ppi) shall provide a class resolution of 39.37 ppmm (1000 ppi).

5.13.3. Friction Ridge Transmitting Resolution Requirement

Each image to be exchanged shall have a specific resolution associated with the transmitted data. This transmitting resolution does not have to be the same as the scanning resolution. However, the transmitting resolution shall be within the range of permissible resolution values for that record type.

5.13.3.1. Record Type-4 Transmitting Resolution Requirement

When an image is captured at a scanning resolution greater than the permissible upper limit of the transmitting resolution of 500 ppi class, the image shall be subsampled, scaled, or interpolated down[5]. This processing to reduce the scanning resolution to a lower nominal resolution shall be performed before the transmission occurs. Processing to increase the resolution above scanning resolution is not permitted. Field 1.012 NTR / Nominal Resolution shall specify the transmitting resolution in pixels per millimeter. It is expressed as two numeric characters followed by a decimal point and two more numeric characters (e.g., 19.69). The transmitting resolution shall be within the range 19.30 ppmm (490 ppi) to 20.08 ppmm (510 ppi) for a ***legacy*** Type-4 record. This range reflects the 2% tolerance from 500 ppi allowed for PIV certified devices. (See Table 5). For example, a sensor that scans natively at 508 ppi would list both NSR and NTR as 20 ppmm (i.e., 508 ppi). These images should not be sampled down to exactly 500 ppi. This field is set to '00.00' if no Type-4 records are present in the transaction. NTR does not apply to Type-7 records, unless so specified by an implementation domain. Given that the transmitting resolution shall not be greater than the scanning resolution, images meant for identification applications, such as those from EBTS Appendix F certified devices are restricted to a 1% tolerance from 500 ppi.

5.13.3.2. Variable-Resolution Record Types Transmitting Resolution Requirement

For variable-resolution friction ridge images (those in Record Types 13, 14, 15, 19 and potentially in Record Types 16 and 20), the transmitting resolution shall be at least as great as the class resolution of 500 ppi. There is no upper limit on the variable-resolution rate for transmission. However, the transmitting resolution shall not be greater than the scanning resolution. For variable resolution records the Transmitted horizontal pixel scale (THPS) and the Transmitted vertical pixel scale (TVPS) shall be specified. Before transmitting variable-resolution records, the operational capabilities of the sending and receiving systems should be addressed, and prior agreement should be made with the recipient agency or organization before transmitting the image.

The migration path to higher transmitting resolutions is the same as for the scanning resolutions, i.e., from 500 ppi class to 1000 ppi class; from 1000 ppi class to 2000 ppi class, etc. For images captured at a native scanning resolution greater than the permissible upper limit of a transmitting resolution step in the migration path, it may be necessary to subsample, scale, or interpolate down. The result of this processing is to obtain a nominal scanning resolution that conforms to a step in the transmission migration path[5].

[5] When downsampling a fingerprint image from 1000 ppi to 500 ppi, the guidance provided in NIST Special Publication 500-289 (https://doi.org/10.6028/NIST.SP.500-289) should be followed in order to produce a 500 ppi image with the minimal effect on the image contents and quality.

5.14. Subject Acquisition Profiles - SAP/ FAP / IAP / TAP / PAP

A subject acquisition profile is used to describe a set of characteristics concerning the capture of the biometric sample. These profiles have mnemonics SAP for face, FAP for fingerprints, IAP for iris records, PAP for palm print and TAP for toe and foot (plantar).

The values do not have the same meaning for different modalities. A multi-biometric capture device could, for example, have an SAP level of 42, FAP level of 45, and an IAP level of 40. With the exception of mobile device SAP levels, the higher the value, the stronger the acquisition requirements.

For friction ridge images, these profiles may apply to images collected using livescan devices or ink on paper.

5.14.1. SAP / Subject Acquisition Profile for Face

The SAP level code for face from Table 6 is entered into Field 10.013: SAP / Subject Acquisition Profile. The SAP level requirements for facial images are described below and in Appendix E.

Table 6 Subject acquisition profiles for face

SAP Level	Subject Acquisition Profile
0	Unknown acquisition profile or other source not mentioned in this table
1	Surveillance facial image
10	Driver's license image (AAMVA)
11	ANSI Full Frontal facial image (*ANSI 385*)
12	ANSI Token facial image (*ANSI 385*)
13	ISO Full Frontal facial image (I*SO/IEC 19794-5*)
14	ISO Token facial image (*ISO/IEC 19794-5*)
15	PIV facial image (*NIST SP 800-76*)
20	Legacy Mugshot
30	Best Practice Application – Level 30
32	Mobile ID Best Practice - Level 32
40	Best Practice Application – Level 40
42	Mobile ID Best Practice - Level 42
50	Best Practice Application – Level 50
51	Best Practice Application – Level 51
52	Mobile ID Best Practice - Level 52

5.14.1.1. Level 0 (Unknown profile)

This level denotes any case when the SAP is unknown or from another source. This value may be used to alert systems that the profile of the face image needs to be determined manually or via advanced face image quality evaluation techniques.

5.14.1.2. Level 1 (Surveillance facial image)

This SAP value denotes a surveillance facial image: a face image captured without specific regard to scene, photographic, or digital requirements. For example, an image of a face from commonly available surveillance video equipment is generally considered a surveillance facial image. Typically, surveillance facial images are of relatively poor quality compared to mugshots, including significant pose angle used for the frontal view, poor image resolution, poor image contrast, etc.

5.14.1.3. Levels 10-15 (Other application profiles)

Levels 10-15 shall denote transaction associated with capture under the guidance of other facial standards or application profiles as defined below. Note that the facial images of Level 13 and Level 14 may come from travel documents as described in "Deployment of Machine-Readable Travel Documents", ICAO Technical Report, version 2.0.

Level 10 denotes a driver license facial portrait described in the AAMVA International Specification – DL/ID Card Design.

Level 11 denotes an ANSI facial image that meets requirements of the Full Frontal Image type defined in ANSI INCITS 385-2004.

Level 13 denotes an ISO facial image that meets the requirements of the Full Frontal Image defined in International standard ISO/IEC 19794-5.49

Level 14 denotes an ISO facial image that meets the requirements of the Token Face Image type defined in International standard ISO/IEC 19794-5.49

Level 15 denotes a PIV facial image that meets requirements of Biometric Data Specifications for Personal Identity Verification defined in NIST SP 800-76.50

See Section 3 Normative References for information about the references cited above.

5.14.1.4. Level 20 (Legacy mugshot)

A facial image conforming to this application profile level shall be a mugshot formatted according to ANSI/NIST-ITL 1-2000, but not necessarily conforming to the best practice requirements given in Level 30. The subject pose(s) may be Frontal, Profile, or Angled.

5.14.1.5. Level 30 (Basic mugshot)

These mugshots shall adhere to strict background, lighting, and resolution requirements. In particular, the background is 18% gray, the lighting is three-point, and the image size is at least 480 x 600 pixels with an aspect ratio of 1:1.25. See Appendix E*, Facial Capture – SAPs 30 and above - Normative* for more information about Level 30.

5.14.1.6. Level 32 (Mobile device basic mugshot)

The requirements for Level 32 are based on those of level 30, but not fully inclusive of all of those requirements. For instance, relative centering error and 18% grayscale with appropriate lighting may not be realistic for a mobile application. Use of this SAP number indicates that the image was captured with a mobile device. See Table 7 Mobile device face SAP levels for the complete requirements for Level 32.

5.14.1.7. Level 40 (Higher resolution mugshot)

A facial image conforming to the Level 40 application profile can be captured with an off-the-shelf 1-megapixel camera. Requirements for conformance with Level 40 facial image capture include the following (See also Appendix E: Facial Capture – SAPs 30 and above):

- The image shall conform to the minimum requirements for the capture of Level 30 facial images.
- At least one full frontal face image shall be captured.
- The minimum number of pixels in the digital image shall be 768 x 1024 pixels, and
- Facial images shall conform to the “head and shoulders” composition detailed requirements shown in Appendix E. Facial Capture – SAPs 30 and above - Normative.

It should be noted that the resolution aspect of the captured facial images improves as the number of pixels in both directions increases. As images are captured with an increased number of pixels, the 3:4 (Width:Height) aspect ratio shall be maintained.

5.14.1.8. Level 42 (Mobile device higher resolution mugshot)

The requirements for Level 42 are based on those of Level 40, but not fully inclusive of those requirements. For instance, relative centering error and 18% grayscale with appropriate lighting may not be realistic for a mobile application. Use of this SAP number indicates that the image was captured with a mobile device. See Table 7 Mobile device face SAP levels for the complete requirements for Level 42.

5.14.1.9. Levels 50 and 51 (Best practice mugshots)

A facial image conforming to the Level 50 and Level 51 application profiles shall include “face image capture requirements”. See Appendix E: Facial Capture – SAPs 30 and above. These profile levels are intended to allow for examination of up to forensic-level (10 ppmm) detail on a subject’s face. The only difference between Level 50 and Level 51 is that Level 50 specifies the “head and shoulders” composition requirements while Level 51 specifies the “head only” composition requirements.

For a Level 50 image capture profile, the minimum number of pixels in the digital image shall be 3300 pixels in the horizontal direction by 4400 pixels in the vertical direction.[6]

Off-the-shelf 15 (or more) megapixel digital cameras satisfy this requirement. As an alternative, allocating 70% of the image width for the head requires approximately 2400 pixels for the "head only" facial capture. For a Level 51 image capture profile, the minimum number of pixels in the digital image shall be 2400 pixels in the horizontal direction by 3200 pixels in the vertical direction. Off-the-shelf 8-megapixel digital cameras satisfy this requirement.

The Level 50 and 51 SAPs allow for the encoding of face images that are consistent with the discussion above and with the "face image capture requirements". It should be noted that the resolution aspect of the captured facial images might be improved as the number of pixels in both directions are increased. Figure 5 illustrates the improvement in image quality from Levels 30 to 50/51. As images are captured with an increased number of pixels, the 3:4 (Width:Height) aspect ratio shall be maintained.

5.14.1.10. Level 52 (Mobile device best practice mugshots)

The requirements for Level 52 are based upon those of Level 50 but are not fully inclusive of all of those requirements. For instance, relative centering error and 18% grayscale with appropriate lighting may not be realistic for a mobile application. Specific roll, pitch and yaw requirements are not included in Level 52. See Table 7 Mobile device face SAP levels for the complete requirements for Level 52.



Figure 3 Examples of resolution for face SAP levels 30/32, 40/42, & 50/51/52

Table 7 Mobile device face SAP levels

Capture Specifications	Comments	Level 32	Level 42	Level 52
Image resolution (size)	Lower resolution may reduce accuracy	≥ 480 x 600	≥ 786 x 1024	≥ 2400 x 3200
Capture device sensor		Progressive scan (no interlace)	Progressive scan (no interlace)	Progressive scan (no interlace)

[6]Identification applications require approximately 1700 pixels wide by 2515 pixels high on the face for the 99th percentile male in the U.S. population. Allocating 50% of the image width for the head requires approximately 3400 pixels for a "head and shoulders photo" image width.

Capture device color space		Minimum of 24-bit RGB color space or a minimum of 8-bit monochrome color space	Minimum of 24-bit RGB color space or a minimum of 8-bit monochrome color space	Minimum of 36-bit RGB color space or a minimum of 12-bit monochrome color space
Capture device controls		Auto gain and auto shutter, optional: control loop for camera parameter (shutter speed / flash intensity) based on face area on-board	Auto gain and auto shutter, optional: control loop for camera parameter (shutter speed / flash intensity) based on face area on-board (requires continuous face detection)	Auto gain and auto shutter, optional: control loop for camera parameter (shutter speed / flash intensity) based on face area on-board (requires continuous face detection)
Capture distance in cm	Lower distance may reduce accuracy	60-200 cm (~ 2 – 6 feet), the longer distance is preferred	60-200 cm (~ 2 – 6 feet), the longer distance is preferred	60-200 cm (~ 2 – 6 feet), the longer distance is preferred
Illuminator type – optional feature		Xenon flash or LED / fill-in flash	Xenon flash or LED / fill-in flash	Xenon flash or LED / fill-in flash
Ambient light	Minimum light level at which flash becomes required	4 lux	4 lux	4 lux
Wavelength range		Visible light. 380-780 nm	Visible light. 380-780 nm	Visible light. 380-780 nm
Exposure time	Capability to freeze motion	$\leq$ 1/100s (10 ms)	$\leq$ 1/100s (10 ms)	$\leq$ 1/100s (10 ms)
Inter-eye distance	Lower resolution may reduce accuracy	$\geq$ 90 pixels	$\geq$ 150 pixels	$\geq$ 300 pixels
Frame rate (frames per second)	For positioning (live view)	$\geq$ 12 fps	$\geq$ 12 fps	$\geq$ 12 fps

5.14.2. FAP / Subject Acquisition Profile for Fingerprint

The profile levels for fingerprint acquisition are optional and are based upon those listed in the Mobile ID Best Practice Recommendation, Version 2. They are chosen from the Subject Acquisition Profiles for Fingerprint table below and entered in Field 14.031 FAP / Subject Acquisition Profile – Fingerprint.

Note that JPEG 2000 is required for compression of 1000 ppi images. WSQ was designed for 500 ppi only. FAP codes of 100 or greater are used for 1000 ppi.

FAP 45 and higher may be used for images collected using livescan devices or ink on paper. FAP 40 and lower only apply to livescan.

Table 8 Subject acquisition profiles for fingerprint

FAP Level	Acquire Flat Images	Acquire Rolled Images	Minimum Gray Levels	Acceptable Image Resolution	Minimum Image Dimension (w x h) in inches	Target Compression Ratio	Compression Algorithm	Simultaneous # of Fingers	Sensor Certification
10	Yes	No	256	500 +- 2%	.5" x .65"	10:1	WSQ 2.0+	1	PIV
20	Yes	No	256	500 +- 2%	.6" x .8"	10:1	WSQ 2.0+	1	PIV
30	Yes	No	256	500 +- 2%	.8" x 1.0"	10:1	WSQ 2.0+	1	PIV
40	Yes	Optional	256	500 +- 2%	1.6" x 1.5"	10:1	WSQ 2.0+	1 – 2	PIV
45	Yes	Optional	256	500 +- 1%	1.6" x 1.5"	15:1	WSQ 3.1+	1 – 2	Appendix F
50	Yes	Optional	256	500 +- 1%	3.2" x 2"	15:1	WSQ 3.1+	1 – 4	Appendix F
60	Yes	Optional	256	500 +- 1%	3.2" x 3"	15:1	WSQ 3.1+	1 – 4	Appendix F
145	Yes	Optional	256	1000 +- 1%	1.6" x 1.5"	10:1	JPEG 2000	1 – 2	Appendix F
150	Yes	Optional	256	1000 +- 1%	3.2" x 2"	10:1	JPEG 2000	1 – 4	Appendix F
160	Yes	Optional	256	1000 +- 1%	3.2" x 3"	10:1	JPEG 2000	1 – 4	Appendix F

5.14.3. IAP / Subject Acquisition Profile for Iris

The profile levels for iris acquisition are selected from the Subject acquisition profiles for iris table below and entered in Field 17.031 IAP / Subject Acquisition Profile – Iris.

A device used to capture iris images shall be based upon near-infrared wavelength capture, approximately 700 to 900 nm. Some systems may use a portion of this range, which is acceptable.

Iris image capture devices typically provide infrared lighting using LEDs to illuminate the iris. The illumination is in a range partly visible to the human eye. Illumination shall be compliant with illumination standard IEC 825-1 and safety specification ISO 60825-1.

The illumination wavelengths shall have > 90% of energy within the 700-900 nm band; and > 35% of energy in the 800-900 nm band.

Many contemporary iris imagers are capable of capturing both left and right iris images simultaneously or quasi-simultaneously (within a few milliseconds). Others only capture one iris at a time. For mobile applications, both images should be captured simultaneously or quasi-simultaneously. This reduces the possibility of mislabeling of the individual images (right or left). It also allows for more accurate estimation of the roll angle and potentially higher accuracy and comparison speed.

In order to achieve acceptable time-to-capture and Failure to acquire (FTA) rates, the iris image sampling frequency must be at least 5 frames per second. The iris image capture sensor shall use progressive scanning. The ability for an iris image capture device to suppress motion blur and to freeze motion, is a function of exposure time. The maximum allowable value for the exposure time, expressed in milliseconds, reduces as Iris acquisition profile (IAP) levels increase, from a maximum of 33 ms at IAP 20 to a maximum of 10 ms at IAP 40, as shown in Table 9.

Standard ISO/IEC 19794-6:2011 adopted the Modulation Transfer Function (MTF) specification of 0.6 with a spatial frequency of 2 cycles / mm.

In order to achieve accurate recognition accuracy, the iris acquisition sensor must achieve a signal-to-noise ratio of at least 36dB.

The new IAP levels state spatial sampling rate instead of minimum pixels. Since a typical iris is 10.2-13.0mm, a sampling rate of 10ppmm would result in an iris diameter of 102-103 pixels, less than the minimum requirement for IAP 20. This revision corresponds to ISO/IEC 19794-6:2011.

Table 9 Subject acquisition profiles for iris

IAP Level	Iris Diameter in true, non-upscaled pixels	Spatial sampling rate (pixels / mm)	Number of (quasi-) simultaneously captured eyes	Exposure time
10		10		≤ 33 ms
11		10		≤ 15 ms
12		10		≤ 10 ms
20	≥ 140		≥ 1	≤ 33 ms
30	≥ 170		≥ 1	≤ 15 ms
40	≥ 210		2	≤ 10 ms

5.14.4. PAP / Subject Acquisition Profile for Palm Print

The capture of palm print exemplars is similar in concept to that of fingerprints. The principal differences are that the area of the print is larger, and the palm is not usually rolled. These are reflected in the equipment specifications. The minimum platen area is 5.0” x 5.0”, corresponding to a PAP 70 level. As with the fingerprint Acquisition Profiles, there are levels corresponding to 500 and to 1000 ppi outputs, with corresponding differences in compression ratio and compression algorithm to be used.

All PAP levels require the ability to capture flat images. Capture of rolled images is optional. The minimum grayscale level is 256. All PAP levels may be used for images collected using livescan or ink on paper.

Table 10 Subject acquisition profiles for palm print

PAP Level	Acceptable Image Resolution	Minimum Image Dimension (w x h) inches	Target Compression Ratio	Compression Algorithm
70	500 +- 1%	5.0” x 5.0”	15:1	WSQ 3.1+
80	500 +- 1%	5.0” x 8.0”	15:1	WSQ 3.1+
170	1000 +- 1%	5.0” x 5.0”	10:1	JPEG 2000
180	1000 +- 1%	5.0” x 8.0”	10:1	JPEG 2000

5.14.5. TAP / Subject Acquisition Profile for Toe and Plantar Prints

The capture of toe and sole (plantar) exemplars is similar in concept to that of fingerprints. The principal differences are that the area of the print is larger, and the foot is not usually rolled. These are reflected in the equipment specifications. The minimum platen area is 5.0” x 5.0”, corresponding to a TAP 70 level. As with the fingerprint Acquisition Profiles, there are levels corresponding to 500 and to 1000 ppi outputs, with corresponding differences in compression ratio and compression algorithm to be used.

Not included in these basic specifications are others that will be of interest to the procuring agency, including (but not limited to):

- Weight of the unit
- Ability to capture images outdoors (protection from too much sunlight)
- Ability to withstand environmental conditions typical of the conditions in which the unit will be used (dust, heat / cold exposure, humidity, etc.)
- Routine maintenance requirements

All TAP levels require the ability to capture flat images. Capture of rolled images is optional. The minimum grayscale level is 256. All TAP levels may be used for images collected using livescan or ink on paper.

Table 11 Subject acquisition profiles for toe and foot (plantar)

TAP Level	Acceptable Image Resolution	Minimum Image Dimension (w x h) inches	Target Compression Ratio	Compression Algorithm
70	500 +- 1%	5.0” x 5.0”	15:1	WSQ 3.1+
80	500 +- 1%	5.0” x 8.0”	15:1	WSQ 3.1+
170	1000 +- 1%	5.0” x 5.0”	10:1	JPEG 2000
180	1000 +- 1%	5.0” x 8.0”	10:1	JPEG 2000

6. Record Types Data Dictionary (Normative)

A transaction is composed of records. The standard supports different biometric and forensic modalities and has reserved record identifiers for the possible future addition of other modalities. Detailed information about each record type follows below.

Table 12 Record types

Record Identifier	Record Contents
1	Transaction information
2	User-defined descriptive text
3	***Deprecated***
4	***Legacy***
5	***Deprecated***
6	***Deprecated***
7	User-defined image
8	Signature image
9	Friction ridge metadata
10	Photographic body part imagery (including face and SMT)
11	Voice data
12	Forensic dental and oral data
13	Variable-resolution latent friction ridge image
14	Variable-resolution fingerprint image
15	Variable-resolution palm print image
16	User-defined variable-resolution testing image
17	Iris image
18	DNA data
19	Variable-resolution plantar image
20	Source representation
21	Associated context
22	Non-photographic imagery
23-97	Reserved for future use
98	Information assurance
99	CBEFF biometric data record

6.1. Record Type-1: Transaction Information Record

Record Type-1 is mandatory; transmissions to be exchanged shall contain exactly one Type-1 record per transaction. The Type-1 record shall always be the first record within the transaction, followed by at least one additional record of Type 2-99. The Type-1 record shall provide information describing type and use or purpose for the transaction involved, a listing of each record included in the transaction in the order presented, the originator or source of the physical record, and other useful and required information items.

Since any alternate character encoding is specified in this record, there must be a default character set agreed upon in order to read this record, particularly with Traditional encoding.

Therefore, 7-bit ASCII shall be required for all field values in record Type-1 (See https://www.ascii-code.com/ASCII for these characters). This provides for backward compatibility with previous versions of the standard.

6.1.1. 1.001 LEN / Record Length

The length of the entire Type-1 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer (1+ N)

6.1.2. 1.002 VER / Version Number

The version of ANSI/NIST-ITL used in this transaction; the first two digits indicate major version, and the second two digits indicate minor value. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

Condition: Mandatory

Occurrence: 1

Value Constraints: For ANSI/NIST-ITL 1-2025 this value is **0600**. (4 N)

6.1.3. 1.003 CNT / Transaction Content

This field specifies each of the records in the transaction by record type REC and its IDC value in the order in which the records appear in the file.

Condition: Mandatory

Occurrence: 1

Value Constraints: 2 to 1000 Subfields; Information Items as described below

Contains:

Information Items comprising the First Subfield Set:

1) *FRC First Record Category Code*

This information item indicates the Type of the first record in the transaction, i.e., FRC = 1.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1

Value Constraints: Fixed Value = 1. (1 N)

2) *CRC Content Record Count*

This information item provides the total count of records of Type 2 through Type 99.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ positive integer ≤ 999. (1-3 N)

Information Items comprising each subsequent Repeating Subfield – the number of occurrences of this subfield set shall be equal to the value of CRC:

3) *REC Record Category Code*

This information item contains the record type identifier, value taken from Table 12 Record Types.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Value from Table 12 Record Types. (1-2 N)

4) *IDC Information Designation Character*

This information item contains the identifier for the image included in the corresponding record (from that record's field x.002). See Section 5.3.2 Leading Zeroes in Field Values for additional information.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ positive integer ≤ 99. (2N)

6.1.4. 1.004 TOT / Type of Transaction

This field value is defined by each application profile and indicates the requested action to be performed by the receiver.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 16 letters (a-Z) in accordance with Domain/Application Profile. (1-16 A)

6.1.5. 1.005 DAT / Transaction Date

This field shall contain the local date that the transaction was submitted. Due to time zone differences, it may be a different date than the GMT.

Condition:	Mandatory

Occurrence:	1
Value Constraints:	Local Date (see Section 5.1.1) Only complete dates are permitted (year, month, and day).

6.1.6. 1.006 PRY / Priority

This field indicates the urgency with which a response is desired, with '1' denoting the highest priority. Default value is defined by the receiving agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 9. (1 N)

6.1.7. 1.007 DAI / Destination Agency Identifier

This field shall contain the official identifier for the receiving organization.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

6.1.8. 1.008 ORI / Originating Agency Identifier

This field shall contain the official identifier for the organization sending this transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

6.1.9. 1.009 TCN / Transaction Control Number

This field shall contain an agency-specific unique identifier for the current transaction, generated by the sending agency.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

6.1.10. 1.010 TCR / Transaction Control Reference Number

This field contains a TCN from a previous transaction in order to link them together, such as a response to a query, or a resubmission of a failed transaction.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

6.1.11. 1.011 NSR / Native Scanning Resolution

This field contains the native scanning resolution of the friction ridge image capture device for ***legacy*** Type-4 records, or Type-7 records if so specified by the domain or application profile. This field shall specify the resolution in pixels per millimeter; the value shall be set to '00.00' if there are no applicable records in the transaction. If Record Type-4 is used and images are scanned at greater than the class of 500 ppi, they shall be subsampled, scaled down, or interpolated down to produce a class resolution of 500 ppi for transmission.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Value between 00.00 and 99.99, inclusive, with a precision of 2 decimal places. (5 NS in the form *NN.NN*)

6.1.12. 1.012 NTR / Nominal Resolution

This field specifies the nominal resolution for the exchange of ***legacy*** Type-4 images, or Type-7 images if so specified by the domain or application profile. This field shall specify the resolution in pixels per millimeter (ppmm), within the 500ppi class defined tolerance of 19.30 ppmm (490 ppi) to 20.08 ppmm (510 ppi) for ***legacy*** Type-4 images (see Table 5 Class resolution with defined tolerance); transmission resolutions for Type-7 records should be specified by the application profile. The value shall be set to '00.00' if there are no applicable records in the transaction.

When transmitting ***legacy*** Type-4 images which are scanned at greater than the class of 500 ppi (per Field 1.011 NSR), they shall be subsampled, scaled down, or interpolated down to produce a class resolution of 500 ppi for transmission. The guidance provided in *NIST Special Publication 500-289*[7] should be followed to produce a 500 ppi image with the minimal effect on the image contents and quality.

Users shall utilize Record Type-14 if transmitting a fingerprint image at greater than the limits of the 500 ppi class. Images with scanning resolution greater than or equal to the 1000 ppi class

[7] https://doi.org/10.6028/NIST.SP.500-289

should not be transmitted using ***legacy*** Record Type-4 unless being transmitted at 500 ppi class to a system incapable of receiving Type-14 records at 1000 ppi class or greater.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	For ***legacy*** Type-4 images, the values must be either 00.00, or between 19.30 ppmm and 20.08 ppmm, inclusive, with a precision of 2 decimal places. For other image types, value as specified by domain or application profile, not to exceed the range of 00.00 and 99.99, inclusive, with a precision of 2 decimal places. (5 NS in the form *NN.NN*)

6.1.13. 1.013 DOM / Transaction Domain Name

This field identifies the domain name and version for the user-defined Type-2 record implementation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; 2 Information Items as described below.

Contains:

1) *DNM* ***Domain Name***

The first information item will uniquely identify the agency, entity, or implementation used for formatting the fields in the Type-2 record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. The default value for the field shall be the North American Domain implementation ('**NORAM**'). (1+ ANS)

2) *DVN* ***Domain Version Number***

The second information item contains the unique version of the particular implementation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS).

6.1.14. 1.014 GMT / Greenwich Mean Time

This field provides a mechanism for expressing the datetime of the transaction in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Shall be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

6.1.15. 1.015 DCS / Character Encoding

This field specifies the character encoding that may appear within this transaction for data with the character type listed as ‘U’ or “user-specified” in the field description. If Field 1.015: DCS / Character Encoding is not included in the transaction, the default character set encoding is 7-bit ASCII with the leftmost (eighth) bit padded with zero for Traditional encoding.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *CSI* ***Character Encoding Index***

The first information item shall be the index number that references an associated character encoding.

Condition:	Mandatory for Traditional Encoding, otherwise omitted
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Shall contain a value from the “Character encoding index” column of Table 1 Character encoding (1-3 N)

2) *CSN* ***Character Encoding Name***

The second information item shall be the “Character encoding name” associated with that index number, taken from Table 1 Character encoding.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain the “Character encoding name” value from Table 1 Character encoding associated with the CSI value. (1-16 ANS)

3) *CSV* ***Character Encoding Version***

The optional third information item may be included to hold the specific version of the character encoding used, such as '1.0'.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1-16 ANS)

6.1.16. 1.016 APS / Application Profile Specifications

This field indicates the transaction's conformance with one or more Application Profile Specifications that are derived from ANSI/NIST-ITL, such as EBTS or INT-I. There may be multiple subfields, each designating an application profile to which this transaction conforms. If multiple Application Profile Specifications are included in this field, the specifications must be compatible with each other, and the transaction must be in conformance with all of the cited specifications.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1-99 Subfields; Information Items as described below

Contains:

1) ***APO*** ***Application Profile Organization***

The first information item shall uniquely identify the agency or entity responsible for the specification.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

2) ***APN*** ***Application Profile Name***

The second information item shall contain the name of the specification.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

3) ***APV*** ***Application Profile Version Number***

The third information item shall contain the specific version of the specification.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

6.1.17. 1.017 ANM / Agency names

This field contains the names of the organizations transmitting and receiving the transaction, corresponding with field DAI and ORI identifiers. The field is comprised of two optional information items but if it appears, it shall include at least one.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *DAN* ***Destination Agency Name***

This name corresponds to the agency listed in Field 1.007 DAI / Destination Agency Identifier/ DAI.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

2) OAN ***Originating Agency Name***

This name corresponds to the agency listed in Field 1.008 ORI / Originating Agency Identifier.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Shall contain only printable ASCII 7-bit values, codes 32 – 126 inclusive. (1+ ANS)

6.1.18. 1.018 GNS / Geographic Name Set

This field shall be used if the transaction uses GENC in lieu of ISO 3166-1 as a code set for country code specifications. ISO 3166-1 is the default country code set used for the transaction when this field is omitted. GENC is available at https://nsgreg.nga.mil/genc/registers.jsp.

Information items affected by this field have “Values from ISO 3166-1 or GENC” noted in their value constraints.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are **ISO** and **GENC**. (3-4 A)

6.2. Record Type-2: User-Defined Descriptive Text Record

When present, Type-2 records shall contain user-defined textual fields providing identification and descriptive information associated with the subject of the transaction, such as state or FBI numbers, physical characteristics, demographic data, and the subject's criminal history.

Each entry in a Type-2 record shall have a definition and format that is listed with the Domain owner. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013 DOM / Transaction Domain Name found in the Type-1 record, if that field is in the transaction. The default domain is NORAM. Field 1.016 APS / Application Profile Specifications/ APS allows the user to indicate conformance to multiple specifications. If Field 1.016 is specified, the Type-2 record must conform to each of the application profiles. A DOM or APS reference uniquely identifies data contents and formats. Each domain and application profile shall have a point of contact responsible for maintaining this list. The contact shall serve as a registrar and maintain a repository including documentation for all of its common and user-specific Type-2 data fields. As additional fields are required by specific agencies for their own applications, new fields and definitions may be registered and reserved to have a specific meaning. When this occurs, the domain or application profile registrar is responsible for registering a single definition for each number used by different members of the domain or application profile.

An implementation domain, coded in Field 1.013: DOM / Domain Name of a Type-1 record as an optional field, is a group of agencies or organizations that have agreed to use pre-assigned data fields with specific meanings (typically in Record Type-2) for exchanging information unique to their installations. The implementation domain is usually understood to be the primary application profile of the standard. Field 1.016: APS / Application Profile Specification allows multiple application profiles to be referenced. The organization responsible for the profile, the profile name and its version are all mandatory for each application profile specified. A transaction must conform to each profile that is included in this field. It is possible to use Field 1.016 and / or Field 1.013. It is recommended that when only one profile is applicable, that Field 1.013 be used, and it be called the implementation domain.

An example of an implementation domain is the one maintained by the Criminal Justice Information Services (CJIS) Division of the Federal Bureau of Investigation (FBI). It is the North American Domain subscribed to by the Royal Canadian Mounted Police (RCMP), the FBI, and several state and Federal agencies in North America. The default value for this field shall be the North American Domain implementation and shall appear as 'NORAM'.

The transaction may include user-defined fields that are not described in any specified application profile or the specified domain. However, when any part of a transaction is defined

by one or more application profiles, it must conform to the requirements of all of the relevant application profiles.

For certain use-cases there may be more than one Type-2 record included in each transaction. Each of these instances of record Type-2 may concern a different individual; however, at least one instance should concern the subject of the transaction. For an example of the use of multiple Type-2 records in a transaction, see the description of the LFFS/LFIS transaction type used by the FBI EBTS specifications available at https://fbibiospecs.fbi.gov.

In some circumstances transactions may have separate Type-2 records when dealing with multiple persons whose identities are being used to establish or verify the identity of the subject of the transaction (such as persons already identified in a voice recording). A particular Type-2 record may be referenced in another Record Type, to logically associate the data in both records as relating to the same subject using the Type-2 T2C / Record Cross Reference.

6.2.1. 2.001 LEN / Record Length

The length of the entire Type-2 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer. (1+ N)

6.2.2. 2.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this Type-2 record as listed in the applicable subfield for this record in Field 1.003: CNT / Transaction Content. See Section 5.11.1 IDC / Information Designation Character and Section 5.3.2 Leading Zeroes in Field Values.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.2.3. Fields 2.003 – 2.9999: User-Defined Fields

Individual fields shall conform to the specifications set forth by the agency to which the transmission is being sent, to the domain listed in 1.013: DOM / Domain Name, the application profiles listed in Field 1.016: APS / Application Profile Specifications and to the requirements specified in Section 5.4 Structure of a Transaction.

6.3. Record Type-3: Deprecated

6.4. Record Type-4: Legacy

Refer to ANSI/NIST-ITL 1-2015 for implementation details for this legacy record. Systems may accept Type-4 records but shall use Type-14 for new records.

6.5. Record Type-5: Deprecated

6.6. Record Type-6: Deprecated

6.7. Record Type-7: User-Defined Image Record

Type-7 records shall contain user-defined image information relating to the transaction submitted for processing. New implementations based on this standard shall use the Record Type-13: Friction-Ridge Latent Image Record for latent records, and other record types, as appropriate, for transmitting biometric and forensic images. Images transmitted using Record Type-7 shall consist of scanned pixels that may be either binary or grayscale output. Each grayscale pixel value shall be expressed as an unsigned byte. A value of 0 shall be used to define a black pixel and an unsigned value of 255 shall be used to define a white pixel. For binary pixels, a value of 0 shall represent a white pixel and a value of 1 shall represent a black pixel. Resolution and compression are not specified for this Record Type.

In traditional encoding, this record is represented as a binary representation, with a fixed byte count for fields 7.001-7.002. The fixed number of bytes required for each of these fields is noted in parentheses in “Value Constraints.”

Since Type-7 records are user-defined, the sender and receiver must exchange information concerning the resolution of the data. Field 1.011: NSR / Native Scanning Resolution and Field 1.012: NTR / Nominal Resolution Apply only to the ***legacy*** Record Type-4, unless specifically stated otherwise in a domain’s specifications.

6.7.1. 7.001 LEN / Record Length

The length of the entire Type-7 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 4294967295 (4 Bytes)

6.7.2. 7.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this Type-7 record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

Condition:	Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (1 Byte)

6.7.3. 7.003 – 7.999 User-Defined Fields

The remaining fields of the Type-7 record shall be user-defined. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction, and to the specifications of the agency to which the transmission is being sent.

6.8. Record Type-8 Signature Image Record

Type-8 records shall contain either scanned or vectored signature data, covering an area of up to 1000 mm2. Two signature image records (from the operator and the subject) are allowed per transaction. See Section 5.13 for resolution information. Vectored signature data shall be expressed as a series of numbers.

Black and white (binary representation) image data may be transmitted in either compressed or uncompressed form. The Type-8 signature record is the only record that uses this data type for images, which was previously used by several deprecated record types in previous versions of this standard.

The uncompressed binary images shall consist of pixels, each of which shall be quantized to one of two levels (binary representation). For uncompressed binary images, eight pixels shall be left justified and packed into a single unsigned byte; the most significant bit of the byte shall be the first of the eight pixels scanned. Compressed binary images use a format agreed upon by the sending and receiving agencies. See Section 5.6 Implementation Domain and Application Profiles.

In traditional encoding, this record is represented as a binary representation, with a fixed byte count for fields 8.001-8.007. The fixed number of bytes required for each of these fields is noted in parentheses in “Value Constraints.”

6.8.1. 8.001 LEN / Record Length

The length of the entire Type-8 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 4294967295 (4 Bytes)

6.8.2. 8.002 IDC / Information Designation Character

This mandatory field shall contain the IDC assigned to this Type-8 record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 6.10.1 and See Section 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (1 Byte Binary value)

6.8.3. 8.003 SIG / Signature Type

This mandatory field shall contain 0 for the signature image of the subject, or 1 for the signature image of the official processing the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 1. (1 Byte Binary value)

6.8.4. 8.004 SRT / Signature Representation Type

This mandatory field shall be 0 if the image is scanned and not compressed, 1 if the image is scanned and compressed, and 2 if the image is vector data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 2. (1 Byte Binary value)

6.8.5. 8.005 ISR / Image Scanning Resolution

This mandatory field shall contain 0 if the scanned and transmitted image resolution is within the range of 19.49 ppmm (495 ppi) to 19.89 ppmm (505 ppi). A value of 1 indicates a different, unreported, image resolution. A value of 0 shall also be used if the image is vector data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 1. (1 Byte Binary value)

6.8.6. 8.006 HLL / Horizontal Line Length

This field shall be used to specify the number of pixels contained on a single horizontal line of the transmitted signature image. For vectored signature data, the value shall be zero.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	If **SRT** = 0 or 1, the value shall be 10 ≤ integer ≤ 65535. (2 Byte Binary value) If **SRT** = 2, the value shall be 0. (2 Byte Binary value)

6.8.7. 8.007 VLL / Vertical Line Length

This field shall be used to specify the number of pixels contained on a single vertical line in the transmitted signature image. For vectored signature data, the value shall be zero.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	If **SRT** = 0 or 1, the value shall be 10 ≤ integer ≤ 65535. (2 Byte Binary value) If **SRT** = 2, the value shall be 0. (2 Byte Binary value)

6.8.8. 8.008 DATA / Signature Image Data

This mandatory field shall contain uncompressed scanned image signature data, compressed scanned image signature data, or vectored image signature data. The entry contained in the **SRT** field shall indicate which form of the signature data is present.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	The representation of the signature will depend on the value of SRT and agreement by the sending and receiving parties. See below for details. For Traditional encoding, the record size is limited by the maximum allowed value for Field 8.001 because the total image size in bytes must be able to be accommodated in that field.

6.8.8.1. Uncompressed Scanned Image Data

If the **SRT** field contains the value of 0, then this field shall contain the uncompressed scanned binary image data for the signature. The uncompressed binary images shall consist of pixels, each of which shall be quantized to one of two levels (binary representation). For uncompressed binary images, eight pixels shall be left justified and packed into a single unsigned byte; the most significant bit of the byte shall be the first of the eight pixels scanned.

6.8.8.2. Compressed Scanned Image Data

If the **SRT** field contains the value of 1, then this field shall contain the scanned binary image data for the signature. Previous editions specified that the image be in compressed form using the ANSI/EIA-538-1988 facsimile compression algorithm. Other data image formats are now allowed. Whatever format is chosen should be agreed upon by the sending and receiving agencies.

6.8.8.3. Vectored Image Data

If the **SRT** field contains the value of 2, then this field shall contain a set of vectors that describes the pen position. Each vector has three parts:

- The first part is an x coordinate value (horizontal).
- The second part is a y coordinate value (vertical).
- The third part is the pen pressure value of line segments within the signature.

Both the x and y coordinates shall be expressed in units of .0254 mm (.001 inches) referenced from the bottom leftmost corner of the signature. Positive values of x shall increase from left-to-right and positive values of y shall increase from bottom-to-top. The pen pressure shall be a constant value until the next vector becomes active. A value or pressure of 0 shall represent a "pen-up" (or no pressure) condition. The value of 1 shall represent the least recordable pressure for a particular device, while 254 shall represent the maximum recordable pressure for that device. To denote the end of the vector list, 255 shall be inserted in this entry.

6.9. Record Type-9: Friction Ridge Metadata Record

Type-9 records shall contain descriptions of minutiae and related information encoded from a finger, palm, or plantar image. Note that Fields 9.005 through 9.012 in this version of the standard shall not appear for all new applications and are ***'legacy'*** fields. Legacy data containing these fields may still be transmitted in a transaction conformant to this version.

Record Fields 9.126 through 9.150 correspond to the conventions defined and described originally by the ANSI INCITS 378 standard. Record Fields 9.300 through 9.399 are the Extended Feature Set. Fields 9.176-9.225 are reserved as *user-defined* to convey additional information that is not included elsewhere in this record. Multiple blocks occurring in a single record (including the INCITS 378 block and the EFS block) shall represent the same features.

6.9.1. 9.001 LEN / Record Length

The length of the entire Type-9 record, measured in bytes, including this field.

Condition:	Mandatory for Traditional Encoding, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer. (2+ N)

6.9.2. 9.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate information items to the other records in the transaction. Two or more records may share a single IDC solely to identify and link together records that pertain to different representations of the same biometric trait. See 5.11.1 IDC / Information Designation Character and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.9.3. 9.003 IMP / Impression Type

The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table below. (1-2 N)

Table 13 Type-9 impression codes

Code	Description
0	Plain Contact; friction ridge skin presented still on platen
1	Rolled Contact; friction ridge skin rolled on platen
4	Latent impression of friction ridge skin deposited on a surface
8	Vertical swipe; friction ridge skin swiped on platen
24- 25, 41-42	***Deprecated***
43	Contactless capture
28	Other
29	Unknown

6.9.4. 9.004 FMT / Minutia Format

This mandatory field is retained only for backward compatibility in traditional encoding. It was a mandatory field in previous versions of the standard. This field shall always have a value ‘U’, unless including legacy fields 9.005 through 9.012, when this field shall contain ‘S’.

Condition: Mandatory for Traditional Encoding, otherwise omitted

Occurrence: 1

Value Constraints: 'U' or 'S'. (1 A)

6.9.5. 9.005-9.012 *Legacy Fields*

These ***legacy*** fields shall only be used for interchange of legacy data.

6.9.6. 9.013-9.030 *Legacy* FBI IAFIS Feature Set

These ***legacy*** fields are defined in the FBI EBTS for backwards compatibility but are superseded by the Extended Feature Set fields; for field descriptions, see https://fbibiospecs.fbi.gov/ebts-1/approved-ebts-1.

6.9.7. 9.031-9.125 Deprecated

6.9.8. 9.126-9.150 INCITS 378 Feature Set

The INCITS Technical Committee M1 developed the INCITS 378 standard. The term "M1" is used in lieu of INCITS 378 to shorten the field names. This entire set of fields is optional. Descriptions of fields in the range 9.126-9.150 use the word "mandatory" to indicate "mandatory" if this set of fields is present. "Optional" in this set of fields shall mean "optional if this set of fields is present."

6.9.8.1. 9.126 CBI / M1 CBEFF Information

This field contains information describing the identity and characteristics of the format of the transmitted minutiae data. Refer to the CBEFF standard for the definition of CBEFF Format Owner and Format Type and the CBEFF Product Identifier.

Condition: Mandatory

Occurrence: 1

Value Constraints: Information Items as described below.

Contains:

1) *CFO* *CBEFF Format Owner*

The first information item shall contain the identification of the assigned by the International Biometric Industry Association (IBIA) to INCITS Technical Committee M1 for traditional encoding.

Condition: Mandatory for Traditional Encoding, otherwise omitted

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Allowed code value is '27' (2 N)

2) *CFT* *CBEFF Format Type*

The second information item shall contain a code value indicating the format of the INCITS-378 represented in this feature set.

Condition:	Mandatory for Traditional Encoding, otherwise omitted
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Allowed code values as listed in the M1 CBEFF Format Codes below. (3 N)

Table 14 M1 CBEFF format codes

Code Value	Description
513	INCITS 378-2004 format, **without extended data** (Fields 9.138, 9.139, or 9.140)
514	INCITS 378-2004 format **with extended data** (Fields 9.138, 9.139 or 9.140)
515	INCITS 378-2009 format

3) *CPI* *CBEFF Product Identifier*

The third information item identifies the "owner" of the encoding equipment from the value at the IBIA website (www.ibia.org) website. This value shall be interpreted as combining the product identifier and the format type as specified in INCITS 378-2009 OR the value that may have been entered by a user interpreting INCITS 378-2004. If it is not posted, enter '0000'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF FFFF. (4-8 H).

6.9.8.2. 9.127 CEI / M1 Capture Equipment Identification

This field contains information describing the identity and characteristics of the device that captured the minutiae data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Information Items as described below.

Contains:

1) *AFS* *Appendix F Status*

The first information item shall indicate if the if the equipment used originally to acquire the image was certified to conform to The FBI's EBTS Appendix F specifications. The list of certified equipment may be found at https://fbibiospecs.fbi.gov/certifications-1/cpl.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**APPF**' or '**NONE**'. (4 A)

2) *CID* *Capture Equipment ID*

The second information item shall contain a vendor assigned product number / identifier of the capture equipment. A value of '0' indicates that the capture equipment ID is unreported.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 30 characters from user-specified character set as indicated in Field 1.015 DCS. (1-30 U).

6.9.8.3. 9.128 HLL / M1 Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N).

6.9.8.4. 9.129 VLL / M1 vertical line length

The number of pixels contained on a single vertical line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N).

6.9.8.5. 9.130 SLC / M1 Scale Units

The image sampling frequency (pixel density).

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from the Scale Unit Codes below. (1 N)

Table 15 Scale unit codes

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch

2	pixels per centimeter

6.9.8.6. 9.131 THPS / M1 Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image if SLC has a value of '1' or '2'. If SLC has a value of '0', this field shall contain the horizontal component of the pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of THPS could be '1000' for a 1000 ppi sensor.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6.9.8.7. 9.132 TVPS / M1 Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image if SLC has a value of '1' or '2'. If SLC has a value of '0', this field shall contain the vertical component of the pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of TVPS could be '1000' for a 1000 ppi sensor.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6.9.8.8. 9.133 FVW / M1 Finger View

This field contains the INCITS 378 View Number of the finger associated with this record's data. This finger view indexes multiple images of the same finger that are included in the transaction. Multiple finger minutiae records from the same finger shall be numbered with consecutively increasing finger view numbers, beginning with zero. The combination of finger location and finger view number shall uniquely identify particular minutiae record within a general record. Where only one finger minutiae record is taken from this finger, this field shall be set to 0.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 15. (1-2 N)

6.9.8.9. 9.134 FGP / M1 Friction Ridge Generalized Position

Valid codes for this field are limited to between 1 and 10, taken from the table below, to indicate the finger position. The values are restricted to these fingerprint codes in order to maintain consistency with INCITS 378.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the M1 Friction Ridge Position Codes, below. (1-2 N)

Table 16 M1 friction ridge position codes

Code	Description
1	Right thumb
2	Right index finger
3	Right middle finger
4	Right ring finger
5	Right little finger
6	Left thumb
7	Left index finger
8	Left middle finger
9	Left ring finger
10	Left little finger

6.9.8.10. 9.135 FQD / M1 Friction Ridge Quality Data

This field shall contain one or more different metrics of latent image quality score data of the overall finger minutiae data. There may be a subfield for each algorithm and predictive performance measure. The second and third information items are dependent on the value of Field 9.126 B/*CBEFF Format Type*, in order to accommodate those users following the 2004 version of INCITS 378.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1-9 repeating Subfields; Information Items as described below

Contains:

1) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255'

shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

2) *QAV* ***Algorithm Vendor ID***

The second information item should specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org).

Condition:	Mandatory if Field 9.126 B/*CBEFF Format Type* = '515', otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

3) *QAP* ***Algorithm Product Identification***

The third information item specifies a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory if Field 9.126 B/*CBEFF Format Type* = **'**515**'**, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

6.9.8.11. 9.136 NOM / M1 Number of Minutiae

This field shall contain a count of the number of minutiae recorded in this block.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

6.9.8.12. 9.137 FMD / M1 Finger Minutiae Data

The total number of subfields shall agree with the count found in Field 9.136 **NOM**. Each subfield has six information items.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1-**NOM** repeating Subfields; Information Items as described below

Contains:

1) *MAN* ***Minutia Index Number***

The first information item shall represent an index to each instance of this subfield. The initial subfield shall contain a minutia index value of '1' and incremented by 1 for each additional minutia in the fingerprint.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ **NOM**. (1-4 N)

2) *MXC* ***X Coordinate***

The second information item shall specify the x coordinate value of the minutia, expressed in pixel units. This number cannot exceed the Horizontal Line Length (**HLL**) value provided in Field 9.128.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **HLL**. (1-5 N)

3) *MYC* ***Y Coordinate***

The third information item shall specify the y coordinate value of the minutia, expressed in pixel units. This number cannot exceed the Vertical Line Length (**VLL**) value provided in Field 9.129.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **VLL**. (1-5 N)

4) *MAV* ***Minutia Angle***

The fourth information item shall contain the angle of the minutia, recorded in in units of 2 degrees. For example, an angle value of 16 represents 32 degrees.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 179. (1-3 N)

5) *MIM* ***Minutia Type***

The fifth information item shall describe the type of minutia representing in this subfield. a value of '0' to represent a minutia of type "OTHER", a value of '1' for a ridge ending and a value of '2' for a ridge bifurcation.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from the Minutia Type Codes, below. (1 N)

Table 17 Minutia type codes

Code Value	Description
0	Other minutia type
1	Ridge ending
2	Ridge bifurcation

6) *QOM* ***Quality of Minutia***

The sixth information item shall record the quality of the minutia representing in this subfield. A value of '0' indicates that no quality value is available.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100. (1-3 N)

6.9.8.13. 9.138 RCI / M1 Ridge Count Information

This field contains extended metadata for the M1 ridge counts. The first subfield appears exactly once, followed by a set of one or more repeating subfields. The number of repeating subfields cannot exceed eight times the value of Field 9.136 **NOM**.

Condition:	Optional when a value of '514' or '515' is entered in **CFT** of **Field 9.126 CBI.** Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	2 to 8(NOM)+1 Subfields; Information Items as described below

Contains:

Information Items comprising the First Subfield Set:

1) *REM* ***Ridge Count Extraction Method***

The first information item shall describe the manner of extraction and ordering of the minutiae.

Condition:	Mandatory

Occurrence: 1

Value Constraints: Value from table below. (1 N)

Table 18 Ridge count extraction method

Code	Description
0	No assumption shall be made about the method used to extract ridge counts, nor their order in the record
1	For each center minutiae, ridge count data was extracted to the nearest neighboring minutiae in four quadrants, and ridge counts for each center minutia are listed together.
2	For each center minutiae, ridge count data was extracted to the nearest neighboring minutiae in eight octants, and ridge counts for each center minutia are listed together.

2) *FI1* ***Filler 1***

The second information item of this first subfield exists to complete the subset.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = **0**. (1 N)

3) *FI2* ***Filler 2***

The third information item of this first subfield exists to complete the subset.

Condition: Mandatory for Traditional Encoding, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = **0**. (1 N)

Information Items comprising each subsequent Repeating Subfield, not to exceed 8(NOM) occurrences:

4) *CMI* ***Center Minutia Index***

This information item shall contain the minutia identifier index.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **NOM**

5) *NMN* ***Neighboring Minutia Index Number***

This information item shall contain the minutia identifier index for the neighboring minutia. It shall be different than the **CMI**.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **NOM**

6) *NRC* *Number of Ridges Crossed*

This information item shall contain the number of ridges crossed.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 99

6.9.8.14. 9.139 CIN / M1 Core Information

This field contains one subfield for each core present in the original image. It can only appear if a value of '514' or '515' is entered in **CFT** of Field 9.126: CBI / M1 CBEFF Information.

Condition: Optional.

Occurrence: It may only appear if a value of '514' or '515' is entered in **CFT** of Field 9.126: CBI / M1 CBEFF Information.

Value Constraints: 1 to 9 Subfields; Information Items as described below

Contains:

1) *XCC* *X Coordinate*

The first information item shall contain the x coordinate value as an integer in pixel units.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **HLL.** (1-5 N)

2) *YCC* *Y Coordinate*

The second information item shall contain the y coordinate value as an integer in pixel units.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **VLL.** (1-5 N)

3) *ANGC* *Angle of the Core*

The third information item shall be recorded in units of two degrees.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 179**.** (1-3 N)

6.9.8.15. 9.140 DIN / M1 Delta Information

This field shall consist of one subfield for each delta present in the original image.

Condition: Optional

Occurrence: 0-1. It may only appear if a value of '514' or '515' is entered in **CFT** of Field 9.126: CBI / M1 CBEFF Information.

Value Constraints: 1 to 9 Subfields; Information Items as described below

Contains:

1) ***XCD*** ***X Coordinate***

The first information item shall contain the x coordinate value as an integer in pixel units.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **HLL.** (1-5 N)

2) ***YCD*** ***Y Coordinate***

The second information item shall contain the y coordinate value as an integer in pixel units.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ **VLL.** (1-5 N)

3) ***ANG1*** ***First Angle of the Delta***

The third information item shall be recorded in units of two degrees. This is the angle closest to 90 degrees (i.e., pointing upwards).

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 179**.** (1-3 N)

6.9.8.16. 9.141 ADA / M1 Additional Delta Angles

This field shall not appear unless Field 9.140: **DIN** / M1 delta information is included in this record, and the subfields shall describe the same deltas in the same order as the **DIN** subfields.

This field has been added to handle the two additional angle specifications of INCITS 378 while maintaining backward compatibility with the 2007 version of this standard.

Condition:	Mandatory when Field 9.140 **DIN** is included in this record, otherwise omitted.
Occurrence:	1 when Condition above it met, 0 otherwise.
Value Constraints:	1 to 9 Subfields; Information Items as described below

Contains:

1) *ANG2* ***Second Angle of the Delta***

The first information item (second angle of the delta /ANG2) is the next angle encoded in order of appearance when moving counterclockwise, recorded in units of two degrees.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 179**.** (1-3 N).

2) *ANG3* ***Third Angle of the Delta***

The second information item shall contain the last angle encoded in order of appearance when moving counterclockwise, recorded in units of two degrees.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 179**.** (1-3 N)

6.9.9. 9.151-9.175 Deprecated

6.9.10. 9.176 – 9.225 Other Feature Sets

This standard has reserved this block of fields for user definition. This block of fields may only be used in conjunction with other Feature Set blocks, and all blocks occurring in a single record shall represent the same features. Application Profiles with operational requirements that cannot be met by the INCITS 378 Feature Set and the Extended Feature Set may use these fields to convey additional information that is not included elsewhere in this record. Data contained in this record shall conform in format and content to the specifications of the Application Profile(s) as listed in Field 1.013: DOM / Domain Name and Field 1.016: APS / Application Profile found in the Type-1 record, if those fields are in the transaction. Fields labeled mandatory in this Section are only mandatory if the block is used. Otherwise, the field shall be absent from the transaction.

6.9.10.1. 9.176 OOD / Other Feature Sets - Owner or Developer

This field shall contain an unformatted text string identifying the editing station or the name of the owner or developer of the processing algorithm.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

6.9.10.2. 9.177 PAG / Other Feature Sets - Processing Algorithm

This field provides information about the algorithm used to produce this feature set.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *PAN* ***Name of Algorithm***

The first information item shall contain the name of the algorithm used to produce the feature set included in this feature block.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

2) *PAV* ***Version of Algorithm***

The second information item describes the version of the algorithm used to produce this feature set.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

6.9.10.3. 9.178 SOD / Other Feature Sets - System or Device

This field provides information about the system or device which generated the data in this record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *OFN* ***Name of System or Device***

The first information item shall contain the name of the system or device used to produce the feature set included in this feature block.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

2) *PAV* ***Version of System of Device***

The second information item describes the version of the system or device used to produce this feature set.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

6.9.10.4. 9.179 DTX / Other Feature Sets –Contact Information

This field shall contain unformatted text with the contact information for additional details regarding the feature data. At a minimum, the text shall identify the name of the organization responsible for the information content.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.10.5. 9.180-9.225 Other Feature Sets – User Defined Fields

These optional fields may be used to record metadata not captured elsewhere in this record. Data contained in this field shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if

that field is in the transaction. Each field used shall be defined by the Application Profile or system owner.

6.9.11. 9.226 – 9.299 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12. 9.300-9.399 Extended Feature Set

This data block defines the content, format, and units of measurement for the definition and/or exchange of friction ridge feature information that may be used in the identification of a subject based on friction ridge information. This information is intended for an individual examiner to define the content of a single impression or comparison of two impressions, as well as for interchange between criminal justice administrations or organizations that use friction ridge information for identification purposes. This specification defines a quantifiable, repeatable, and clear method of characterizing the information content of a fingerprint or other friction ridge image. See Appendix F: Extended Feature Set Detailed Instructions for specific instructions on entering data in these fields.

This entire block of fields is optional. Descriptions of fields in the range 9.300-9.399 use the word “mandatory” to indicate “mandatory if this block of fields is present.” “Optional” in this block of fields shall mean “optional if this block of fields is present.”

6.9.12.1. EFS Coordinate System

The relative position of all EFS features shall be expressed as integers in units of either pixels or 10 micrometers (ƛ). One ƛ is equivalent to 1/100 mm, 1/1000 cm, or 1/2540 in. When converting between ƛ and pixels, this exact ratio shall be used in the conversion. The decimal approximation of the ratio (e.g., 0.00039 in., as indicated in previous versions of this standard) **shall not** be used. This is of primary concern for images whose resolution is noted in imperial units, as approximating the ratio can introduce error. After conversion to pixels, implementations shall round to the nearest integer value, rounding halfway cases away from zero.

In this coordinate system, the origin is the top left of the Field 9.300: EFS region of interest (ROI). Values of X increase from left to right and values of Y increase from top to bottom. With the exception of Field 9.323: EFS center point of reference (CPR), all positions shall be in the range (0,0) - (ROI.width-1, ROI.height-1). Width and height dimensions for a single impression will always fall within an upper bound of 50000 ƛ (50 cm or 19.7”). This is the origin used in EFTS, EBTS (both the FBI‘s and that of the Department of Defense), INTERPOL’s INT-I and the IAFIS Type-9 fields, but not in the original ANSI/NIST-ITL Type-9 Fields 9.005 through 9.012 (legacy fields), which used a bottom left origin.

There are no specific maximum dimensions in the coordinate system because dimensions are limited by the image dimensions, and this standard does not have stated maximum dimensions for Type 13, 14, 15, or 19 images. Dimensions for a single impression will always fall well within an upper bound of 50 cm (19.7”, or 50000 ƛ).

6.9.12.2. EFS Region of Interest

The Region of Interest is defined in Field 9.300: ROI / EFS Region of Interest as a rectangle and optional polygon that bounds the area of the original image containing a single friction ridge impression and separates it from the background and any other friction ridge data present in the image. All EFS features are in relation to the Region of Interest, not to the original image; all coordinates are relative to the top left corner of the ROI. With the exception of Field 9.323: CPR / EFS Center Point Of Reference, the X and Y values for an EFS feature may not equal or exceed the width and height of the ROI. The X and Y values for CPR are the only EFS values that may be negative, or greater than the ROI width or height; however, the center point of reference must be within the bounds of the overall image itself. The ROI may be identical to the dimensions of the image.

When the ROI is a polygon, the ROI rectangle is simply a bounding box around that polygon: the ROI offset is defined as the minimum of the x and y coordinates of all ROI vertices, and the ROI width and height are defined as the range (maximum – minimum) of the x and y coordinates of all ROI vertices. It is permissible for the ROI rectangle to be expanded slightly around the ROI polygon so that its dimensions or offset are evenly divisible by 4 or 8, as long as this does not exceed the bounds of the image itself. See Figure 4 Region of Interest (ROI) for an ROI example.

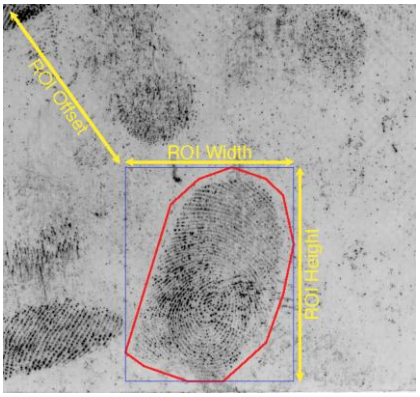


Figure 4 Region of Interest (ROI)

There can only be one region of interest for a given feature set. If there are multiple impressions within a single image, more than one feature set can be marked for the image, resulting in multiple Type-9 records associated with a single image, differentiated by the region of interest, as specified in Field 9.300: ROI / EFS Region Of Interest.

6.9.12.3. EFS Paths

Paths in EFS require a special data construct for Traditional encoding, to avoid conflicts with systems that had already programmed using the EFS method of specifying paths. The vertices for paths in Traditional encoding of EFS fields are defined in a single information item, with each vertex expressed as an (x,y) pair of non-negative integers in units as indicated by Field 9.304: EFS Measurement Units. A comma separates the x and y coordinates for a given vertex,

and a dash separates consecutive vertices. For example: x1,y1-x2,y2-x3,y3. Other encodings allow vertices to be expressed as multiple separate (x,y) values.

For all encodings, the order of the vertices shall be in their consecutive order along the length of the path, either clockwise or counterclockwise. A path may not have any sides crossing. No two vertices shall occupy the same position. If multiple paths are present, they are stored within separate subfields.

A closed path is a simple polygon (no overlapping sides) which completes a circuit and shall have a minimum of three vertices. The closed path side defined by the last vertex and the first vertex shall complete the polygon.

EFS fields using closed paths (i.e., polygons), requiring between 3 and 99 vertices, are:

Field 9.300: ROI / EFS Region of Interest

Field 9.302: FPP / EFS Finger - Palm - Plantar Position

Field 9.324: DIS / EFS Distinctive Features

Field 9.357: LQI / EFS Local Quality Issues

Field 9.360: AOC / EFS Area of Correspondence

An open path (contour, polyline) is a series of connected points in which there is not an implicit connection between the last and first vertices and requires a minimum of two vertices. Within EFS, open paths are used in **Field 9.373: RPS / EFS Ridge Path Segments**.

6.9.12.4. EFS Angles

All angles are measured in integer degrees. Positive numbers indicate angles counterclockwise from the right, whereas negative numbers (when permitted by specific fields) indicate angles clockwise from the right.

6.9.12.5. 9.300 ROI / EFS Region Of Interest

See Section 6.9.12.2 for a general description of ROI. This field defines a rectangle (and an optional polygon) that bounds the region of the image that contains the friction ridge print of interest and separates it from the background and any other prints present in the image. This field contains five information items.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) ***EWI*** ***ROI Width***

The first information item is the integer width of the region of interest in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 50000. (1-5 N)

2) *EHI* *ROI Height*

The second information item is the height of the region of interest in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 50000. (1-5 N)

3) *EHO* *ROI Horizontal Offset*

The third information item is the horizontal distance from the left edge of the original image to the left edge of the region of interest in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304. If omitted, the default value shall be zero.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 50000. (1-5 N)

4) *EVO* *ROI Vertical Offset*

The fourth information item is the vertical distance from the top edge of the original image to the top edge of the region of interest in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304. If omitted, the default value shall be zero.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 50000. (1-5 N)

5) *ROP* *ROI Polygon*

The fifth information item contains a polygon (closed path) that further defines the friction ridge area under consideration within the ROI. The format of EFS polygons is described in Section 6.9.12.3. If the polygon is defined, the ROI rectangle shall be the bounding box for the polygon. The vertices of the polygon are relative to the ROI. In Traditional encoding only, a comma separates the x and y coordinates for a given vertex, and a hyphen separates

consecutive vertices. For example: x1,y1-x2,y2-x3,y3. For the XML/JSON layout of this information item, see the corresponding NIEM exchange package documentation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 50000 for all values of X; (1-5 N)
	0 ≤ integer ≤ 50000 for all values of Y; (1-5 N)
	Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

6.9.12.6. 9.301 ORT / EFS Orientation

This field allows the orientation (deviation from upright) and its uncertainty to be specified. See Appendix F.5.1.1, Field 9.301: ORT / EFS Orientation instructions for more information about this field. If this field is omitted, the direction shall default to 0 (upright) and uncertainty shall default to 15, indicating that the image is rotated 0±15°. If orientation cannot be determined, the uncertainty value shall be set to 180.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *EOD* ***EFS Orientation Direction***

The first information item shall contain the deviation of the region of interest from upright (fingertip up) in integer degrees. Positive angles are counterclockwise, negative angles are clockwise. A value of '0' indicates an upright direction. The allowed special character is the negative sign.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	-179 ≤ integer ≤ 180. (1-4 NS)

2) *EUC* ***EFS Uncertainty***

The second information item contains the uncertainty of the orientation direction, in non-negative integer degrees; the resulting orientation is Direction± Uncertainty°.

Condition:	Optional
Occurrence:	0-1

Value Constraints: 0 ≤ integer ≤ 180. (1-3 N)

6.9.12.7. 9.302 FPP / EFS Finger - Palm - Plantar Position

This field shall describe the possible physical positions that correspond to the region of interest. If the image/region of interest contains multiple areas, this field allows the option to label and mark each of those areas within the region of interest. Each of the areas present should be indicated using the appropriate friction ridge generalized position (FGP); polygons are required in this case to delineate the locations of the positions. Polygons may overlap if appropriate. For more information about this field, see Appendix F.5.1.2.

If the image is an exemplar entire joint image or full finger view (from a set of complete friction ridge exemplars), or a latent of equivalent area, it shall be marked with the information item FGP / Friction Ridge Generalized Position (0-10, 13-14) and should have the individual segments marked with the information item SGP / Segment Polygon. If the image is of a palm or foot, each of the palm or plantar areas present shall be marked with the relevant Friction Ridge Generalized Position (FGP) and delineated with the information item Segment Polygon (SGP).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 20 Subfields; Information Items as described below

Contains:

1) *FGP* *Friction Ridge Generalized Position*

This information item shall contain the code number corresponding to the known or most probable position, entered as a one- or two-digit value. See Section 5.10.

Condition: Mandatory

Occurrence: 1

Value Constraints: Values are limited to the following ranges: 0 - 10, 13-14, 16 - 18, 20 -38, 60-79, 81- 86; See Table 3 Friction ridge generalized position codes.

2) FSM* *Image Segment

This information item only applies to fingerprints in which all or part of the medial or proximal segments (lower joints) are present in the image. It contains the 3-character code from the table below to indicate the finger segment position (DST, PRX, or MED). See Figure 2 Finger Views and Finger Segments for an illustration. UNK for “Unknown” may also be specified. This information item defaults to DST if the FGP / Friction Ridge Generalized Position indicates a fingerprint and the Finger Segment is not specified; in which case, the impression shall be regarded as including solely the distal segment with no substantive portions of the medial or proximal segments. This information item shall be omitted if the FGP / Friction Ridge Generalized Position indicates a palm or plantar.

Condition: Optional when **FGP** contains a finger code value, otherwise omitted

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (3 A)

Table 19 EFS joint image segment codes

Code	Description
PRX	Proximal segment
DST	Distal segment
MED	Medial segment
UNK	Unknown

3) OCF Off-Center Fingerprint

This information item only applies to fingerprints in which the impression does not contain the central area of the fingerprint (i.e., the core or a center point of reference), in which case the 1-character code from Table 20, below, is used to indicate the off-center position of the fingerprint image. This information item shall be omitted if the **FGP** indicates a palm or plantar.

Condition: Optional when **FGP** contains a finger code value, otherwise omitted

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table, below. (1 A)

Table 20 Off-center fingerprint positions

Code	Description
T	Tip - The plain or rolled tip of the finger or thumb
R	Right Side - The right side of the finger or thumb
L	Left Side -The left side of the finger or thumb

4) SGP Segment Polygon

This information item is a closed path polygon that delineates the area that corresponds to the specified position / segment. Each polygon can contain between 3 and 99 coordinates. The representation of coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.12.3, traditional encoding in Appendix B, and XML/JSON encoding in Appendix C.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 50000 for all values of X; (1-5 N)

0 ≤ integer ≤ 50000 for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

6.9.12.8. 9.303 FSP / EFS Feature Set Profile

This field is used to indicate an EFS Profile, which defines the specific set of EFS fields incorporated in a specific ANSI/NIST-ITL transaction. Profiles can be incorporated by reference into the definition of transactions: this decoupling of feature sets from transactions enables different transactions to share a common feature set, aiding in interoperability. If a given ANSI/NIST-ITL transaction is conformant with two or more profiles, the code for each profile is entered in a separate subfield. More information about these profiles is available in the EFS Profile Specification, NIST Special Publication 1134. See Section 3 Normative References.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 to 9 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides the code value for an EFS profile that this record conforms to. If there are additional conforming profiles, their EFS profile codes shall also be included in subsequent Subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (1-2 N)

Table 21 Extended feature set profile codes

Code	Description
1	Minimal markup profile
2	Quick minutiae search profile
3	Detailed markup profile
10	Skeleton profile
11	Minutiae ridge count profile
20	Legacy IAFIS latent feature search profile
21	Quick minutiae search profile without image
30	Search response profile with all, and corresponding minutiae
31	Search response profile without corresponding minutiae
90	Full annotation profile

6.9.12.9. 9.304 UNT / EFS Measurement Units

This field indicates EFS units of measurement. All EFS fields will be interpreted using this field. When the field is omitted, the unit of measure shall be in units of ƛ (0.01 mm) to maintain backward compatibility. Domains and Application Profiles may restrict the allowable units.

Condition: Optional

Occurrence: 0-1

Value Constraints:	Allowed values are ‘P’ (pixels) or ‘M’ (ƛ). If omitted, the default value shall be ‘M’. (1 A)

6.9.12.10. 9.305 – 9.306 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.11. 9.307 PAT / EFS Pattern Classification

This field shall contain fingerprint classification information for a finger impression. and shall be omitted for other friction ridge impressions. For more information about this field, see Appendix F 5.2.1 Field 9.307: PAT / EFS Pattern Classification instructions. There may be up to seven subfields, indicating all possible pattern classifications.

Condition:	Mandatory when record describes a finger impression, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 7 Subfields; Information Items as described below

Contains:

1) *GFC General Class*

The first information item is the general set of pattern classifications (arch, whorl, left & right loop) used by most current automated systems. This is a two-character code selected from the General Class column of the Pattern Classification Codes Table, below.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value selected from the General Class column of the Pattern Classification Codes Table, below. (2 A)

2) *SUB Subclass*

The second information item contains the detailed sub-classification of arches and whorls that may optionally be provided by a human examiner or automated system. This information item shall only be included for arches or whorls, and only if the sub-classification can be determined precisely. This is a two-character code selected from the Subclass column the Pattern Classification Codes Table, below.

Condition:	Optional
Occurrence:	0-1. May only occur for General Class values of ‘AU’ or ‘WU’
Value Constraints:	Code value selected from the Subclass column of the Pattern Classification Codes Table, below. (2 A)

3) *WDR Whorl-Delta Relationship*

The third information item may optionally be used by a human examiner or automated system to provide the relationship between the deltas in a whorl. This information item shall only be included for whorls if the subclass is known, and only if the whorl delta relationship can be determined precisely.

Condition:	Optional
Occurrence:	0-1. May only occur for General Class values of 'WU' with a designated Subclass value.
Value Constraints:	Allowed values are: 'I' (Inner), 'O' (Outer), or 'M' (Meeting). (1 A)

Table 22 Pattern classification codes

Type	Pattern Classification	General Class	Subclass	Whorl – Delta Relationship
Arches	Arch, type not designated	**AU**	*None*	*None*
	Plain Arch	**AU**	**PA**	*None*
	Tented Arch	**AU**	**TA**	*None*
Whorls	Whorl, type not designated	**WU**	*None*	*None*
	Plain Whorl	**WU**	**PW**	**I, O, or M**
	Central Pocket Loop	**WU**	**CP**	**I, O, or M**
	Double Loop	**WU**	**DL**	**I, O, or M**
	Accidental Whorl	**WU**	**AW**	**I, O, or M**
Loops	Right Slant Loop	**RS**	*None*	*None*
	Left Slant Loop	**LS**	*None*	*None*
Capture Issues	Amputation, some friction ridge remains	**XX**	*None*	*None*
	Unable to print (e.g., complete amputation; bandaged)	**UP**	*None*	*None*
Classification Issues	Unable to Classify	**UC**	*None*	*None*
	Complete Scar	**SR**	*None*	*None*
	Dissociated Ridges/Dysplasia	**DR**	*None*	*None*

6.9.12.12. 9.308 RQM / EFS Ridge Quality/Confidence Map

Local friction ridge quality (as defined in the Ridge Quality Map) is an assessment of confidence in small local areas within an image. The local quality map is used to define the confidence in all other features and therefore is key information. In addition, when the quality map indicates a high-quality region in which features are not marked, that information can be used as "negative features" or definitive absence of features, which can be used for exclusion.

For every cell in a grid superimposed on the Region of Interest, this field notes the local ridge quality of the friction ridge detail within that cell. Local ridge quality defines clarity in terms of the ability to discern detail in a given location. The quality of each cell will be represented with a local quality value 0 through 5 representing the quality of ridge detail in that cell, as specified in Table 23, below. If a region of interest is defined, cells outside of the ROI polygon shall be set to a local quality value of 0 (black).

This field is comprised of a repeating set of values, one subfield for each row in the ROI grid. Each row value is represented as indicated in Field 9.309 RQF / EFS Ridge Quality Map Format. Regardless of format, the first cell starts at the top left corner of the Region of Interest, with cells in order left to right. All of the quality values for each row are stored in one subfield, and subfields are ordered from top to bottom of the ROI. See Appendix F.4 for more information.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to (row count) Subfields, as described below

Contains:

Local Quality Map Row

Each subfield represents a single row of the image grid.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: See Table 97 Definitions for ridge quality map values and the Local Ridge Quality Codes Table, below. (1-50000 H or N).

Table 23 Local ridge quality codes

Code	Local Quality Name	Description	Display Color
5	Definitive pores	Pores and ridge edges are obvious and unambiguous	Aqua [RGB= (0,240,240)]
4	Definitive ridge edges, debatable pores	Ridge edges, minutiae, and ridge flow are obvious and unambiguous; pores are either debatable or not present	Blue [RGB= (0,0,255)]
3	Definitive minutiae, debatable ridge edges	Minutiae, and ridge flow are obvious and unambiguous; ridge edges are debatable	Green [RGB= (0,255,0)]
2	Definitive ridge flow, debatable minutiae	Continuity of ridge flow is certain; minutiae are debatable	Yellow [RGB= (255,255,0)]
1	Debatable ridge flow	Continuity of ridge flow is uncertain	Red [RGB= (255,0,0)]
0	Background	No ridge information	Black or no color [RGB= (0,0,0)]

6.9.12.13. 9.309 RQF / EFS Ridge Quality Map Format

This field defines the grid size and data representation format used in Field 9.308: RQM / EFS Ridge Quality/Confidence Map.

Condition:	Mandatory when Field 9.308 RQM is present. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *GSZ* ***Grid Size***

The first information item shall define grid sizes (both the horizontal and vertical dimensions of a single cell in the grid) in units of ƛ or pixels if so indicated in Field 9.304. The recommended grid size is 20ƛ (0.20mm or 0.008") – note this is 4 pixels at 500 ppi, or 8 pixels at 1000 ppi. If the width and/or height of the Region of Interest are not evenly divisible by the Grid Size, partial cells shall be included at the right and/or bottom of the ridge flow map.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 41. (1-2 N)

2) *RDF* ***Data Format***

The second information item defines the format used in Field 9.308. For all formats:

- The first cell starts at the top left corner of the Region of Interest, with cells in order left to right.
- All of the quality values for each row are stored in one repeating subfield.
- The subfields are ordered from top to bottom.
- If the width and/or height of the Region of Interest are not evenly divisible by the Grid Size, partial cells shall be included at the right and/or bottom of the ridge flow map.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from table, below. (3 A)

Table 24 Ridge quality map data representation format

Code	Type	Description
UNC	Uncompressed (concatenated decimal)	The values for each grid cell in the Ridge Quality Map field are single-character integers as defined in Table 23 Local Ridge Quality Codes, with one character per cell. All quality values for one row are

		concatenated left to right, with one repeating subfield of Field 9.308: RQM / EFS ridge quality/confidence map for each row. The number of characters in one repeating subfield of Field 9.308 is the same as the number of cells in one row: the Region of Interest's width divided by the Grid Size, rounded up to the nearest integer.
RLE	Run-Length Encoded	The unencoded values for each entry are identical to those used in UNC format. The numeric values for each grid cell (0-5) are then replaced with alphabetic equivalents (A-F), and then any sequential runs of the same character are prefixed by the decimal count of repeated characters. Individual characters are not preceded by a count. For example: 00000000000000000000000000000000000000000000000000 (50 characters) Is saved as '50A' 00000000000011223345555554444422100000000000000000 (50 characters) Is saved as '12A2B2C2DE6F5E2CB16A' (20 characters)

6.9.12.14. 9.310 RFM / EFS Ridge Flow Map

This field contains the direction of friction ridges at sampling points throughout the region of interest. The sampling frequency is optionally defined in Field 9.311: RFF EFS ridge flow map format and otherwise defaults to 41ƛ (0.41 mm) in uncompressed format. The first sampling point in the image is the top left-most point in the region of interest. The same sampling frequency is used both horizontally and vertically. Values shall be included for all sampling points in the region of interest, even if the sampling points are at the edge of the region of interest. For each sampling point, angles shall be reported in integer degrees, with 0 degrees to the right (horizontal), increasing counterclockwise to a maximum value of 179° (since 180°=0°). Undefined angles are recorded in Field 9.311: RFF / EFS Ridge Flow Map Format. Each subfield corresponds to one row of the map in order from top to bottom.

The area used for determining direction (window size) may be larger or smaller than the sampling frequency. Different window sizes may be used within a single image, at the discretion of the implementer. For example, an implementer may choose to use a uniform window size except in areas of high curvature, in which a smaller window size may be used.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to (ROI Height ÷ Sampling Frequency) Subfields, as described below

Contains:

Ridge Flow Map rows

This information item represents the direction of friction ridges at each sampling point within the current row of the ROI. Each subfield corresponds to one row of the map in order from top to bottom.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: See Table 25 Ridge Flow Map Data Representation Formats. (1-100000 Base64 or H).

6.9.12.15. 9.311 RFF / EFS Ridge Flow Map Format

This field permits setting the sampling frequency or data representation format used in Field 9.310: RFM / EFS Ridge Flow Map to values other than the defaults. It may only be used in the presence of Field 9.310. This field contains two information items.

Condition: Optional when Field 9.310 occurs.

Occurrence: 0-1 when about condition is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *SFQ* *Sampling Frequency*

The first information item shall be used to define other resolution sampling frequencies than the default value, which is 41ƛ (0.41 mm, or 0.016”).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 41. (1-2 N)

2) *RDF* *Data Format*

The second information item shall specify the format used in the Ridge Flow Map field.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Ridge Flow Map Data Representation Formats, below. (3 AN)

Table 25 Ridge flow map data representation formats

Code	Type	Description
UNC	Uncompressed (concatenated hexadecimal)	Each ridge flow value is a 2-character hexadecimal value. The angles are stored in 2-character hexadecimal representation with leading zeros, so valid values range from ‘00’ (0dec) to ‘B3’ (179dec). Undefined angles: If the direction cannot be determined at a given location, the location at that point shall be marked as ‘XX’. All of the ridge flow values for a given row shall be concatenated in order left to right and saved as a separate instance / repeating subfield of Field 9.310: RFM / EFS Ridge Flow Map. For this format, the number of characters in one repeating subfield of Field 9.310 is twice the number of cells in one row.
B64	base-64	Each ridge flow value is a 1-character base-64 value. The angles are divided by three to enable storing in a single base-64 character, which has the effect of quantizing to three degrees. Undefined angles: If the direction cannot be determined at a given location, the location at that point shall be marked as ‘*’ (asterisk). All of the ridge flow values for a given row shall be concatenated in order left to right and saved as a separate instance / repeating subfield of Field 9.310. For this format, the number of characters in one instance of Field 9.310: RFM / EFS Ridge Flow Map is the number of cells in one row.

6.9.12.16. 9.312 RWM / EFS Ridge Wavelength Map

This field contains the peak-to-peak distance between ridges at various sampling points throughout the region of interest. The sampling frequency is optionally defined in Field 9.313: RWF / EFS Ridge Wavelength Map Format and otherwise defaults to 0.41 mm in uncompressed format. The first sampling point in the image is the top left-most point. The same sampling frequency is used both horizontally and vertically. Values shall be included for all sampling points in the image, even if the sampling points are at the edge of the image.

For each sampling point in the Region of Interest, distances between ridge peaks, measured perpendicular to ridge flow, shall be reported in 2-character decimal format using units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

The size of the area around the sampling point (window size) used to determine measurements is left to the discretion of the implementer and may vary within an image. Unknown values shall be set to 'XX'. Valid values for ƛ are therefore '01' (0.01 mm) through '99' (0.99 mm or greater). (In practice, the actual stored values of ƛ are likely to be '30' to '70' in most cases (0.3 – 0.7 mm). The 2-character decimal wavelength values for each sampling point are concatenated left to right for all sampling points in a row. Each subfield corresponds to one row of the map, in order from top to bottom. The number of characters in one subfield is twice the number of sampling points in one row.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to (ROI Height ÷ Sampling Frequency) Subfields, as described below

Contains:

Ridge Wavelength Map Row

Each subfield contains the peak-to-peak distance between ridges at various sampling points across a single row of the ROI.

Condition:	Mandatory
Occurrence:	1 per Subfield
Value Constraints:	Two digits per sampling point (**01**-**99**), or **XX** for unknown sampling point values. (2-100000 AN).

6.9.12.17. 9.313 RWF / EFS Ridge Wavelength Map Format

This field permits setting the sampling frequency or data representation format used in Field 9.312: RWM / EFS Ridge Wavelength Map to values other than the defaults. It may only be used in the presence of Field 9.312. It consists of two information items.

Condition:	Optional when Field 9.312 RWM occurs.

Occurrence: 0-1 when about condition is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *FWS* *Sampling Frequency*

The first information item shall be used to define other resolution sampling frequencies than the default value, which is 41ƛ (0.41 mm or 0.016”).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 41. (1-2 N)

2) *FDF* *Data Format*

The second information item shall specify the format used in Field 9.312 EFS Ridge Wavelength Map. The default (and currently the only setting) is the uncompressed (‘UNC’) format.

Condition: Optional

Occurrence: 0-1

Value Constraints: Fixed Value = **UNC**. (3 A)

6.9.12.18. 9.314 TRV / EFS Tonal Reversal

Ridges in friction ridge images are generally represented as dark areas, with valleys as light areas, in which case this field is omitted. If the entire image is reversed tonally (black-for-white) this field value is set to ‘N’. If part of the image is reversed tonally this field value is set ‘P’. The Unknown code is used in the unusual case that it cannot be determined whether ridges or valleys are represented as dark or light areas in the image. If analysis has not occurred, the field shall be omitted or set to ‘O’. For values ‘U’ or ‘O’, it may be prudent for the recipient (software system or examiner) to search/compare the impression and features both as presented and color inverted.

Partial tonal inversion can occur in different ways. If definable portions of the image are negative, Field 9.357 LQI / EFS Local Quality Issues can be used to define the specific tonally reversed areas. For example, very heavy pressure can leave matrix from valleys, whereas lighter pressure at the edges of the same impression would leave matrix from ridges. Note that in some cases, the tonal reversal is so mixed that only portions of individual ridges are reversed, making it impractical or impossible to define the tonally reversed areas. For instance, if light powder is applied from a single direction, one edge of each ridge is light and the remainder dark.

Setting this field and reversing the image when saving will result in inconsistent data. Therefore, when this field is set, a software user interface may display the tonally corrected image but shall save the image in the Type-13 record as received (i.e., tonally reversed).

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (1 A)

Table 26 Tonal reversal codes

Code	Description
N	Negative – ridges are light, and valleys are dark throughout the image.
P	Partial – ridges are light, and valleys are dark only in portions of the image
U	Unable to determine – it cannot be determined whether ridges or valley are represented as dark or light areas in the image
O	Analysis process has not occurred

6.9.12.19. 9.315 PLR / EFS Possible Lateral Reversal

This field indicates the corresponding Type-13 image is or may be laterally reversed (i.e., reversed left-right). In many cases, an examiner cannot tell the correct lateral direction of the image, such as latents on tape that has been closed on itself, or latents that may have been transferred to the substrate/surface. If the image is or may be laterally reversed, field shall contain the appropriate value, otherwise this field shall be omitted.

Setting this field and reversing the image when saving will result in inconsistent data. Therefore, when this field is set to '**L**', a software user interface may display the laterally corrected image but shall save the image in the Type-13 record as received (i.e., laterally reversed).

When this field is set to '**U**' (Image *may be* laterally reversed), it is incumbent on the recipient (software system or examiner) to search/compare the impression and features both as presented and flipped left-right.

Condition: Mandatory when the corresponding Type-13 image is known or suspected to be laterally reversed, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 A)

Code	Description
L	Image is known to be laterally reversed
U	Image may be laterally reversed

6.9.12.20. 9.316 FQM / EFS Friction Ridge Quality Metric

This field specifies one or more different metrics of friction ridge quality for the friction ridge impression corresponding to this record, as delimited by the region of interest.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

2) *QAV* ***Algorithm Vendor ID***

The second information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

3) *QAP* ***Algorithm Product Identification***

This information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

4) *QPV* ***Algorithm Product Version***

This information item specifies the version of the product assigned by the vendor.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM Algorithm Comments*

This information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK Algorithm Model Checksum*

This information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.9.12.21. 9.317 PGS / EFS Possible Growth or Shrinkage

This field shall only be used in the unusual circumstance that the friction ridge impression is believed to have changed size or scale from potential comparisons; it shall otherwise be omitted. This allows for handling of images from deceased subjects with desiccated skin, or with swollen skin due to water exposure. This also allows for handling of overall growth of subjects between capture, such as in comparing an adult's fingerprints with those taken as a child. In these cases, the size of ridges and distances between ridges change to a greater extent than would ordinarily be assumed in comparisons; this field acts as a flag to indicate that greater than ordinary dimensional variation should be expected in performing subsequent comparisons.

This field shall be omitted unless there is reason to believe that growth or shrinkage may have occurred, in the informed opinion of the submitter.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *TGS* *Growth or Shrinkage Type*

The first information item describes the known or suspected dimensional change.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value from the table below. (1 A)

Code	Description
G	Growth: impression is believed to be dimensionally larger than exemplars or other prints from the same subject.
S	Shrinkage: impression is believed to be dimensionally smaller than exemplars or other prints from the same subject.
B	Both: impression may be dimensionally larger or smaller than exemplars or other prints from the same subject.

2) *CGS* *Growth or Shrinkage Comments*

The second information item describes the rationale for believing that growth or shrinkage may have occurred.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.12.22. 9.318 – 9.319 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.23. 9.320 COR / EFS Cores

A core is located at the focus of the innermost recurving ridge line of a ridge pattern: if the ridge is viewed as a section of a circle, the core is the center of that circle; if the ridge is viewed as an ellipse or parabola, the core is the focal point of that curve. Note that the core is not on the innermost recurving ridgeline itself.

The direction of the core is away from the center of the curve. The core or cores of a fingerprint are defined for all pattern classifications other than plain arches, as shown in the Number of Cores and Deltas by Pattern Class table. Cores may be marked on tented arches if an innermost recurving ridge is present above the delta, so that each side of the recurving ridge extends to either side of the delta. Plain or central pocket loop whorls will only have one core if the innermost recurving ridge is circular, or two cores if elliptical. A circular whorl only has one core and does not have a defined direction. Accidentals may have any number of cores.

If one or more cores are present and the feature set is from a fingerprint, Field 9.307: PAT / EFS Pattern Classification should be defined. Note that this does not mean that the classification has to be known definitively but must at least be known to the extent of excluding plain arches. When no cores are present, this field shall not be used and Field 9.325: NCOR / EFS No Cores Present shall be set. For palm prints or other non-fingerprint friction ridge images, any number of core-like patterns may be defined using this field if such structures are present. Each core is defined in a separate subfield.

Table 27 Number of cores and deltas by pattern class

Pattern	Classification	Cores	Deltas
Arches	Plain Arch	0	0
	Tented Arch	0 or 1	0 or 1
Whorls	Plain Whorl	1 or 2	2
	Central Pocket Loop	1 or 2	2
	Double Loop	2	2
	Accidental Whorl	N	N
Loops	Loop	1	1

Condition: Optional when Field 9.325 **NCOR** absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *CXC* *X Coordinate*

The first information item represents the x coordinate of the core and shall be expressed in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ ROI width. (1-5 N)

2) *CYC* *Y Coordinate*

The second information item represents the y coordinate of the core and shall be expressed in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ ROI height. (1-5 N)

3) *CDI* *Direction*

The third information item contains the average tangent direction of the two closest ridges as measured 1.63 mm (0.064 inches) from the focal point. This is approximately the same as the direction of the directrix of the best fitting parabola. The direction shall be omitted (left empty) for circular whorls, or if the direction is unknown.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 359. (1-3 N)

4) *RPU* *Radius of Position Uncertainty*

The fourth information item defines the radius of a circle centered at the location (x,y) of the core; the circle is sized to include the area of other possible locations of the core, if the precise location cannot be determined (such as due to poor clarity). If the location is known precisely, the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty is measured in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304, and may overlap the edge of the image.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 999. (1-3 N)

5) *DUY* *Direction of Uncertainty*

The fifth information item contains the uncertainty of the direction of the core, in non-negative integer degrees. A value of ‘0’ (default) indicates a certain direction, while a value of ‘180’ indicates an unknown orientation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 180. (1-3 N)



Figure 5 Placement of the core at the focus of the innermost recurving ridgeline

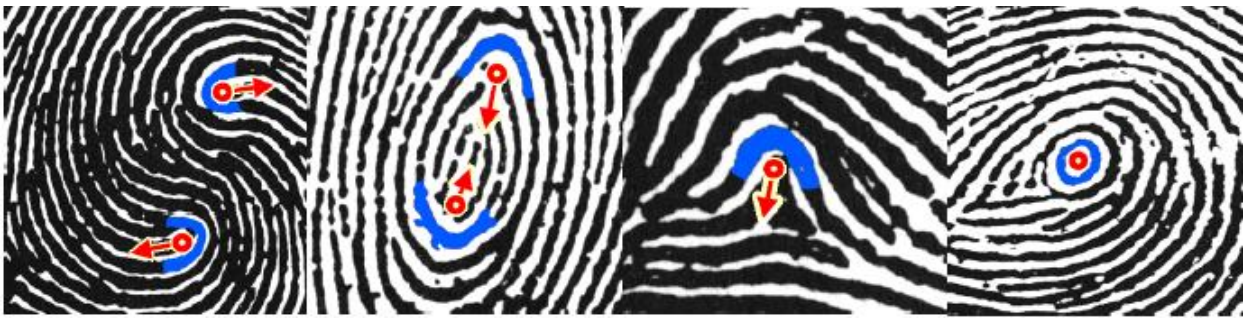


Figure 6 Examples of core locations for a double loop whorl, plain whorl, tented arch, and central pocket loop whorl

6.9.12.24. 9.321 DEL / EFS Deltas

For fingerprints, one or more deltas are defined for all pattern classifications other than plain arches, as shown in the EFS Delta Codes table. For palm prints or other non-fingerprint friction ridge images, any number of delta-like patterns may be defined using this field if such structures are present. Each delta is defined in a separate subfield. For more information about this field, see Appendix F.5.3.1 Field 9.321: DEL / EFS Deltas instructions. When no deltas are present, this field shall not be used, and Field 9.326: NDEL / EFS No Deltas Present shall be set.

Condition:	Optional when Field 9.326 **NDEL** is absent. Otherwise omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *DXC* ***X Coordinate***

The first information item represents the x coordinate of the delta and shall be expressed in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *DYC* ***Y Coordinate***

The second information item represents the y coordinate of the delta and shall be expressed in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

The following three angles shall be reported in order by increasing angle, which for fingerprint deltas with known orientation will result in the order up, left, then right:

3) *DUP* *Direction Up*

The third information item is expressed in degrees counterclockwise from the right.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 359. (1-3 N)

4) *DLF* *Direction Left*

The fourth information item is expressed in degrees counterclockwise from the right.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 359. (1-3 N)

5) *DRT* *Direction Right*

The fifth information item is expressed in degrees counterclockwise from the right.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 359. (1-3 N)

6) *DTP* *Delta Type*

The sixth information item describes the type of delta in the subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 28 EFS Delta Codes. (1-3 AN)

Table 28 EFS delta codes

Code	Applies to	Name	Description
L	Fingerprint	Left fingerprint delta	The delta to the left of the image for whorls or right loops. For accidentals with more than two deltas, this indicates the leftmost delta.
R	Fingerprint	Right fingerprint delta	The delta to the right of the image for whorls or left loops. For accidentals with more than two deltas, this indicates the rightmost delta.
I00 **I02 - I05** **I07 - I10** **I16 - I17**	Palm	Interdigital delta (with finger number)	The deltas at the base of the fingers in the interdigital areas. The finger number shall be noted if known (2 to 5, 7 to 10, or 16 or 17, selected from Table 3 Friction ridge generalized position codes), else set to 0. Note that thumbs do not have interdigital deltas.
C	Palm	Carpal delta	The delta at the base of the palm where the thenar and hypothenar meet.
<NULL>[a]	Fingerprint, Palm, or Foot	Other delta	Any other delta or delta-like structure in a friction ridge impression.

[a] This means that the information item occurs, but there is no value. It does not mean a space or absence of the information item.

7) *RPU* *Radius of Position Uncertainty*

The seventh information item defines the radius of a circle centered at the location (x,y) of the delta; the circle is sized to include the area of other possible locations of the delta, if the precise location cannot be determined (such as due to poor clarity). If the location is known precisely, the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty is measured in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304, and may overlap the edge of the image.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 999. (1-3 N)

8) *DUU* *Direction of Uncertainty Up*

The eighth information item contains the uncertainty of the direction of the delta angle up, in non-negative integer degrees. A value of ‘0’ (default) indicates a certain direction, while a value of ‘180’ indicates an unknown orientation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 180. (1-3 N)

9) *DUL* *Direction of Uncertainty Left*

The eighth information item contains the uncertainty of the direction of the delta angle left, in non-negative integer degrees. A value of ‘0’ (default) indicates a certain direction, while a value of ‘180’ indicates an unknown orientation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 180. (1-3 N)

10) *DUR* *Direction of Uncertainty Right*

The eighth information item contains the uncertainty of the direction of the delta angle right, in non-negative integer degrees. A value of ‘0’ (default) indicates a certain direction, while a value of ‘180’ indicates an unknown orientation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 180. (1-3 N)

6.9.12.25. 9.322 CDR / EFS Core Delta Ridge Counts

This field contains the count of intervening ridges between each core and delta. Each ridge count has a minimum and maximum value, so that a range may be noted. If the exact value is known, then that value should be put in the minimum and maximum fields. If only a minimum is known, such as when a delta is not visible, the maximum value shall be omitted. Ridge counts may be any non-negative integer. When this field is used for fingerprints, ridge counts shall be provided between each core and each delta, unless there are more than two cores or two deltas in an accidental whorl, in which case only the leftmost and rightmost of the cores and deltas need be used for ridge counts. Each subfield represents a distinct core-delta ridge count. Each subfield consists of four information items.

Condition:	Optional when Field 9.325 NCOR absent. Otherwise omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *CIX* ***Core Index***

The first information item is the (1-based) index of the core corresponding to this count (‘1’ if only one core is defined). If the relevant core is not defined, this shall be set to ‘U’ to indicate an upper core or ‘L’ to indicate a lower core (whorls only), permitting minimum ridge counts when cores are not in the region of interest.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99 or ‘L’ or ‘U’. (1-2 AN)

2) *DIX* ***Delta Index***

The second information item is the (1-based) index of the delta corresponding to this count (‘1’ if only one delta is defined). If the relevant delta is not defined, this shall be set to ‘L’ to indicate a left delta or ‘R’ to indicate a right delta, permitting minimum ridge counts when deltas are not in the region of interest.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99 or ‘L’ or ‘R’. (1-2 AN)

3) *MNRC* ***Minimum Ridge Count***

The third information item contains the precise ridge count, if it is known; otherwise, it contains the minimum of the range of ridge count values.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 99. (1-2 N)

4) *MXRC* ***Maximum Ridge Count***

The fourth information item contains the precise ridge count (if the count is known precisely), or the maximum range of ridge count values (if there is a known or estimated maximum); otherwise, it shall be omitted.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 99. (1-2 N)

6.9.12.26. 9.323 CPR / EFS Center Point of Reference

This field contains the location of a center point of reference of a friction ridge print, which may be used to define how centered a print is, as a feature, for registration or orientation, and for quality measurements. While the core may serve some of the same purposes, a center point of reference is defined for arches and provides a single center location for complex whorls, unlike cores. For more information about this field see Appendix F.5.3.2 Field 9.323: CPR / EFS Center Point of Reference instructions.

The center point of reference is the sole EFS feature that can be located outside of the EFS region of interest. For example, this allows the estimated center of the finger to be marked even for an extreme side. The origin of CPR, like all other EFS features, is relative to the top left of Field 9.300: ROI / EFS Region of Interest. Note that this means that the x and y values for CPR are the only EFS coordinates that may be negative, or greater than the ROI width or height. The center point of reference must be within the bounds of the overall image itself.

The location of a center point of reference can be determined using different algorithms, as stored in the Method information item, in which case different center points of reference may be stored in different subfields. The center point of reference is defined for fingerprints or toe prints, not for other types of friction ridge images.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 3 Subfields; Information Items as described below

Contains:

1) *CPM* ***Method***

The first information item contains the method of determining the (x,y) location, selected from the "Code" column of the table below. It is a one-character value.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value from Table 29 EFS Methods of Determining Center Point of Reference Locations. (1 AN)

Table 29 EFS methods of determining center point of reference locations

Code	Name	Description
L	Lateral center only	The center location is defined laterally (across the finger) but is not meaningful in the other dimension (longitudinally, or along the finger), such as for defining the center line of arches, tips, and lower joints. Lateral center is only meaningful if the orientation (Field 9.301: ORT/ EFS orientation) is known; the point marked is the center with respect to the orientation angle.
0	Uppermost point of the ridge with greatest curvature	For a fingerprint with a known or estimated orientation, the center point is determined by finding the highest point of each ridge that is convex and pointing upward and measuring the curvature/peak angle by following the ridge 1.63 mm (0.064 in) in both directions from that point, as shown in Figure 33. The point with the minimum angle (greatest curvature) is the center point of reference.
1	Overall fingerprint focal point	The overall fingerprint focal point is the point where the lines perpendicular to ridge flow converge as shown in Figure 34. The point of convergence is determined in terms of least squares[a].
H	Human estimate of finger center	Human estimation of the approximate center of distal fingerprint pad, used when methods 0 or 1 are not practical.

[a] For example, see Novikov S.O and Kot V.S.; "Singular Feature Detection and Classification of Fingerprints using Hough Transform"; *Proc. Of SPIE (Int. Workshop on Digital Image Processing and Computer Graphics (6th): Applications in Humanities and Natural Sciences)*; vol 3346, pp 259-269, 1998

2) *PXC* *X Coordinate*

The second information item represents the x coordinate of the center point of reference and shall be expressed in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: **-(**ROI Horizontal Offset) ≤ integer ≤ 50000. (1-6 NS)

3) *PYC* *Y Coordinate*

The third information item represents the y coordinate of the center point of reference and shall be expressed in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: **-(**ROI Vertical Offset) ≤ integer ≤ 50000. (1-6 NS)

4) *CRU* *Radius Position of Uncertainty*

The fourth information item contains the radius of position uncertainty, which is 0 (default) if the location is known precisely; otherwise, the position is marked at the best estimate of position, with a radius including the area of other possible locations, in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304. The radius of uncertainty may overlap the edge of the image.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 999. (1-3 N)

6.9.12.27. 9.324 DIS / EFS Distinctive Features

This field is used to define one or more areas containing unusually discriminating features that are not fully defined using other Extended Friction Ridge features. The characteristics noted in this field are specific to the friction skin itself, as opposed to issues specific to the impression (such as smudging) that are noted in Field 9.357 LQI / EFS Local Quality Issues.

When no distinctive features are present, this field shall not be used, and Field 9.327 NDIS / EFS No Distinctive Features Present shall be set.

Condition:	Optional when Field 9.327 **NDIS** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 99 Subfields; Information Items as described below

Contains:

1) ***DIT*** ***Distinctive Feature Type***

The first information item describes the distinctive feature in this subfield.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Value selected from the “Code” column of Table 30 EFS Types of Distinctive Features. (4-9 A)

2) ***DFP*** ***Distinctive Features Polygon***

The second information item contains a closed path polygon that outlines the area of the distinctive feature. A polygon can contain between 3 and 99 coordinates. The representation of coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.12.3, traditional encoding in Appendix B, and XML/JSON encoding in Appendix C.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 50000 for all values of X; (1-5 N)

0 ≤ integer ≤ 50000 for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

3) *DFC* *Distinctive Features Comments*

The third information item may contain a text description of the distinctive feature.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

Table 30 EFS types of distinctive features

Code	Description
SCAR	Scar
WART	Wart or blister
MINGROUP	Unusual group or cluster of minutiae
CORE	Unusually distinctive core area
DELTA	Unusually distinctive delta area
MINUTIA	Unusually shaped minutia
CREASE	Unusually distinctive crease
CLEAR	Large clear field of ridges; large clear area with no minutiae
DYSPLASIA	Dissociated ridges / Dysplasia
OTHERFEAT	Other unusual features not characterized elsewhere; details should be noted in comments

6.9.12.28. 9.325 NCOR / EFS No Cores Present

This field is used to indicate that the analysis process has determined that no cores could be discerned in the image. If the analysis process has determined that no cores could be discerned in the image, this field shall be set to ‘Y’. If the analysis has not been performed for cores, or if the analysis has determined there are cores present in the image, the field shall be omitted from the transaction.

Condition: Optional when Field 9.320 **COR** is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: Fixed Value = **Y**. (1 A)

6.9.12.29. 9.326 NDEL / EFS No Deltas Present

This field is used to indicate that the analysis process has determined that no deltas could be discerned in the image. If the analysis process has determined that no deltas could be discerned in the image, this field shall be set to 'Y'. If the analysis has not been performed for deltas, or if the analysis has determined there are deltas present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.321 **DEL** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.30. 9.327 NDIS / EFS No Distinctive Features Present

This field is used to indicate that the analysis process has determined that no distinctive features could be discerned in the image. If the analysis process has determined that no distinctive features could be discerned in the image, this field shall be set to 'Y'. If the analysis has not been performed for distinctive features, or if the analysis has determined there are distinctive features present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.324 **DIS** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.31. 9.328 – 9.330 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.32. 9.331 MIN / EFS Minutiae

Detailed instructions concerning this field are in Appendix F 5.4.1 Field 9.331: MIN / EFS Minutiae instructions. The type of minutiae shall be marked if clearly identifiable as a ridge ending or bifurcation; otherwise, it shall be marked as unknown type. The location for a bifurcation shall be at the "Y" of the ridge, with the direction running down the valley. The location for a ridge ending or unknown type shall be at the "Y" of the valley, with the direction running up the ridge. If the precise location for a ridge ending cannot be ascertained, a radius of uncertainty shall be marked to include the area of possible locations. If the type is unknown, the radius of uncertainty shall be indicated. When no minutiae are present, this field shall not be used, and Field 9.334 NMIN / EFS No Minutiae Present shall be set.

Condition:	Mandatory when EFS Minutiae are present; otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 9999 Subfields; Information Items as described below

Contains:

1) *MXC* ***X Coordinate***

The first information item represents the x coordinate of the minutia in this subfield and shall be expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ ROI width. (1-5 N)

2) *MYC* ***Y Coordinate***

The second information item represents the y coordinate of the minutia in this subfield and shall be expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ ROI height. (1-5 N)

3) *MTD* ***Theta Degrees***

The third information item represents the direction of the minutia, expressed in degrees. The angle of the minutia is determined by constructing three virtual rays originating at the minutia and extending 1.93 mm (0.064” – about three ridge widths) along each ridge (for a bifurcation) or valley (for a ridge ending). The smallest of the three angles formed by the rays is bisected to indicate the minutiae direction.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 359. (1-3 N)

4) *MTY* ***EFS Minutia Type***

The fourth information item describes the minutia in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code Value from Table 31 EFS Minutia Type. (1 A)

Table 31 EFS minutia type

Code	Description
E	Ridge ending
B	Ridge bifurcation
X	Ridge ending or bifurcation, no distinction provided

5) *MRU* ***Radius of Position Uncertainty***

The fifth information item defines the radius of a circle centered at the location (x,y) of the minutia; the circle is sized to include the area of other possible locations of the minutia, if the precise location cannot be determined (such as due to poor clarity). If the location is known precisely, the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty shall be expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304, and may overlap the edge of the Region of Interest.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 999. (1-3 N)

6) *MDU* ***Minutia Direction Uncertainty***

The sixth information item contains an integer from '0' (default) to '180' indicating the precision in the direction (theta) of the minutia, measured in degrees. The resulting direction is Theta±Uncertainty°. If **MDU** is set to 180, **MTD** is undefined and should not be displayed to the user.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 180. (1-3 N)

7) *MINX* ***Minutia Index Number***

The seventh information item contains an index number for referencing the minutia described in this subfield.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 9999. (1-4 N)

6.9.12.33. 9.332 MRA / EFS Minutiae Ridge Count Algorithm

This field defines the algorithm used in determining how neighboring minutiae are selected for use in the ridge counts in Field 9.333: MRC / EFS Minutiae Ridge Counts.

Condition:	Mandatory when Field 9.333 EFS occurs in the record, otherwise Optional
Occurrence:	1 when Condition above is met, 0-1 otherwise
Value Constraints:	Minutiae ridge count algorithm code from Table below. (5-8 AN)

Code	Description

OCTANT	The minutiae used for ridge counts are the nearest neighbors in eight octants, with the center of the 0th octant defined by the current minutia's theta, and the 1st through 7th octants proceeding counterclockwise. Ridge count values are set to number of intervening ridges. (Default)
EFTS7	Identical to OCTANT algorithm, except that ridge count values are one more than the number of intervening ridges. This was the format used by the FBI in its EFTS Version 7.1
QUADRANT	The minutiae used for ridge counts are the nearest neighbors in four quadrants, defined by the image's vertical and horizontal axes. The quadrants, with the 1st quadrant at the upper right and the 2nd through 4th quadrants proceeding counterclockwise. Ridge count values are set to the number of intervening ridges.

6.9.12.34. 9.333 MRC / EFS Minutiae Ridge Counts

9.332: MRA / EFS Minutiae Ridge Count Algorithm governs how the minutiae are selected for ridge counts, and the details of how the ridges are counted. Each ridge count is represented in a separate subfield. Field 9.335: RCC / EFS Minutiae Ridge Count Confidence may be used to indicate ridge count confidence between minutiae. If Field 9.372 SIM / EFS Skeletonized Image is used, ridge counts can be derived from that field rather than included explicitly.

Condition: Optional when Field 9.332 MRA is present in the record, otherwise omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *MIA* ***Minutia Index A***

The first information item contains the (1-based) index of the first minutia.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 9999. (1-4 N)

2) *MIB* ***Minutia Index B***

The second information item contains the (1-based) index of the second minutia.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 9999. (1-4 N)

3) *MIR* ***Ridge Count***

The third information item contains the number of intervening ridges between minutiae A and B. Unknown ridge counts shall be omitted (left empty). The value of Field 9.332 MRA / EFS Minutiae Ridge Count Algorithm governs other details or special cases (if any).

Condition: Mandatory when ridge count is known. Otherwise, it shall be omitted.

Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	0 ≤ integer ≤ 99. (1-2 N)

4) *MRN Reference Number*

The fourth information item contains a reference number specific to the ridge count algorithm, as indicated in Field 9.332. For the OCTANT and EFTS7 ridge count algorithms, this information item specifies the octant. For the QUADRANT ridge count algorithm, this information item specifies the quadrant.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 7. (1 N)

5) *MRS Residual*

The fifth information item is specific to the OCTANT and EFTS7 ridge count algorithms, specifying the half of the octant in which the neighboring minutia lies. The residual is 0 if the neighboring minutia lies in the clockwise half of the octant, or 1 if the minutia lies in the counterclockwise half of the octant.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are ‘0’ or ‘1’. (1 N)

6.9.12.35. 9.334 NMIN / EFS No Minutiae Present

This field is used to indicate that the analysis process has determined that no minutiae could be discerned in the image. If the analysis process has determined that no minutiae could be discerned in the image, this field shall be set to ‘Y’. If the analysis has not been performed for minutiae, or if the analysis has determined there are minutiae present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.331 **MIN** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.36. 9.335 RCC / EFS Minutiae Ridge Count Confidence

This field indicates the confidence in intervening ridge counts between any two points. Each ridge count confidence value is represented in a separate repeating subfield. While primarily used to indicate ridge count confidence between minutiae, this confidence measure may also

apply to other features such as Core/Delta ridge counts. If this field is not used, the default assumption is that the ridge counts were manually determined. This field provides a means to state when only a portion of ridge counts have been manually checked.

Condition:	Optional when Field 9.333: MRC / EFS Minutiae Ridge Counts appears in the record, otherwise omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 7992 Subfields; Information Items as described below

Contains:

1) *ACX* ***X Coordinate, Point A***

The first information item shall contain the x coordinates for Point A, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *ACY* ***Y Coordinate, Point A***

The second information item shall contain the y coordinates for Point A, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

3) *BCX* ***X Coordinate, Point B***

The third information item shall contain the x coordinates for Point B, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

4) *BCY* ***Y Coordinate, Point B***

The fourth information item shall contain the y coordinates for Point B, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ ROI height. (1-5 N)

5) *MORC* *Method of Ridge Counting*

The fifth information item shall contain the method by which ridge counts were determined and / or validated.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table, below. (1 A)

Code	Description
A	Automatic - The ridge count was automatically performed without human review.
T	Manual Tracing - The ridge count was automatically determined, based on a skeletonized image created by a human examiner.
M	Manual Ridge Count - The ridge count was determined or validated manually by a human examiner.

6) *MCV* *Confidence Value*

The sixth information item shall contain the integer confidence value for a ridge count from '0' to '99', with '0' indicating no confidence.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 99. (1-2 N)

6.9.12.37. 9.336 – 9.339 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.38. 9.340 DOT / EFS Dots

A dot is a single or partial ridge unit that is shorter than local ridge width. Longer ridge units are considered standard ridges and should be marked as such, with two ridge endings. Potential dots that are substantially thinner than local ridge width should be marked as incipient ridges. A dot is marked by its center point. Elongated dots may optionally have their length marked along the longest dimension. When no dots are present, this field shall not be used and Field 9.346 NDOT / EFS No Dots Present shall be set.

Condition: Optional when Field 9.346 NDOT is absent. Otherwise, it shall be omitted.

Occurrence: 0-1 if Condition above is met, 0 otherwise

Value Constraints: 1 to 999 Subfields; Information Items as described below

Contains:

1) *DOX* *Dot X Coordinate*

The first information item shall contain the x coordinate of the center of the dot, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *DOY* *Dot Y Coordinate*

The second information item shall contain the y coordinate of the center of the dot, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

3) *DOL* *Dot Length*

The third information item contains the length of the dot along its longest dimension in integer units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.9.12.39. 9.341 INR / EFS Incipient Ridges

An incipient ridge is a thin ridge, substantially thinner than local ridge width. An incipient is marked as one or more line segments, each defined with the (x,y) endpoints along its longest dimension. When no incipient ridges are present, this field shall not be used and Field 9.347 NINR / EFS No Incipient Ridges Present shall be set. This field consists of a subfield for each segment of an incipient ridge, each with four information items. If the incipient is composed of a series of segments:

Mark the incipient ridge as a single line when the segments of the incipient are close together or the separations between segments are indistinct.

Mark the incipient ridge segments individually when they are clearly separate, with distinct lines drawn for each one.

Mark the incipient ridge as a series of adjoining, unbroken line segments when it curves.

Condition:	Optional when Field 9.347 **NINR** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 999 Subfields; Information Items as described below

Contains:

1) *X1C* ***X Coordinate Point 1***

The first information item shall contain the x coordinate of one endpoint, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *Y1C* ***Y Coordinate Point 1***

The second information item shall contain the y coordinate of one endpoint, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

3) *X2C* ***X Coordinate Point 2***

The third information item shall contain the x coordinate of the other endpoint, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

4) *Y2C* ***Y Coordinate Point 2***

The fourth information item shall contain the y coordinate of the other endpoint, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

6.9.12.40. 9.342 CLD / EFS Creases and Linear Discontinuities

This field defines the permanent flexion creases (shown in Figure 7 EFS locations of major flexion creases, below), as well as linear discontinuities (minor creases, cracks, cuts, and thin or non-permanent scars). Each segment of a crease or linear discontinuity is represented as a separate subfield. If a continuous discontinuity curves, it should be marked as a series of adjoining line segments. If a crease is feathered or composed of a series of crisscross creases, each of the short creases shall be marked separately. When no creases or linear discontinuities are present, this field shall not be used and Field 9.348 NCLD / EFS No Creases or Linear Discontinuities Present shall be set.

Condition:	Optional when Field 9.348 **NCLD** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 999 Repeating Subfields; information Item as described below.

Contains:

1) ***X1D*** ***X Coordinate Point 1***

The first information item shall contain the x coordinate of one endpoint, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1 per Subfield
Value Constraints:	0 ≤ integer ≤ ROI width (1-5 N)

2) ***Y1D*** ***Y Coordinate Point 1***

The second information item shall contain the y coordinate of one endpoint, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1 per Subfield
Value Constraints:	0 ≤ integer ≤ ROI height (1-5 N)

3) ***X2D*** ***X Coordinate Point 2***

The third information item shall contain the x coordinate of the other endpoint, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1 per Subfield
Value Constraints:	0 ≤ integer ≤ ROI width (1-5 N)

4) *Y2D* *Y Coordinate Point 2*

The fourth information item shall contain the y coordinate of the other endpoint, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: 0 ≤ integer ≤ ROI height (1-5 N)

5) *TPD* *Type*

The fifth information item shall indicate the type of permanent flexion crease described in this subfield but is omitted for linear discontinuities. For a feathered crease, multiple line segments may all share the same flexion crease label.

Condition: Mandatory for permanent flexion creases; otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise.

Value Constraints: Code value from Table 32 EFS Codes for Permanent Flexion Creases. (2-5AN)

Table 32 EFS codes for permanent flexion creases

Code	Name	Location	Applies To	Corresponding FPP values
DIP	Distal interphalangeal crease	Finger between medial and distal segments, or Thumb between proximal and distal segments	Distal segments	0-10, 16, 17
PIP	Proximal interphalangeal crease	Finger between proximal and medial segments	Medial or proximal segments	0-10, 16, 17
PDC00 – PDC10 PDC16, PDC17	Proximal digital crease	Finger or Thumb at Palm. The 2-digit position code for the relevant finger is appended to the string PDC.	Proximal or palm segments	0-10, 16,17, 20-38, 60-79, 81-86
RLC	Radial longitudinal crease (bottom crease)	Palm around base of thumb (thenar)	Palm segments	20-38, 81-86
PTC	Proximal transverse crease (middle crease)	Diagonal across palm	Palm segments	20-38, 81-86
DTC	Distal transverse crease (top crease)	Palm at base of interdigital area	Palm segments	20-38, 81-86
WC	Wrist crease (wrist bracelet)	Wrist	Palm segments	20-38, 81-86

6) *FGP* *FPP Segment Position*

The sixth information item indicates in which segment position (from 9.302 FPP) the crease or discontinuity described in this subfield is located.

Condition: Optional

Occurrence: 0-1

Value Constraints: FGP value from Field 9.302 FPP

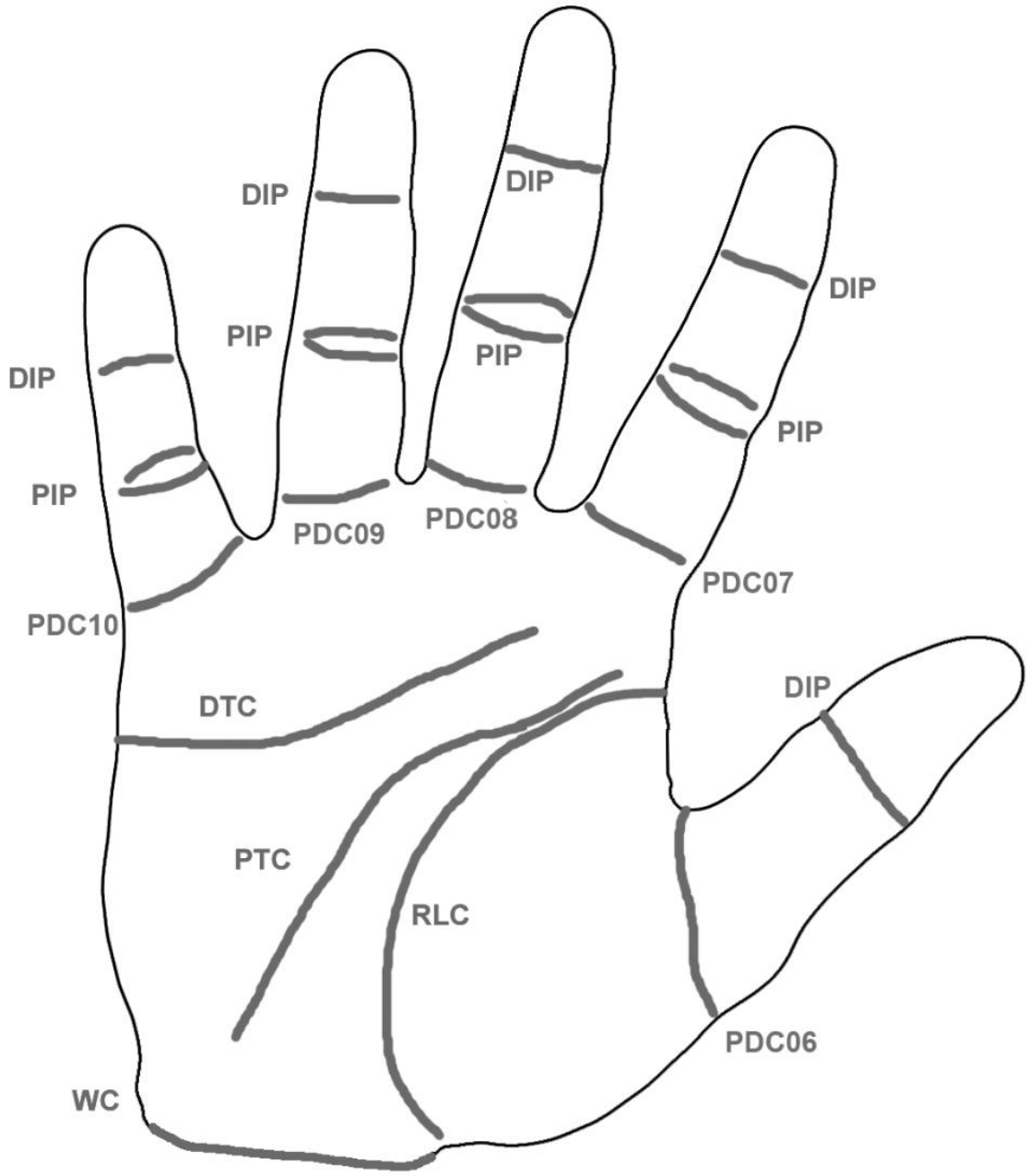


Figure 7 EFS locations of major flexion creases

6.9.12.41. 9.343 REF / EFS Ridge Edge Features

Ridge edge features include Protrusions (abrupt increases in ridge width), Indentations (abrupt decreases in ridge width), and Discontinuities (points where a ridge stops briefly). For more information about ridge edge features, see Appendix F.5.5.1, Field 9.343: REF / EFS Ridge Edge Features instructions. When no ridge edges are present, this field shall not be used and Field 9.349 NREF / EFS No Ridge Edge Features Present shall be set. Each ridge edge feature is represented as a separate subfield consisting of three information items.

Condition:	Optional when Field 9.349 **NREF** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 999 Subfields; Information Items as described below

Contains:

1) *CLX* ***X Coordinate***

The first information item shall contain the x coordinate of the center of the feature, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *CLY* ***Y Coordinate***

The second information item shall contain the y coordinate of the center of the feature, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

3) *CLT* ***Feature Type***

The third information item shall describe the type of feature: P (Protrusion), I (Indentation), or D (Discontinuity).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**P**' (protrusion), '**I**' (indentation), and '**D**' (discontinuity). (1 A)

6.9.12.42. 9.344 NPOR / EFS No Pores Present

This field is used to indicate that the analysis process has determined that no pores could be discerned in the image. If the analysis process has determined that no pores could be discerned in the image, this field shall be set to 'Y'. If the analysis has not been performed for pores, or if the analysis has determined there are pores present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.345 **POR** is absent. Otherwise, it shall be omitted.

Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.43. 9.345 POR / EFS Pores

Each pore is marked by its center point. When no pores are present, this field shall not be used and Field 9.344 NPOR / EFS No Pores Present shall be set. Each pore is represented as a separate repeating subfield consisting of two information items.

Condition:	Optional when Field 9.344 **NPOR** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 9999 Subfields; Information Items as described below

Contains:

1) *POX* ***X Coordinate***

The first information item shall contain the x coordinate of the center of the pore, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *POY* ***Y Coordinate***

The second information item shall contain the y coordinate of the center of the pore, expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

6.9.12.44. 9.346 NDOT / EFS No Dots Present

This field is used to indicate that the analysis process has determined that no distinctive features could be discerned in the image. If the analysis process has determined that no distinctive features could be discerned in the image, this field shall be set to Y. If the analysis has not been performed for dots, or if the analysis has determined there are dots present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.340 **DOT** is absent. Otherwise, it shall be omitted.

Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.45. 9.347 NINR / EFS No Incipient Ridges Present

This field is used to indicate that the analysis process has determined that no incipient ridges could be discerned in the image. If the analysis process has determined that no incipient ridges could be discerned in the image, this field shall be set to 'Y'. If the analysis has not been performed for incipient ridges, or if the analysis has determined there are incipient ridges present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.341 **INR** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.46. 9.348 NCLD / EFS No Creases or Linear Discontinuities Present

This field is used to indicate that the analysis process has determined that no creases could be discerned in the image, in which case this field shall be set to 'Y'. If the analysis has not been performed for creases or linear discontinuities, or if the analysis has determined there are creases or linear discontinuities present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.342 **CLD** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.47. 9.349 NREF / EFS No Ridge Edge Features Present

This field is used to indicate that the analysis process has determined that no ridge edge features could be discerned in the image, in which case this field shall be set to 'Y'. If the analysis has not been performed for ridge edge features, or if the analysis has determined there are ridge edge features present in the image, the field shall be omitted from the transaction.

Condition:	Optional when Field 9.343 **REF** is absent. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	Fixed Value = **Y**. (1 A)

6.9.12.48. 9.350 MFD / EFS Method of Feature Detection

This field states the method(s) by which the Extended Friction Ridge features were detected and/or edited. Each time EFS feature fields are created or modified, the date and name of the automated algorithm or human examiner is noted in a new data entry (repeating subfield). When features are created or edited on multiple occasions, the new data entries should be added to this field without deleting the original data entries. For example, if minutiae are manually encoded by an examiner, then subsequently a second examiner modifies the minutiae, there would be 'MAN' entries for each change in 9.331 MIN / EFS Minutiae.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FIE* *Field*

The first information item shall indicate which field(s) correspond to the method noted: it shall contain either a single field (e.g., '9.331'), a comma-separated list of fields without spaces (e.g., '9.340,9.341,9.343'), or 'ALL'.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**ALL**', or a comma-separated list of EFS field value(s) from 9.300 – 9.373, with no white space. (3-999 ANS)

2) *FME* *Method*

The second information item shall state the method by which the print features were detected and encoded.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value selected from table, below. (3-4 A)

Code	Description
AUTO	The features were detected and encoded by an automated process without any possibility of human editing. The algorithm shall be noted in the appropriate information item.
REV	The features were detected and encoded by an automated process and manually reviewed without the need for manual editing. The algorithm and examiner's name shall be noted in the appropriate information items.
EDIT	The features were detected and encoded by an automated process but manually edited. The algorithm and examiner's name shall be noted in the appropriate information items.
MAN	The features were manually detected and encoded. The examiner's name shall be noted in the appropriate information item.

3) *FAV* *Algorithm Vendor*

The third information item shall identify the vendor of the encoding algorithm if the method is not ‘MAN’.

Condition:	Mandatory if the value of information item FME ≠ MAN. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

4) *FAL* ***Algorithm***

The fourth information item shall identify the algorithm by name and version for methods other than ‘MAN’.

Condition:	Mandatory if the value of information item FME ≠ MAN. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

5) *ESN* ***Examiner Surname***

The fifth information item shall contain the surname (last name) of the print examiner, for methods other than ‘AUTO’.

Condition:	Mandatory if the value of information item FME ≠ AUTO. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

6) *EGN* ***Examiner Given Name***

The sixth information item shall contain the first name (given name, or first and middle names) of the print examiner for methods other than ‘AUTO.’

Condition:	Mandatory if the value of information item FME ≠ AUTO. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

7) *EAF* ***Examiner Affiliation***

The seventh information item shall contain the employer or organizational affiliation of the examiner, for methods other than 'AUTO'.

Condition:	Mandatory if the value of information item FME ≠ AUTO. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

8**)** ***EMT*** ***Date and Time***

The eighth information item should contain the date and time that the determination was made, using Greenwich Mean Time (GMT). See Section 5.1.4.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

9) ***NTS*** ***Notes***

The ninth information item contains text with additional information regarding the detection or modification of features.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

10) ***MNXR*** ***Minutia Index Reference***

The tenth information item contains the index number associated with a specific minutia from Field 9.331 MIN / EFS Minutiae (i.e., MINX / Minutia Index Number).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 9999. Value selected from MINX, the seventh information item of Field 9.331. (1-4 N)

6.9.12.49. 9.351 COM / EFS Comments

This field contains additional information not noted in other fields. This may include unformatted text information such as location, background information, or descriptive information. If comments need to be made about specific portions of the impression, use the

associated comment instead, for example, Field 9.324: DIS / EFS Distinctive Features contains an optional comment.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.9.12.50. 9.352 LPM / EFS Latent Processing Method

This field contains one or more codes indicating the technique(s) used to process the latent print. This field is only used for latent images. All methods used shall be marked in separate subfields, in order of most destructive to least destructive. Unprocessed impressions (latent images visible to the naked eye) shall be labeled 'VIS'.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Repeating Subfields; information Item as described below

Contains:

The sole information item in this field provides the code value representing a latent processing method used. If there are additional processing methods, their codes shall also be included in separate Subfields.

Condition:	Mandatory
Occurrence:	1 per Subfield
Value Constraints:	Code Value from Table 33 Latent processing method codes. (3 AN)

Table 33 Latent processing method codes

Code	Processing Method
12I	1,2-Indanedione
ADX	Ardrox
ALS	Alternate light source
AMB	Amido black
AY7	Acid yellow 7
BAR	Basic red 28
BLE	Bleach (sodium hypochlorite)
BLP	Black powder
BPA	Black powder alternative (for tape)
BRY	Brilliant yellow (basic yellow 40)
CBB	Coomassie brilliant blue
CDS	Crowle's double stain
COG	Colloidal gold
DAB	Diaminobenzidine
DFO	1,8-diazafluoren-9-one
FLP	Fluorescent powder

GEN	Genipin
GRP	Gray powder
GTV	Gentian violet/Crystal violet/Basic Violet 3
HCA	Hydrochloric acid fuming
IOD	Iodine fuming
ISR	Iodine spray reagent
LAS	Laser
LCV	Leucocrystal violet
LIQ	Liquinox
LQD	Liquid-drox
MBD	7-p-methoxybenzylanimo-4-nitrobenz-2-oxa-1, 3-diazole
MBP	Magnetic black powder
MGP	Magnetic grey powder
MPD	Modified physical developer
MRM	Maxillon flavine 10gff, Rhodamine 6g, and MBD
NIN	Ninhydrin
OTH	Other
PDV	Physical developer
R6G	Rhodamine 6G
RAM	Rhodamine 6G, Ardrox, MBD Mixture
RUV	Reflective ultra-violet imaging system (RUVIS)
SAO	Safranin O
SDB	Sudan black
SGF	Superglue fuming (cyanoacrylate)
SPR	Small particle reagent
SSP	Stickyside powder
SVN	Silver nitrate
TEC	Theonyl Europiom Chelate
TID	Titanium dioxide
VIS	Visual (latent image, not processed by other means)
WHP	White powder
ZIC	Zinc chloride

6.9.12.51. 9.353 EAA / EFS Examiner Analysis Assessment

This field indicates an examiner's assessment of the value of the single impression delineated by Field 9.300: ROI / EFS Region of Interest. See also Field 9.362: ECD / EFS Examiner Comparison Determination for comparison determinations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *AAV* ***Value Assessment Code***

The first information item indicates the value of the impression, from table, below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table, below. (5-8 A)

Code	Usage
VALUE	The impression is of value and is appropriate for further analysis and potential comparison. Sufficient details exist to render an individualization and/or exclusion decision.
LIMITED	The impression is of limited, marginal, value. It is not of value for individualization but may be appropriate for exclusion.
NOVALUE	The impression is of no value, is not appropriate for further analysis, and has no use for potential comparison.
NONPRINT	The image is not a friction ridge impression.

2) *ALN* *Examiner Surname*

The second information item shall contain the surname (last name) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

3) *AFN* *Examiner Given Name*

The third information item shall contain the first name (given name, or first and middle names) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

4) *AAF* *Examiner Affiliation*

The fourth information item shall contain the employer or organizational affiliation of the examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

5) *AMT* *Determination Date and Time*

The fifth information item shall contain the date and time that the determination was made, using Greenwich Mean Time (GMT).

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

6) *ACM* *Comments*

The sixth information item contains additional clarifying information for the examiner analysis assessment.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

7) *CXF* *Analysis Complexity Flag*

The seventh information item is only used when the examiner determines that the analysis was complex as defined in *ANSI/ASB Best Practice Recommendation 165, First Edition 2024 Best Practice Recommendation for Analysis of Friction Ridge Impressions*. (See Normative references). This decision is based on the available quality of features, low specificity of features, significant distortion, or disagreement among examiners. This information item shall be omitted if no such determination has been made, regardless of the reason. This information item is included for use in quality assurance / quality control processes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**LOW**', '**HIGH**' or '***COMPLEX***' (*legacy* use only). (3-7 A)

6.9.12.52. 9.354 EOF / EFS Evidence of Fraud

This field indicates that there is basis for determination that the image may be fraudulent. This information item shall be omitted if no such determination has been made, regardless of the reason. This field consists of two information items:

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 4 Subfields; Information Items as described below

Contains:

1) *FRA* *Fraud Type*

The first information item indicates the potential type of fraud attempted as determined from the impression, using the values in the "Code" column from the table, below.

Condition:	Mandatory
Occurrence:	1

Value Constraints: Code value from the table, below. (3 A)

Code	Name	Description
EVA	Evidence of evasion	Evasion includes actions that prevent/lessen the likelihood of matching such as by degrading or obscuring physical characteristics or mutilating fingers.
SPO	Evidence of spoofing	Spoofing includes purposefully attempting to be identified as a different person in a biometric system; techniques include modifying biological characteristics and using fabricated characteristics.
FOR	Evidence of forged evidence	Forged evidence is forensic evidence that was fraudulently placed on the surface from which it was collected, using another mechanism or device than the natural contact with friction ridge skin.
FAB	Evidence of fabricated evidence	Fabricated evidence is forensic evidence that never existed on the surface from which it was supposedly collected.

2) *CFD* *Comments*

The second information item provides clarifying information regarding the assessment of potential evidence of fraud.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

6.9.12.53. 9.355 LSB / EFS Latent Substrate

This field is used to define the substrate, or surface on which the friction ridge impression was deposited. If multiple substrates are present, they are represented by separate subfields.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; Information Items as described below

Contains:

1) *CLS* *Latent Substrate Code*

The first information item indicates the type of substrate, taken from the code table below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 34 Latent Substrate Codes. (1-2 AN)

Table 34 Latent substrate codes

Code	Description
Porous Substrates	
1A	Paper

1B	Cardboard
1C	Unfinished/raw wood
1D	Other/unknown porous substrate
Nonporous Substrates	
2A	Plastic
2B	Glass and Ceramics
2C	Metal, painted
2D	Metal, unpainted
2E	Glossy painted surface
2F	Tape, adhesive side
2G	Tape, non-adhesive side
2H	Aluminum foil
2I	Other/unknown nonporous substrate
Semi-porous Substrates	
3A	Rubber or latex
3B	Leather and leatherette
3C	Photograph, emulsion side
3D	Photograph, paper side
3E	Glossy or semi-glossy paper or cardboard
3F	Satin or flat finish painted surface
3G	Other/unknown semi-porous substrate
Other / Unknown Substrates	
4A	Other substrate (Specify)
4B	Unknown substrate

2) *OSD Object or Substrate Description*

The second information item may contain text that describes the object or surface on which the print was deposited or provide clarifying information regarding the substrate. An example is "Neck of green glass beer bottle".

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.12.54. 9.356 LMT / EFS Latent Matrix

This field is used to define the matrix, or substance deposited by the finger that forms the impression. Each latent matrix in the impression is represented by a separate subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; Information Items as described below

Contains:

1) *TOM* ***Type of Matrix***

The first information item shall indicate the type of matrix in the impression. All visible contaminants are apparent rather than necessarily known to certainty: for example, the substrate may be marked as blood if it appears to be blood; if known for certain that should be indicated in **CLA**.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 34 Latent Substrate Codes. (1-2 N)

Table 35 Latent matrix codes

Code	Description
1	Natural perspiration and/or body oils (eccrine and/or sebaceous)
2	Visible Blood
3	Visible Paint
4	Visible Ink
5	Visible Oil or grease
6	Visible Dirt or soil
7	Other visible contaminants
8	Impression in pliable material
9	Contaminant removal via touch
10	Other/unknown matrix

2) *CLA* ***Matrix Comments***

The second information item may contain text that provides clarifying information regarding the matrix.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.12.55. 9.357 LQI / EFS Local Quality Issues

This field is used to define one or more areas containing quality or transfer issues that indicate that the anatomical friction ridge features may not have been accurately represented in the image. Each area with local quality issues is represented as a separate repeating subfield. The problems noted in this field apply to the specific impression under consideration; anatomical

features of the friction skin itself (such as scars) are noted in Field 9.324 DIS / EFS Distinctive Features.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *LQT* *Location Quality Type*

The first information item shall describe the type of quality issue noted in the impression.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table, below. (4-10 A)

Code	Description
ARTIFACT	Digital artifacts, such as occasionally caused by compression or livescan devices.
BACKGROUND	Interference with background makes following ridges difficult (e.g., check patterns)
COMPRESSED	Distorted area in which ridges are compressed together
DISTORT	Miscellaneous distortion (See also Compressed and Stretched)
NEGATIVE	Used if only a portion of the friction ridge image is tonally reversed (has ridges and valleys inverted so that ridges appear white, and valleys appear black). Note that Field 9.314 Tonal Reversal (TRV) is used if the entire image is tonally reversed.
OVERDEV	Overdeveloped area: excessive processing medium such as ink, powder, etc.
OVERLAP	Area in which another friction ridge impression is superimposed over the impression of interest
SMEAR	Smeared or smudged area
STRETCHED	Distorted area in which ridges are stretched apart from each other
TAPE	Lifting tape artifacts (crease, bubble, etc.)
OTHER	Other quality issues not characterized elsewhere; details should be noted in **LQC**.

2) *LQP* *Latent Quality Polygon*

The second information item shall describe a closed path outlining the area of the quality issue. A polygon can contain between 3 and 99 coordinates. The representation of coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.12.3, traditional encoding in Appendix B, and XML/JSON encoding in Appendix C.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 50000 for all values of X; (1-5 N)

0 ≤ integer ≤ 50000 for all values of Y; (1-5 N)

Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

3) *LQC* *Latent Quality Comments*

The third information item may provide further description of the quality issue.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.12.56. 9.358 – 9.359 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.57. 9.360 AOC / EFS Area of Correspondence

This field is to be used only when two or more images contained in a single transaction are compared as candidates for individualization (potential mates). The area of correspondence is a polygon enclosing the region of usable ridge detail present in both images being compared. If the corresponding areas are discontinuous, more than one area of correspondence may be defined for a pair of images, each in a separate subfield. One Type-9 record may have multiple AOCs defined that correspond to different images, each in a separate repeating subfield. Figure - EFS IDC References in Areas of Correspondence for More than Two Images, below, shows the interrelationships of the IDCs and AOCs for three different Type-9 records in a single transaction.

Note that the AOC in a given Type-9 record contains an IDC reference for one or more other Type-9 record in a transaction. For example, a latent could have areas of correspondence with both the rolled and plain exemplars from one subject, or a latent could have areas of correspondence with candidate exemplars from two different subjects. If two prints overlap but neither encloses the area of the other (such as shown in Figure 8, the AOC shall be marked for both prints. If the area of a small print is completely enclosed by the area of a larger print so that the AOC for the small print is identical to the ROI, the AOC may be omitted for the smaller print.

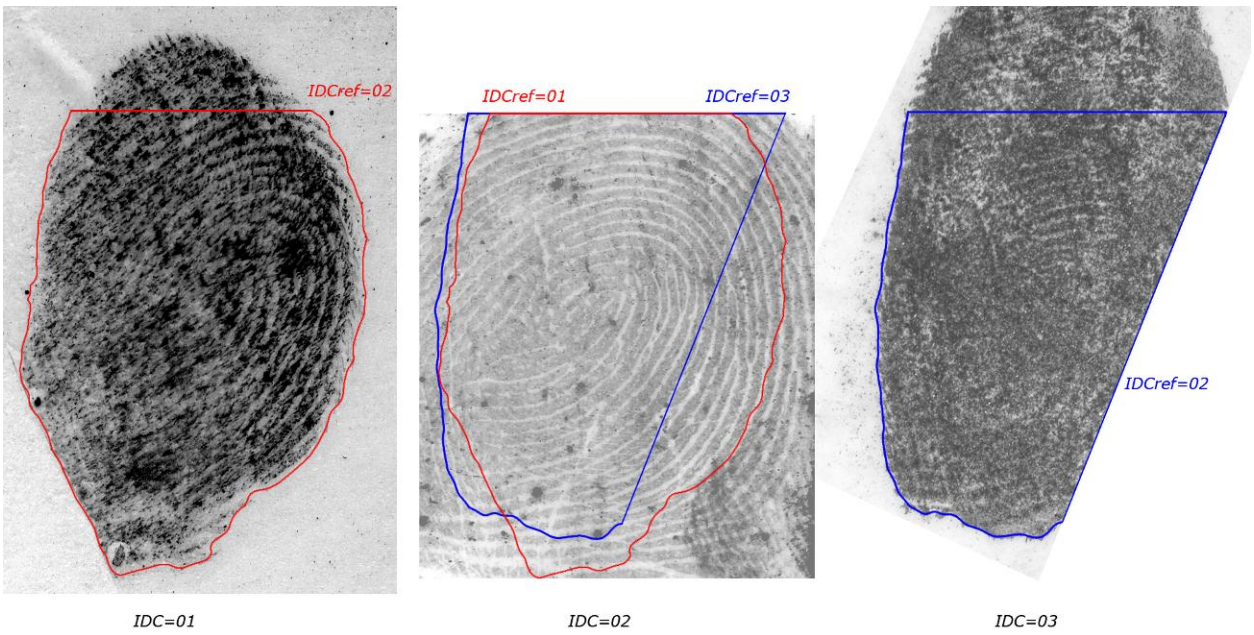


Figure 8 EFS IDC references in areas of correspondence for more than two images

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *CIR* ***Corresponding IDC Reference***

The first information item shall indicate the IDC for the target image / Type-9 record for a given AOC. See Section 5.11.1 and Section 5.3.2 Leading Zeroes in Field Values. Figure 8 shows examples of the use of IDC references in Corresponding Regions of Interest:

The first image (IDC = 01) has a single AOC, corresponding to the second image, so CIR = 02.

The second image (IDC = 02) has AOCs corresponding to each of the other images, so must have two subfields, one with CIR = 2 and one with CIR = 3; The third image (IDC = 03) has a single AOC, corresponding to the second image, so CIR = 02.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

2) *AOP* ***Corresponding Polygon***

The second information item shall describe a closed path polygon that outlines the area of the corresponding area. A polygon can contain between 3 and 99 coordinates. The representation of coordinates varies by encoding. The format of EFS polygons is described in Section 6.9.12.3, traditional encoding in Appendix B, and XML/JSON encoding in Appendix C.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 50000 for all values of X; (1-5 N)
	0 ≤ integer ≤ 50000 for all values of Y; (1-5 N)
	Between 3 to 99 vertices shall represent a polygon, with each pair of (x,y) values formatted according to applicable encoding rules.

3) *CAC* ***Corresponding Area Comments***

The third information item allows a free text comment or description related to the AOC.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.12.58. 9.361 CPF / EFS Corresponding Points or Features

This field is used to label points or features for comparison of the current feature set with other Type-9 feature sets in a transaction, as shown in Figure 9, which shows the interrelationships of the CPF labels for three different Type-9 records in a single transaction. This field is to be used only when two or more images contained in a single transaction are compared, either as candidates for individualization (potential mates), or to annotate reasons for exclusion. For more information about the field, see Appendix F.5.6.1 Field 9.361: CPF / EFS Corresponding Points or Features instructions.

For each of the images being compared, specific points or features are marked in each of the Type-9 records, with correspondence indicated by the use of the same label, each in a separate data entry (repeating subfield). Labels within a single Type-9 record shall be unique. For example, if a transaction contains one latent and multiple candidate exemplars, a feature labeled “A” in the latent Type-9 feature set corresponds with the feature labeled “A” (if present) in all of the exemplar Type-9 feature sets. Corresponding Points or Features may refer to arbitrary points or may refer to predefined features (as noted in Table 37 EFS Field Numbers Used for Corresponding Features). The features include point features (such as minutiae, dots, or pores), but also may refer to areas (such as distinctive characteristics), lines (incipient ridges or creases), or paths (ridge path segments). Arbitrary points may be used to indicate characteristics that were not noted during analysis, or to indicate points in an exemplar that was not previously marked up.

Each feature corresponds to a separate subfield containing up to seven information items.

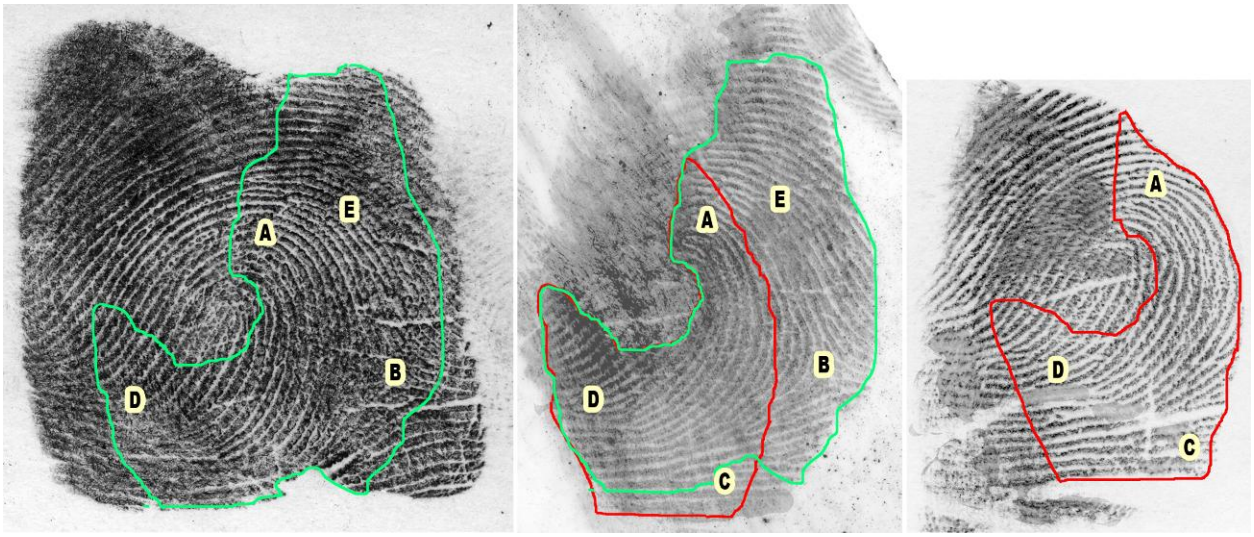


Figure 9 EFS areas and points of correspondence in rolled exemplar, latent, and plain exemplar images

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *COL* ***Correspondence Label***

The first information item shall label points or features for comparison of the current feature set with other Type-9 feature sets in this transaction. The label names may be selected and assigned at the discretion of the system or the examiner. For each of the images being compared, specific points or features are marked in each of the Type-9 records, with correspondence indicated by the use of the same label. Labels within a single Type-9 record shall be unique.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1-3 Alphanumeric characters. (1-3 AN)

2) *TOC* ***Type of Correspondence***

The second information item shall indicate the type of correspondence or non-correspondence, set to the appropriate Code value from Table 36 EFS Codes for Types of Corresponding Points and Features.

Condition:	Mandatory

Occurrence: 1

Value Constraints: Code value chosen from Table 36 EFS Codes for Types of Corresponding Points and Features. (1-2 A)

Table 36 EFS codes for types of corresponding points and features

Code	Type	Description
F	Definite correspondence - Feature	The labeled feature definitely corresponds to the specific feature defined by the Field Number and Field Occurrence information items. (X and Y information items are unused)
P	Definite correspondence - Point	The labeled feature definitely corresponds to the location with the coordinates defined in the(x,y) information items. (Field Number and Field Occurrence information items are unused)
DF	Possible or debatable correspondence - Debatable Feature	The labeled feature may debatably correspond to the feature defined by the Field Number and Field Occurrence information items. (X and Y information items are unused)
DP	Possible or debatable correspondence - Debatable Point	The labeled feature may debatably correspond to the location with the coordinates defined in the (x,y) information items. (Field Number and Field Occurrence information items are unused)
X	Definite lack of correspondence - Does not exist	The labeled feature definitely does not exist in the impression, and the consistency of presentation of the potentially corresponding region is sufficient to make a definite determination. The (x,y) position may be used to optionally indicate where the absent feature would have been expected.
R	Inconclusive - Out of region	The labeled feature is not visible in the impression because it lies outside of the area of correspondence for this image: the feature may or may not be present, but the impression does not include the relevant area (X, Y, Field Number, and Field Occurrence information items are unused)
U	Inconclusive -Unclear area	The labeled feature is not visible in the impression because the potentially corresponding region is not sufficiently clear: the feature may or may not be present, but local quality issues prevent a definite determination. (X, Y, Field Number, and Field Occurrence information items are unused)

3) *CFN* *Corresponding Field Number*

The third information item indicates the type of field being compared and shall correspond to the Type-9 field number of the compared field, as listed below. It shall only be used when **TOC** = F or DF. Otherwise, it shall be omitted.

Condition: Mandatory when **TOC** = **F** or **DF**. Otherwise, it shall be omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the Field Number column in Table 37 EFS Field Numbers Used for Corresponding Features. (3 N)

Table 37 EFS field numbers used for corresponding features

Field Number	Type
320	Cores
321	Deltas
324	Distinctive Characteristics
331	Minutiae
340	Dots
341	Incipient Ridges
342	Creases and Linear Discontinuities
343	Ridge Edge Features
345	Pores
373	Ridge Path Segments

4) *FOC* ***Corresponding Field Occurrence***

The fourth information item shall be used only when **TOC** = F or DF. It indicates which specific subfield of the field in CFN the label is applied to. Occurrences are numbered sequentially starting at 1.

Condition:	Mandatory when **TOC** = F or DF. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 999. (1-3 N)

5) *CXC* ***Corresponding X Coordinate***

The fifth information item is mandatory if **TOC** = P or DP and is optional if **TOC** = X. Otherwise, it shall not appear. This information item provides the x coordinate location of the CPF. It is expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory when **TOC** = P or DP; Optional when **TOC** = X; Otherwise, it shall be omitted.
Occurrence:	0-1 dependent on conditions above
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

6) *CYC* ***Corresponding Y Coordinate***

The sixth information item is mandatory if **TOC** = P or DP and is optional if **TOC** = X. Otherwise, it shall not appear. This information item provides the y coordinate location of the CPF. It is expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory when **TOC** = P or DP; Optional when **TOC** = X; Otherwise, it shall be omitted.
Occurrence:	0-1 dependent on conditions above
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

7) *COC* ***Corresponding Comments***

The seventh information item may contain a text comment or description related to the **CPF**.

Condition:	Optional
Occurrence:	1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.9.12.59. 9.362 ECD / EFS Examiner Comparison Determination

This field indicates an examiner's determination based on analysis and comparison of two specified friction ridge images. If multiple examiners' determinations are represented, each is contained separately in a repeating subfield. Comparison determinations against multiple impressions in the same transaction are specified in a separate subfield with distinct IDC references.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *EDC IDC Reference*

The first information item shall indicate the target image for a given determination and is used in the same way as the IDC in Field 9.360: AOC / EFS Area of Correspondence. See Section 5.11.1 IDC / Information Designation Character and Section 5.3.2 Leading Zeroes in Field Values.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

2) *EDE Examiner Determination*

The second information item shall indicate a comparison conclusion in accordance with *ASB Best Practice Recommendation 166, First Edition 2024 Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions*, using the "Code" column from the table below. *Legacy* values are permitted in historical records but shall not be used for new evaluations.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 38 EFS Codes for Comparison Determinations. (4-33 AS)

Table 38 EFS codes for comparison determinations

Code	Category	Description / Usage
Source Exclusion	ASB BPR 166	"All of the following conditions are met: a) the observed data in the relevant areas of both impressions used to support the source conclusion are present and designated as Category 2 (yellow) quality or higher during analysis; b) the observed data between the impressions are in disagreement."

Inconclusive with Dissimilarities	ASB BPR 166	"the following condition is met: a) the observed data between the impressions needed to support the source conclusion display dissimilarities, but a more definitive determination of disagreement cannot be made due to limiting factors; the limiting factor(s) affecting a more definitive determination should be documented."
Inconclusive	ASB BPR 166	"at least one of the following conditions are met: a) the observed data in the relevant area of at least one of the impressions needed to support a source conclusion are not present or designated as Category 1 (red) quality or lower during analysis thus preventing a determination of agreement or disagreement, the limiting factor(s) affecting a more definitive determination should be documented; b) the similarities and dissimilarities of the observed data are insufficient to support either agreement or disagreement, the limiting factor(s) affecting a more definitive determination should be documented."
Inconclusive with Similarities	ASB BPR 166	"the following condition is met: a) The observed data between the impressions needed to support the source conclusion display similarities, but a more definitive determination of agreement cannot be made due to limiting factors, the limiting factor(s) affecting a more definitive determination should be documented."
Source Identification	ASB BPR 166	"all of the following conditions are met: a) the observed data in the relevant areas of both impressions used to support the source conclusion are present and designated as Category 2 (yellow) quality or higher during analysis; b) the observed data between the impressions are in agreement resulting in overall conformity; c) the observed data in the agreement include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during analysis."
NONE	No determination	No determination has been made.
INDIV	***Legacy only***	Individualization - The two impressions originated from the same source.
INC_I	***Legacy only***	Inconclusive due to insufficient information - Individualization and exclusion are not possible because of insufficient corresponding or contradictory data. This category should be used if the specific other types of inconclusive determinations do not apply.
INC_C	***Legacy only***	Inconclusive, but with corresponding features noted - No conclusive determination can be made. Corresponding features are present, and no substantive contradictory features are present. The correspondence of features is supportive of the conclusion that the two impressions originated from the same source, but not to the extent sufficient for individualization. This determination should be made if the examiner determines that the impressions are almost certainly from the same source but cannot make an individualization determination. This is sometimes described as a qualified conclusion.
INC_D	***Legacy only***	Inconclusive, but with dissimilar features noted - No conclusive determination can be made. Non-corresponding features are present. The dissimilarity of features is supportive of the conclusion that the two impressions originated from different sources, but not to the extent sufficient for exclusion. This determination should be made if the examiner determines that the impressions are almost certainly not from the same source but cannot make an exclusion determination. This is sometimes described as a qualified exclusion.
INC_N	***Legacy only***	Inconclusive due to no overlapping area - Individualization and exclusion are not possible because no corresponding or potentially corresponding areas of friction ridge detail are present. This determination should be made if there is sufficient information in the impressions to determine that there are no areas in the impressions to compare, such as when one print is of the left half of a finger and the other is of the right half.
EX_SRC	***Legacy only***	Exclusion of source - The two impressions originated from different sources of friction ridge skin (e.g., different fingers), but the subject cannot be excluded.

EX_SUB	***Legacy only***	Exclusion of subject - The two impressions originated from different subjects.

3) *WIP* *Work in Progress*

The third information item shall be set to either 'PRELIMINARY' or 'FINAL'. The purpose of this is to allow saving work in progress. The status shall be set to 'FINAL' before a determination is accepted for further processing.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**PRELIMINARY**' or '**FINAL**'. (5-11 A)

4) *ELN* *Examiner Last Name*

The fourth information item shall contain the last name (surname) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

5) *EFN* *Examiner First Name*

The fifth information item shall contain the given name(s) (first name or first and middle names) of the print examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 40 characters from user-specified set as indicated in Field 1.015 DCS. (1-40 U)

6) *EAF* *Examiner Affiliation*

The sixth information item shall contain the employer or organizational affiliation of the examiner.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 99 characters from user-specified set as indicated in Field 1.015 DCS. (1-99 U)

7) *DTG* *Determination Date and Time*

The seventh information item shall contain the date and time that the determination was made, using Greenwich Mean Time (GMT). See Section 5.1.4.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

8) *CZZ Determination Comments*

The eighth information item may contain text that provides clarifying or qualifying information regarding the comparison determination.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

9) *CCF Complex Comparison Flag*

The ninth information item shall only appear when the examiner determines that the comparison was complex as defined in *ASB Best Practice Recommendation 166, First Edition 2024 Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions.* (See Section 3 Normative References), based on the available quality and quantity of features, low specificity of features, significant distortion, or disagreement among examiners. In such cases, this value shall be set. No further assumptions should be made based on absence of this field. This information item is included for use in quality assurance/quality control processes.

Condition:	Mandatory when comparison was determined to be complex, otherwise it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Allowed values are '**LOW**', '**HIGH**' or '***COMPLEX***' (*legacy* use only). (3-7 A)

6.9.12.60. 9.363 RRC / EFS Relative Rotation of Corresponding Print

This field may be used when two or more images contained in a single transaction are compared to indicate the relative overall rotation necessary for the prints to be compared. The number of subfields is limited only by the number of Type-9 records in the transaction.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *RIR* ***Rotation IDC Reference***

The first information item shall indicate the IDC for the Type-9 record associated with the target image/ Type-9 record for a given **RRC**. See Section 5.11.1 IDC / Information Designation Character and Section 5.3.2 Leading Zeroes in Field Values. See Field 9.360 or Field 9.362 for examples of other IDC references).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

2) *ROR* ***Relative Overall Rotation***

The second information item shall define the integer number of degrees that the target image and/or features referenced by **RIR** shall be rotated to correspond to the data in this Type-9 record. Positive numbers indicate degrees counterclockwise; negative numbers indicate degrees clockwise: (-179 to 180 inclusive).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	-179 ≤ integer ≤ 180. (1-4 NS)

6.9.12.61. 9.364 – 9.371 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.62. 9.372 SIM / EFS Skeletonized Image

This optional field contains a skeletonized image, also known as a ridge tracing, which reduces the friction ridge impression to an image with thinned representations of each ridge. Incipient ridges, dots, ridge discontinuities, and protrusions are not included in the skeleton. The skeletonized image is a 2-tone image with a white background and a black single-pixel-wide thinned representation of each ridge. Each black pixel may have 1, 2, or 3 neighboring black pixels; other values (i.e., 0, 4-8) are errors. The same information may alternatively be represented using Field 9.373: RPS / EFS Ridge Path Segments. For more information about skeletonized images, See Appendix F 5.7 Ridge path: Skeletonized image and ridge path segments.

The skeletonized image is stored as a 1-bit grayscale PNG compressed image, bit-packed 6 bits per character using Base-64 representation (See Section 5.2.3). The entire PNG formatted image is included as a single data entry / information item. Interlacing, alpha transparency, and color palettes shall not be used. The skeletonized image's dimensions shall be identical width and height of the ROI (See Field 9.300 ROI / EFS Region of Interest). The resolution of the skeletonized image shall be the same as the original image and shall be set in the PNG header.

Condition:	Optional

Occurrence: 0-1

Value Constraints: Base64-encoded PNG image. (8+ Base64)

6.9.12.63. 9.373 RPS / EFS Ridge Path Segments

This field contains an alternate representation of the same skeletonized image data contained in Field 9.372: SIM / EFS Skeletonized Image. Each ridge path segment is saved as an open path (ordered set of vertices). See Section 6.9.12.3 EFS Paths. Multiple segments may be included in this field; each skeletonized ridge segment is stored as a separate subfield. Incipient ridges, dots, ridge discontinuities, and protrusions are not included in the ridge path representation. Each endpoint of a ridge segment is either shared by three ridge segments (at a bifurcation) or is unique to a single ridge segment (at a ridge ending). For more information about ridge path segments, See Appendix F.5.7 Ridge path: Skeletonized image and ridge path segments.

Each ridge path segment (if completely visible) is the portion of a ridge that connects two minutiae, so each ridge path segment starts and stops either where the ridge intersects another ridge path segment (a bifurcation) or ends (a ridge ending). In the infrequent case in which a ridge segment forms a complete loop back on itself without intersecting another ridge segment (such as near the core of some plain whorls or central pocket loops), the ridge path starts and stops at a single arbitrary point on the ridge. Ridge path segments may not be visible over their entire length due to image consistency-of-presentation problems or due to being truncated by the edge of the impression, and therefore one or both ends of a ridge segment may not end at points defined as minutiae.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; 1 Information Item as described below

Contains:

The sole information item in this field shall represent a ridge path segment, saved as an open path. Each skeletonized ridge segment shall be stored as a separate subfield. The representation of coordinates varies by encoding. The format of EFS paths is described in Section 6.9.12.3, traditional encoding in Appendix B, and XML/JSON encoding in Appendix C.

Condition: Mandatory

Occurrence: 1 per Subfield

Value Constraints: $0 \leq$ integer ≤ 50000 for all values of X; (1-5 N)

$0 \leq$ integer ≤ 50000 for all values of Y; (1-5 N)

Each pair of (x,y) values shall be formatted according to the applicable encoding rules.

6.9.12.64. 9.374 – 9.379 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.12.65. 9.380 TPL / EFS Temporary Lines

This field is used by a latent examiner to annotate a friction ridge image with temporary lines, generally for use as reference points in making a comparison. These lines are solely for the individual examiner's use and reference – there are no implied semantics through the use of this field. This field has subfields, each of which describes a line segment.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 999 Subfields; Information Items as described below

Contains:

1) *TXA* ***X Coordinate, Point A***

The first information item shall contain the x coordinates for Point A, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

2) *TYA* ***Y Coordinate, Point A***

The second information item shall contain the y coordinates for Point A, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI height. (1-5 N)

3) *TXB* ***X Coordinate, Point B***

The third information item shall contain the x coordinates for Point B, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ ROI width. (1-5 N)

4) *TYB* ***Y Coordinate, Point B***

The fourth information item shall contain the y coordinates for Point B, in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ ROI height. (1-5 N)

5) *TLC* *Line Color*

The fifth information item shall contain an RGB color value expressed as a hexadecimal number. Some basic colors are red (FF0000), yellow (FFFF00), blue (0000FF), green (008000), black (000000) and white (FFFFFF).

Condition: Mandatory

Occurrence: 1

Value Constraints: 000000 ≤ hexadecimal ≤ FFFFFF. (6 H)

6) *TLT* *Temporary Line Thickness*

The sixth information item shall be expressed as a positive integer. Thickness is expressed in units of ƛ (0.01 mm), or pixels if so indicated in Field 9.304. Suggested ƛ values are 3 (thin); 6 (medium); 9 (thick), and 15 (bold).

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.9.12.66. 9.381 FCC / EFS Feature Color and Comments

This field enables a latent print examiner to annotate individual features with color for display and / or comment. It consists of multiple subfields.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 999 Subfields; Information Items as described below

Contains:

1) *FTF* *Feature Field Number*

The first information item indicates the field which is annotated with color for display and/or comment. This information item is selected from the Field Number column of table below.

Condition: Mandatory

Occurrence: 1

Value Constraints: Field Number value from Table 39 EFS Codes for Field Numbers Used for Feature Color. (3 N)

Table 39 EFS codes for field numbers used for feature color

Field Number	Type
320	Cores
321	Deltas
323	Center Point of Reference
324	Distinctive Characteristics
331	Minutiae
340	Dots
341	Incipient Ridges
342	Creases and Linear Discontinuities
343	Ridge Edge Features
345	Pores
357	Local Quality Issues
373	Ridge Path Segment

2) *FTO* *Feature Field Occurrence*

The second information item shall indicate which repeating subfield of the specified field the label is applied to. Occurrences are numbered starting with 1.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 999. (1-3 N)

3) *FTC* *Feature Color*

The third information item, if present, shall contain an RGB color value expressed as a hexadecimal number. Some basic colors are red (FF0000), yellow (FFFF00), blue (0000FF), green (008000), black (000000) and white (FFFFFF).

Condition: Mandatory when **COM** is omitted; otherwise, Optional.

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 000000 ≤ hexadecimal ≤ FFFFFF. (6 H)

4) *COM* *Feature Comments*

The fourth information item, if present, allows a free text comment or description to be provided by the examiner about the referenced field and subfield in this instance of a Type-9 record.

Condition: Mandatory when **FTC** is omitted; otherwise, Optional.

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.9.12.67. 9.382 – 9.399 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.13. 9.400 – 9.900 Reserved for Future Use Only by ANSI/NIST-ITL

6.9.14. 9.901 ULA / Universal Latent Workstation Annotation Information

This field is used to store annotation, logging, or processing information associated with the FBI-developed Universal Latent Workstation (ULW) or compatible software. If present, this text field shall consist of one or more subfields, each describing a single processing step.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; 1 Information Item as described below

Contains:

The sole information item in this field shall describe a single processing step. Each entry shall begin with the date and time followed by a hyphen encoded as:

{M}M/{D}D/YYYY {h}h:mm:ss {AM|PM} - (e.g., '3/27/2010 7:21:47 PM -')

The remainder of the entry shall contain an unformatted text string describing a process or procedure applied to the fingerprint, palm print, or plantar print associated with this Type-9 record. Additional entries may be included as separate subfields, each describing a subsequent processing step.

Condition:	Mandatory
Occurrence:	1 per Subfield
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.9.15. 9.902 ANN / Annotation Information

This field is used to store annotation, logging, or processing information associated with one or more processing algorithms or latent workstations (other than the FBI developed ULW).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item shall specify when the processing occurred.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full time and date, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall contain the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no “algorithm owner” (e.g., for a physical process or procedure) enter ‘N/A’

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall describe a process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.9.16. 9.903 DUI / Device Unique Identifier

This field shall contain a string uniquely identifying the device or source of the data. This field shall be one of:

• Host MAC address, identified by the first character ‘M’, or

• Host processor ID, identified by the first character ‘P’.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with ‘M’ or ‘P’ and shall contain only printable ASCII 7-bit characters, i.e., values 32 – 126 inclusive. (13-16 ANS)

6.9.17. 9.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. This field is mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 when Condition above is met, 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of ‘0’ in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of ‘0’ in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV* ***Capture Device Firmware/Software Version***

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* ***Device Mobility***

This information item describes the general stability of the capture device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* ***COTS Designation***

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) ***DSR COTS Serial Number***

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition:	Mandatory if DCT = Y, otherwise Optional
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.9.18. 9.905 FCT / Friction Ridge Capture Technology

This field signifies the type of technology used to capture the friction ridge image. For specific examples of these technologies, refer to https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/ .

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	Code value from Table 40 Friction Ridge Capture Technology. (1-2 N)

Table 40 Friction ridge capture technology

Code	Technology	Description
0	Unknown	Capture technology not provided by sensor manufacturer.
1	Other	Capture technology not sufficiently characterized by table.
2	Scanned ink on paper	Ink applied to friction ridge skin, which is applied to paper, typically with assistance from a trained technician and then scanned with a flatbed scanner (not a camera).
3	Optical – Total Internal Reflection (TIR) – bright field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (dark ridges on a white background).
4	Optical – TIR – dark field	Using optical angle of incidence effects, a contact fingerprint scanner captures ridge information such that ridges absorb light, and absence of ridges reflects light back to the sensor (white ridges on a dark background).
5	Optical direct imaging - native	Light reflected from the friction ridge is imaged, resulting in a light gray on darker gray image. This may be performed contact or contactless and may incorporate merging images from multiple sensors or rocking or swaying sensors / subjects.
6	Optical direct imaging – low frequency unwrapped	Light reflected from the friction ridge is imaged onto one or more sensors. This may be performed contact or contactless and utilizes the **low frequency** 3D detail to "unwrap" or project the image

Code	Technology	Description
		texture onto a 2D grayscale image.
7	3-dimensional imaging – high frequency unwrapped	High frequency friction ridge information is collected (optically, acoustically, etc.) and then "unwrapped" to create a 2D image from the 3D point cloud or mesh.
9	Capacitive	A contact technology in which the capacitance of the fingerprint is assessed via a conducted AC signal.
10	Capacitive – radio frequency (RF)	A contact technology in which the capacitance of the fingerprint is assessed via a radiated RF signal.
11	Electro-luminescent (EL) optical direct imaging	A contact technology in which the ridges and an alternating current (AC) signal cause an EL panel to emit light which is captured by an imaging system.
12	Reflected ultrasonic image	A contact technology in which the friction ridge reflects ultrasonic energy which is assessed by the sensor.
13	Ultrasonic impediography	A contact technology in which the absorption of ultrasonic energy is measured by changes in the impedance of a piezo-electric material.
14	Thermal imaging	A contact technology in which the sensor measures the heat reflected from the fingerprint in contact with the sensor.
15	Direct pressure sensitive	A contact technology in which the pressure of the fingerprint ridges against a material is measured.
16	Indirect pressure	A contact technology in which the pressure of the fingerprint ridges against a deformable material is assessed optically to produce a friction ridge image.
17	Live tape (one time use)	A technology in which tape is used on a real finger to collect friction ridge detail, and the tape is then subsequently imaged by traditional photography.
18	Latent impression	A capture process in which the digital image of the latent impression is acquired directly from the latent impression, using a scanner or digital camera.
19	Latent photo	Physical photograph of the latent impression subsequently scanned using a flatbed scanner or digital camera.
20	Latent molded / cast impression	A capture process in which a mold / cast is taken from a latent friction ridge and then subsequently a "duplicate" is generated from moldable / printable material and imaged.
21	Latent tracing	An older legacy latent friction ridge capture process in which a hand-drawn or computer-drawn tracing would subsequently be imaged by a flatbed scanner or photographed.
22	Latent lift	A process in which powder or a chemical is applied to a latent friction ridge print, subsequently transparent tape is applied to lift the print from the latent surface, and the tape is then placed on paper to be imaged.

6.9.19. 9.906 – 9.999 Reserved for Future Use Only by ANSI/NIST-ITL

6.10. Record Type-10: Face, SMT and Body Part Photographic Image Record

Type-10 records shall contain face, SMT, and / or other body part image data and related information pertaining to the specific image contained in this record. It shall be used to exchange both grayscale and color image data in a compressed or uncompressed form.

Type-10 records are restricted to 2D images created using visible light. Other types of imagery are stored in a Type-22 record See Record Type-22: Non- photographic imagery data record.

Source images used to derive photographs in a Type-10 record are contained in a Type-20: Source Representation Record. An example would be a surveillance video of a person of interest, transmitted in a Type-20 record. A still 2D image of the person of interest could be captured from the video and transmitted in a Type-10 record.

Photographs that are synthetic in nature, such as morphed images, shall not be transmitted in Type-10 records, but instead shall be placed in Type-21: Associated Context Record. This requirement separates true biometric imagery from non-biometric imagery.

6.10.1. 10.001 LEN / Record Length

The length of the entire Type-10 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer. (2+ N)

6.10.2. 10.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction. Two or more records may share a single IDC solely to identify and link together records that pertain to different representations of the same biometric trait. See Section 5.11.1 for additional about this use of IDC.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.10.3. 10.003 IMT / Image Type

This field shall be used to indicate the type of image contained in this record. See also Field 10.042 SMD / SMT Descriptors, and Field 10.040 SMT / NCIC Code which further describe the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code from Table 41 Image Type Codes (3-11 AS)

Table 41 Image type codes

Image Code	Description
SCAR	Indicates a visible difference from standard tissue appearance on a body surface that is non-intentional or (quasi)medically induced
TATTOO	Intentional placing of patterns on the skin
MARK	Visible needle marks on the skin
FACE	A facial photograph. This may be used for facial recognition algorithms. Designation of FACE excludes the image from possibly being entered into

	systems for tattoo recognition. If a face has a tattoo on it, enter one image as a mugshot, indicated by FACE, and another marked TATTOO
FRONTAL-C	Frontal Body Image, Clothed
REAR-C	Rear Body Image, Clothed
HEAD	Head Image
FRONTAL-N	Frontal Body Image, Nude
REAR-N	Rear Body Image, Nude
TORSO-BACK	Torso Image, Back
TORSO-FRONT	Torso Image, Front
CONDITION	Image of physical abnormality; must also use the appropriate NCIC code in Field 10.040: SMT / NCIC code
MISSING	Shows the location on the body where the part would normally be
OTHER	Image of a different NCIC SMT category; must also use the appropriate NCIC SMT code in Field 10.040: SMT / NCIC code
CHEST	Chest Image
FEET	Foot or Feet Image
EXTRAORAL	Exterior Mouth Area Image. Not intended for use on living individuals. **FACE** should be used for living individuals.
INTRAORAL	Interior Mouth Area Image. Need not be captured with the imager inserted into the oral cavity.
LIP	Lip Image
HANDS-PALM	Hand Image, Palm Side
HANDS-BACK	Hand Image, Back
GENITALS	Genital Image
BUTTOCKS	Buttocks Image
RIGHT LEG	Right Leg Image
LEFT LEG	Left Leg Image
RIGHT ARM	Right Arm Image
LEFT ARM	Left Arm Image

6.10.4. 10.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 10.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.10.5. 10.005 PHD / Photo Capture Date

This field shall contain the date that the image contained in the record was captured by the Source Agency (SRC). It may not be possible to know the exact date of imagery capture. In such cases, specify the date to the level known.

Condition: Mandatory

Occurrence: 1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

6.10.6. 10.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.10.7. 10.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.10.8. 10.008 SLC / Scale Units

The image sampling frequency (pixel density). For non-contact images of faces and other body parts, SLC shall be set to 0 unless the object being imaged is a fixed distance from the capture device and the ppi or ppmm values for the capture device are accurately known at that fixed distance.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

6.10.9. 10.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image if Field 10.008: SLC / Scale Units has a value of ‘1’ or ‘2’. If SLC has a value of ‘0’, this field shall contain the horizontal component of the pixel aspect ratio, up to 5 integer digits.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6.10.10. 10.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image if Field 10.008: SLC / Scale Units has a value of '1' or '2', in which case TVPS shall equal THPS. If SLC has a value of '0', this field shall contain the vertical component of the pixel aspect ratio, up to 5 integer digits.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6.10.11. 10.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted images. Appendix E.6.1 Compression algorithm lists additional conditions for facial images by SAP level.

Condition: Mandatory

Occurrence: 1

Value Constraints: A code value from the table below. (3-5 AN)

Table 42 Type-10 compression algorithms

Code	Description
NONE	Uncompressed (Lossless)
JPEGB	JPEG (Lossy)
JPEGL	JPEG (Lossless)
JPEG2	JPEG 2000 (Lossy)
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)
MEDIA	A compression type referenced from the IANA registry (https://www.iana.org/assignments/media-types/media-types.xhtml), only as permitted by the receiving agency (see Section 5.6)

6.10.12. 10.012 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. The Color Spaces table lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Value from the Code column of Table 4 Color Spaces. (3-4 A)

6.10.13. 10.013 SAP / Subject Acquisition Profile

The Subject Acquisition Profile is a set of characteristics grouped by "level" which expresses what combination of features is defined in a particular device. See Section 5.14.1 for detailed information about Acquisition Profiles for face images.

Condition:	Mandatory when **10.003 IMT** = FACE, otherwise omitted
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Value from the Code column of Table 6 Subject acquisition profiles for face. (1-2 N).

6.10.14. 10.014 FIP / Face Image Bounding Coordinates in Full Image

This field is only appropriate for face images (**IMT** = 'FACE') where **SAP** Level < 30 because higher SAP images are cropped to a "head only" or "head and shoulders" composition. This field is an alternative approach to the bounding box in Field 10.015: FPFI / Face Image Path Coordinates in Full Image. If the image contains more than one face, the bounding box indicates the face of interest; otherwise, this box can be used for cropping the single facial image. All associated Type-10 fields are limited to the face defined by the bounding box in the larger image.

Condition:	Optional when SAP < 30, otherwise omitted.
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *LHC* ***Left Horizontal Coordinate Value***

The first information item is the left horizontal offset of the bounding box relative to the origin positioned in the upper left corner of the image. It is expressed in pixel counts across.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer < Value of Field 10.006 **HLL**. (1-5 N)

2) *RHC* ***Right Horizontal Coordinate Value***

The second information item shall contain the right horizontal offset of the bounding box relative to the origin positioned in the upper left corner of the image. It is expressed in pixel counts across.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer < Value of Field 10.006 **HLL**. (1-5 N)

3) *TVC* ***Top Vertical Coordinate Value***

The third information item is the top vertical offset of the bounding box relative to the origin positioned in the upper left corner of the image. It is expressed in pixel counts down.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer < Value of Field 10.007 **VLL**. (1-5 N)

4) *BVC* ***Bottom Vertical Coordinate Value***

The fourth information item contains the bottom vertical offset of the bounding box relative to the origin positioned in the upper left corner of the image. It is expressed in pixel counts down.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer < Value of Field 10.007 **VLL**. (1-5 N)

5) *BBC* ***Bounding Box Head Position Code***

The fifth information item contains the bounding box type, indicating the contents of the bounding box. If this field is omitted, the default value shall be H (Head only).

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (1A)

Code	Description
S	Head and shoulders: the image within the bounding box is conformant with a "head and shoulders" composition (full frontal)
H	Head only: the image within the bounding box is conformant with a "head only" composition
F	Face only: the image within the bounding box contains a subject's two eyes, nose and mouth
N	Non-frontal head: the image within the bounding box contains the subject's entire head, but it is not frontal-facing or is otherwise not conformant with a "head only" composition
X	Partial face: the composition consists of a partial face, containing less than two eyes, nose and mouth

6.10.15. 10.015 FPFI / Face Image Path Coordinates in Full Image

If a face image (**IMT** = 'FACE') contains more than one face, or is not cropped to a "head only" or "head and shoulders" composition (i.e., **SAP** < 30), this optional field may contain offsets to the location of the path defining a region containing the face of the subject within a larger image. This field is an alternative approach to the bounding box described in Field 10.014: FIP / Face Image Bounding Box Coordinates in Full Image.

This field uses a 2-99 vertex path to encompass the subject face. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the boundary, either clockwise or counterclockwise. No two vertices may occupy the same location. A polygon side defined by the last vertex and the first vertex shall complete the polygon. The path shall be a simple plane figure with no sides crossing and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *BYC* *Boundary Code*

The first information item describes shape of the bounding path.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**E**' (ellipse), '**C**' (circle), or '**P**' (polygon). (1A)

2) *NOP* *Number of Points*

The second information item shall contain the number of vertices defining the path.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	2 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order describe the path bounding this segment. The number of occurrences of this pair of information items shall be equal to the value of **NOP**:

3) *HPO* *Horizontal Point Offset*

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per vertex
Value Constraints:	0 ≤ integer < Value of Field 10.006 **HLL.** (1-5 N)

4) *VPO* *Vertical Point Offset*

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per vertex
Value Constraints:	0 ≤ integer < Value of Field 10.007 **VLL**. (1-5 N)

6.10.16. 10.016 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression providing that Field 10.008 SLC contains a ‘1’ or ‘2’. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in THPS / Transmitted Horizontal Pixel Scale. Note that density is directly related to resolution.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.10.17. 10.017 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression providing that Field 10.008 SLC contains a '1' or '2'. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in TVPS / Transmitted Vertical Pixel Scale. Note that density is directly related to resolution. If SLC is 1 or 2 and SHPS is entered, then SVPS shall equal SHPS.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.10.18. 10.018 DIST / Distortion

This optional field contains the type of distortion, whether it is estimated or calculated, and its relative severity. This field consists of three information items, all of which are subjective in nature.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *IDK* ***Distortion Code***

The first information item describes the distortion. 'Barrel' refers to an image that appears to be spherized, 'Inflated' refers to a wide angle or "fisheye" distortion, and 'Pincushion' refers to an image "pinched" at the center or "bowed inwards."

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**Barrel**', '**Inflated**', or '**Pincushion**'. (6-10 A)

2) *IDM* ***Distortion Measurement Code***

The second information item describes how the distortion was measured.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are **E** (estimated) or **C** (calculated). (1 A)

3) *DSC* *Distortion Severity Code*

The third information item describes the severity of the distortion in the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**Mild**', '**Moderate**', or '**Severe**'. (4-8 A)

6.10.19. 10.019 LAF / Lighting Artifacts

This field contains the type of lighting artifacts found in a face image (**IMT** = 'FACE').

Condition: Optional when **IMT** = FACE, otherwise omitted

Occurrence: 0-1

Value Constraints: 1 to 3 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field describes one type of lighting artifact found in a face image. Multiple lighting artifacts may be repeated as separate subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (1 A)

Code	Description
F	Face shadows
H	Hot spots
R	Reflections from eyeglasses

6.10.20. 10.020 POS / Subject Pose

This field is only used for the exchange of facial image data (**IMT** = 'FACE'). When included, this field shall describe the pose of the subject.

A value of POS = D does not imply that the image itself is a 3D image, such as a point cloud. 3D imagery shall be transmitted in a Type-22 record. For the determined 3D pose entry '**D**', Field 10.025 SPA / Subject Pose Angles shall contain a set of determined 3D pose angles (i.e., Yaw, Pitch, and Roll angles) away from the full-frontal face orientation.

Note that the pose offset angle in Field 10.021 POA / Pose Offset Angle is opposite from the yaw angle in Field 10.025 as indicated by a minus sign. See Appendix E.6.2 Subject Pose (POS) and Subject Pose Angles (SPA) for more information about pose angles.

Condition: Optional when **IMT** = FACE, otherwise omitted

Occurrence: 0 - 1

Value Constraints: Code value from table below. (1 A)

Code	Description
F	Full Face Frontal
R	Right Profile (90 degree)
L	Left Profile (-90 degree)
A	Angled Pose
D	Determined 3D Pose

6.10.21. 10.021 POA / Pose Offset Angle

This field shall only be used for the exchange of facial image data (**IMT** = 'FACE') if Field 10.020 **POS** contains an '**A**' to indicate an angled pose of the subject. The field shall not be used for other values of **POS**.

This field specifies the pose direction of the subject at any possible orientation within a circle. Its value shall be to the nearest degree. The offset angle shall be measured from the full-face pose position and have a range of values from -180 degrees to +180 degrees. A positive angle is used to express the angular offset as the subject rotates from a full-face pose to their left (approaching a right profile). The allowed special character for traditional encoding is the negative sign.

Condition: Optional when **IMT** = FACE and **POS** = A, otherwise omitted

Occurrence: 0 - 1

Value Constraints: -180 ≤ integer ≤180. (1-4 NS)

6.10.22. 10.022 PXS / *Legacy Field*

See ANSI/NIST-ITL 1-2007 for a description of this field. Only to be used for interchange of legacy data; new implementations shall use Field 10.026 SXS / Subject Facial Description**.**

6.10.23. 10.023 PAS / Photo Acquisition Source

This field shall specify the classification of the source of the image contained in this record. This field is mandatory if the SAP entry (Field 10.013 SAP / Subject Acquisition Profile) is '40' or greater for face image records. (IMT=FACE only).

A Record Type-20 may be used to store the original reference data. For this case, Field 10.997 SOR / Source Representation shall be contained in this record, and the corresponding Record Type-20 shall be included in the transaction.

Note that all of the acquisition sources in the acquisition source type table, below, result in a 2D image in visible light. To transmit other types of imagery, use the Record Type-22: Non-photographic imagery data record.

Condition: Mandatory when **IMT** = FACE and **SAP** ≥ 40, otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *PAC* ***Photo Attribute Code***

The first information item describes the acquisition source of the captured image data. Acquisition source type codes result in a 2D image in visible light. To transmit other types of imagery, use the Record Type-22: Non-photographic imagery data record. Note that the first seven attribute codes in the table below directly correspond to attribute codes '0' through '6' in Table 91 Type 20 Acquisition Source Types table, which is used in Field 20.014 AQS / Acquisition Source. 'OTHER' corresponds to attribute code '31' in that table, as well as attribute code '11' (computer screen image capture). 'VENDOR' corresponds to code '30'. The remaining attribute codes in the table relate to audio and video capture.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed code value from table below. (5-14 ANS)

Code	Acquisition Source Type
UNSPECIFIED	Unspecified or unknown
UNKNOWN PHOTO	Static photograph from an unknown source
DIGITAL CAMERA	Static photograph from a digital still-image camera
SCANNER	Static photograph from a scanner
UNKNOWN VIDEO	Single video frame from an unknown source
ANALOG VIDEO	Single video frame from an analog video camera
DIGITAL VIDEO	Single video frame from a digital video camera
VENDOR	Vendor specific source
TYPE20	Record Type-20 original source representation
OTHER	Another source image

2) *VSD* ***Vendor-Specific Description***

The second information item may be entered to describe a vendor-specific source of the captured image or to enter unlisted or miscellaneous source attributes for the facial image.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1- 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

6.10.24. 10.024 SQS / Subject Quality Score

This field shall specify one or more different metrics of quality score data for facial images (IMT = FACE) stored in this record. If this field is present, a subfield shall exist for each different quality score and algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 100, or '254', or '255'. (1-3 N)

2) *QAV* ***Algorithm Vendor ID***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF. (4 H)

3) QAP **Algorithm Product Identification**

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535 (1-5 N)

4) *QPV* ***Algorithm Product Version***

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.10.25. 10.025 SPA / Subject Pose Angles

This field shall be present if and only if Field 10.020 POS / Subject Pose contains a '**D**' to indicate a set of determined 3D pose angles of the same subject for a facial image (**IMT** = 'FACE'). Each angle value shall be to the nearest integer degree. See Appendix E.6.2 Subject Pose (POS) and Subject Pose Angles (SPA) for more information about pose angles.

Condition:	Mandatory when **POS** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *YAW* *Yaw Angle*

The first information item describes the rotation about the vertical y axis.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	-180 ≤ integer ≤ 180. (1-4 NS)

2) *PIT* ***Pitch Angle***

The second information item shall describe the rotation about the horizontal x axis.

Condition: Mandatory

Occurrence: 1

Value Constraints: -90 ≤ integer ≤ 90. (1-3 NS)

3) *ROL* ***Roll Angle***

The third information item describes the rotation about the z axis

Condition: Mandatory

Occurrence: 1

Value Constraints: -180 ≤ integer ≤ 180. (1-4 NS)

4) *YAWU* ***Uncertainty in Degrees for Yaw***

The fourth information item is the uncertainty in degrees for the given yaw angle.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 90. (1-2 N)

5) *PITU* ***Uncertainty in Degrees for Pitch***

The fifth information item is the uncertainty in degrees for the given pitch angle.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 90. (1-2 N)

6) *ROLU* ***Uncertainty in Degrees for Roll***

The sixth information item is the uncertainty in degrees for the given roll angle.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 90. (1-2 N)

6.10.26. 10.026 SXS / Subject Facial Description

This field is mandatory for a facial image (**IMT** = FACE) if the **SAP** level is 30 or greater. It is optional for facial images with lower values of **SAP**. When present, it shall describe attributes

associated with the subject's captured facial image. For a "Physical Characteristic", enter a characteristic as listed in the NCIC code. See Appendix D: NCIC Code Table.

Condition: Mandatory when SAP ≥ 30; otherwise, Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides the code value describing a single attribute associated with the subject's captured facial image. For a "Physical Characteristic", enter a characteristic as listed in the NCIC code. See Appendix D: NCIC Code Table. Additional attributes shall be placed in separate subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (3-20 AS)

Code	Description
UNKNOWN	Expression unspecified
NEUTRAL	Neutral (non-smiling) with both eyes open and mouth closed
SMILE	Smiling (inside of the mouth and/or teeth is not exposed - closed jaw).
MOUTH OPEN	Subject having mouth open
BEARD	Having beard
NO EAR	Ear(s) obscured by hair
BLINK	Blinking (either or both eyes closed)
DISTORTING CONDITION	Having distorting medical condition, impacting feature point detection
From Appendix D: NCIC code table	Physical characteristics
Alphabetic Text, up to 20 characters	Other characteristics

6.10.27. 10.027 SEC / Subject Eye Color

This field is mandatory if the **SAP** level is '30' or greater. For other facial images (**IMT** = FACE), the field is optional. It describes the eye color of the subject as seen in the image. If unknown, unusual, or unnatural, such as may be the case when colored contact lenses are present and the "real" eye color cannot be ascertained, then the color should be labeled as 'XXX'. Eye color attributes and codes are given below.

Condition: Mandatory when SAP ≥ 30; otherwise, Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: Code value from Table 43 Eye Color Codes. (3 A)

Table 43 Eye color codes

Code	Eye Color
BLK	Black
BLU	Blue

BRO	Brown
GRY	Gray
GRN	Green
HAZ	Hazel
MAR	Maroon
MUL	Multicolored
PNK	Pink
XXX	Unknown

6.10.28. 10.028 SHC / Subject Hair Color

This field is mandatory if the **SAP** level is '30' or greater. For other facial images (**IMT** = 'FACE'), the field is optional. When present, it shall contain one or two entries from the code table below that describes the hair color of the subject as seen in the image. For unusual or unnatural colors not listed in the table, or the "real" color cannot be ascertained, the hair color should be labeled as 'XXX'. If the subject is completely bald, or has a completely shaved head, then the hair color shall be labeled as 'BAL'. When the subject is predominantly bald, but hair color is discernible, then the appropriate hair color attribute code shall follow 'BAL' in a second entry. If a person has multiple hair colors (such as blue in the middle and orange on the sides), select one color for the first entry and the other for the second. For streaked hair, use 'STR' in the first subfield; use the second subfield to describe the principal color of the hair. There need not be more than one subfield.

Condition: Mandatory when SAP ≥ 30; otherwise, Optional

Occurrence: 1 when Condition above is met, 0-1 otherwise

Value Constraints: 1 to 2 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides a code value describing the hair color associated with the subject's captured facial image. If present, an additional hair color shall be described in a second subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (3 A)

Code	Description
XXX	Unspecified or unknown
BAL	Bald
BLK	Black
BLN	Blonde or Strawberry
BRO	Brown
GRY	Gray or Partially Gray
RED	Red or Auburn
SDY	Sandy
WHI	White
BLU	Blue
GRN	Green

ONG	Orange
PNK	Pink
PLE	Purple
STR	Streaked

6.10.29. 10.029 FFP / 2D Facial Feature Points

The optional field shall be used for the exchange of facial feature points or landmarks. When present, it shall describe special attributes of manually or automatically detected facial feature points of the captured facial image. This information shall be entered as a four-information item feature point block in a repeating subfield. Multiple facial points may be listed using these information items, each in a separate subfield.

Condition:	Optional when **IMT** = 'FACE', 'HEAD', 'LIP', 'EXTRAORAL' or 'CONDITION'; otherwise omitted.
Occurrence:	0-1
Value Constraints:	1 to 88 Subfields; Information Items as described below

Contains:

1) FPT Feature Point Type

The first information item describes the type of attributes used in the subfield, either MPEG4 Feature points or anthropometric landmarks.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '1' (MPEG4 Feature point) or '2' (anthropometric landmark)

2) FPC Feature Point Code

The second information item provides the appropriate landmark code for the feature. If **FPT** = 1, this information item shall be represented as "A.B" with A and B defined in Section 6.10.29.1, MPEG4 feature points and illustrated in Figure 10.

If **FPT** = 2, the codes are entered as shown in the "Feature Point ID" column of Table 45 ISO definitions of the anthropometric landmarks.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Appropriate code as described above. (1-5 ANS)

3) HCX X Coordinate

The third information item denotes the pixel count horizontally to the right from the upper left pixel, which is set to 0.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer < Value of Field 10.006 **HLL.** (1-5 N).

4) HCY Y Coordinate

The fourth information item denotes the pixel count vertically down from the upper left pixel, which is set to 0.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer < Value of Field 10.007 **VLL**. (1-5 N)

6.10.29.1. MPEG4 feature points

The feature point code (**FPC)** item shall specify the feature point that is stored in the feature point block. FPT = 1 in either Field 10.029: FFP / 2D Facial Feature Points or Field 10.032: 3DF / 3D Facial Feature Points denotes the codes for the feature points are taken from the MPEG4 standard and defined as MPEG4 feature points. Each feature point code is represented by a notation “A.B” using a major (‘A’) and a minor (‘B’) value. The encoding of the feature point code is given by the numeric ASCII representation of the values of “A” and “B”. The period is required, and the maximum size of this entry shall be 5 characters.

For the entire face, Figure 10 Feature point codes defined in ISO/IEC 14496-2 denotes the feature point codes associated with feature points as given by Annex C of ISO/IEC 14496-2. For the eyes and nose, additional detail is shown in Figure 11 Eye and nostril center feature points. Each code is given by major value A and minor value B. For example, the code for the left corner of the left eye is given by major value 3 and minor value 7. “A” specifies the global landmark of the face to which this feature point belongs, such as nose, mouth, etc. “B” specifies the particular point. In case a Landmark Point has two symmetrical entities (left and right) the right entity always has a greater and an even minor code value. Landmark points from the left part of the face have odd minor codes, and those from the right part have even minor codes. Both A and B are codes and can range from 1 to 15.

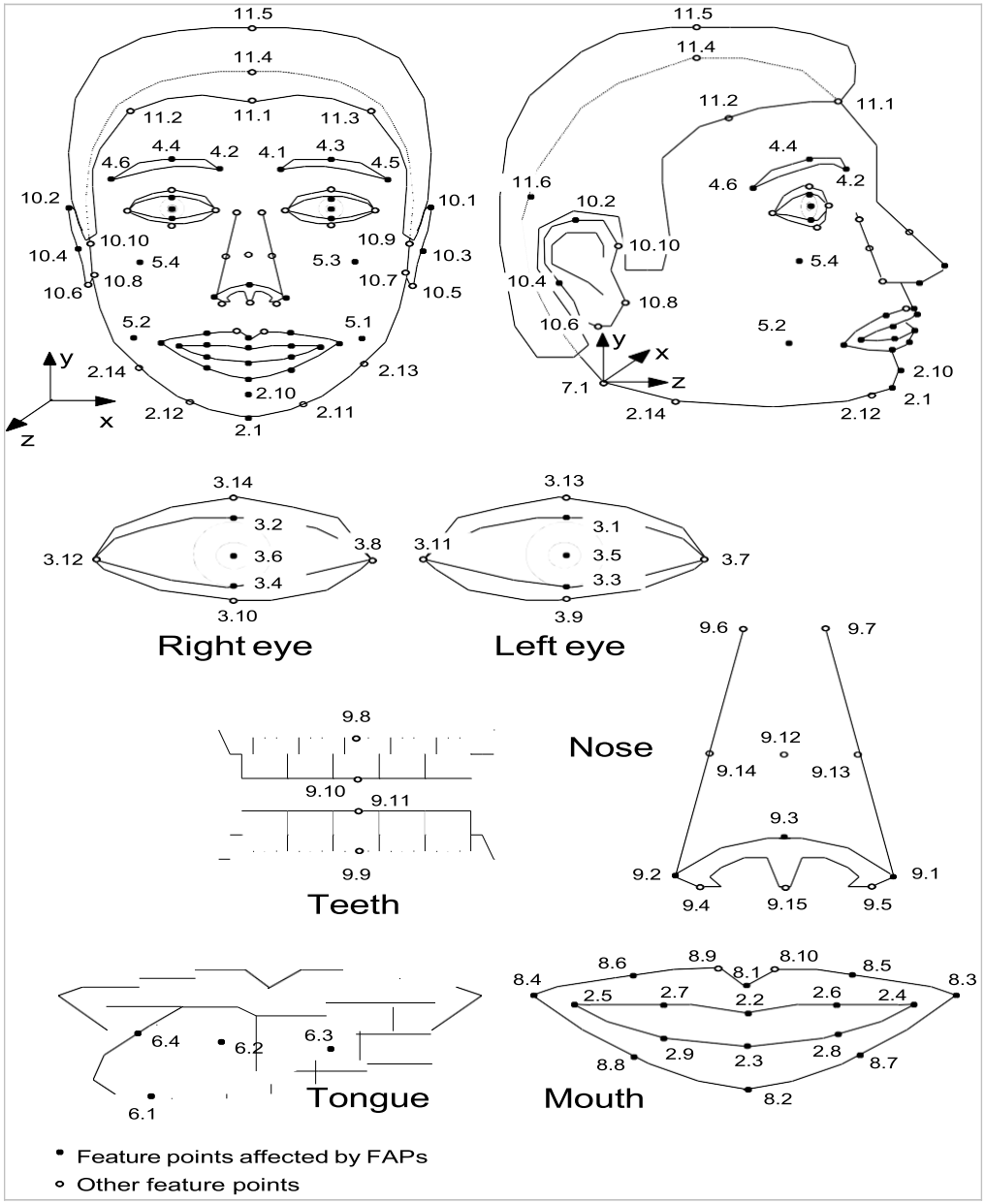


Figure 10 Feature point codes defined in ISO/IEC 14496-2

6.10.29.2. Eye and nostril center feature points

The eye center feature points 12.1 (left) and 12.2 (right) are defined to be the horizontal and vertical midpoints of the eye corners (3.7, 3.11) and (3.8, 3.12) respectively. The left nostril center feature point 12.3 is defined to be the midpoint of the nose feature points (9.1, 9.15) in the horizontal direction and (9.3, 9.15) in the vertical direction. Similarly, the right nostril center feature point 12.4 is defined to be the midpoint of the nose feature points (9.2, 9.15) in the horizontal direction and (9.3, 9.15) in the vertical direction. Both the eye center and nostril center Feature points are shown in Figure 11 Eye and nostril center feature points and values are given in Table 44 Eye and nostril center feature point codes.

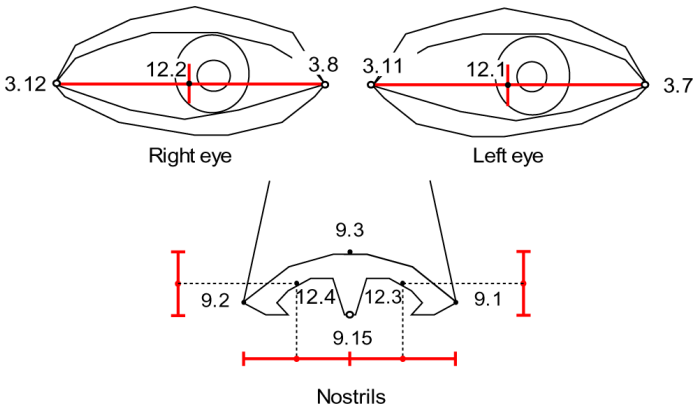


Figure 11 Eye and nostril center feature points

Table 44 Eye and nostril center feature point codes

Feature Point Code	Center Feature Point	Midpoint of Feature Points
12.1	Left Eye	3.7, 3.11
12.2	Right Eye	3.8, 3.12
12.3	Left Nostril	Horizontal:9.1, 9.15 Vertical: 9.3, 9.15
12.4	Right Nostril	Horizontal:9.2, 9.15 Vertical: 9.3, 9.15

6.10.29.3. Anthropometric landmarks with and without MPEG4 counterparts

This Section references the definitions specified by ISO/IEC 19794-5 *Information technology – Biometric data interchange formats – Part 5: Face image data*, Section 5.5.6 Anthropometric Landmarks.

Anthropometric landmarks extend the MPEG4 feature model with points that are used in forensics and anthropology for person identification via two facial images or image and skull. They also allow specification of points that are in use by criminal experts and anthropologists.

Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5 and Table 45 ISO definitions of the anthropometric landmarks show the definition of the anthropometric landmarks. Some of these points have MPEG 4 counterparts, others not - red landmarks denote those with MPEG4 counterparts and blue those without MPEG4 counterparts. The set of points represents the craniofacial landmark points of the head and face. The latter are used in forensics for “Face to face” and “Skull to face” identification. The error of an anthropometric 3D landmark point location should be no greater than 3 mm. The point on the surface is a vertex, or a point on an edge, or a point on a face of the surface.

The locations of points ZY and FT have been corrected in the profile view in Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5.

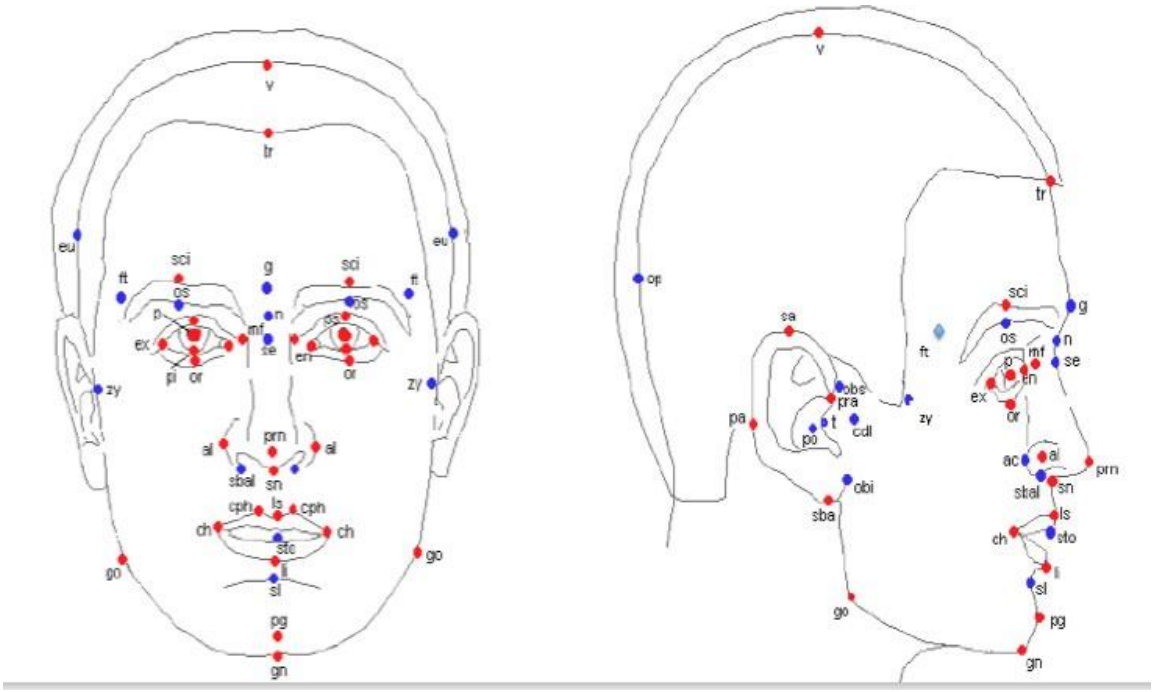


Figure 12 Anthropometric facial landmarks defined in ISO/IEC 19794-5

Table 45 ISO definitions of the anthropometric landmarks

Feature Point ID	MPEG4 Feature Point	Anthropometric Point Name	Description
v	11.4	vertex	The highest point of head when the head is oriented in Frankfurt Horizon.
g		glabella	The most prominent middle point between the eyebrows
op		opisthocranion	Situated in the occipital region of the head is most distant from the glabella
eu		eurion	The most prominent lateral point on each side of the skull in the area of the parietal and temporal bones
ft		frontotemporale	The point on each side of the forehead, laterally from the elevation of the linea temporalis
tr	11.1	trichion	The point on the hairline in the midline of the forehead
zy		zygion	The most lateral point of each of the zygomatic bones
go	2.13 2.14	gonion	The most lateral point on the mandibular angle close to the bony gonion
sl		sublabiale	Determines the lower border of the lower lip or the upper border of the chin
pg	2.10	pogonion	The most anterior midpoint of the chin, located on the skin surface in the front of the identical bony landmark of the mandible
gn	2.1	menton (or gnathion)	The lowest median landmark on the lower border of the mandible
cdl		condylion laterale	The most lateral point on the surface of the condyle of the mandible
en	3.11 3.8	endocanthion	The point at the inner commissure of the eye fissure
ex	3.7 3.12	exocanthion (or ectocanthion)	The point at the outer commissure of the eye fissure
p	3.5 3.6	center point of pupil	Is determined when the head is in the rest position and the eye is looking straight forward
or	3.9 3.10	orbitale	The lowest point on the lower margin of each orbit
ps	3.1 3.2	palpebrale superius	The highest point in the mid-portion of the free margin of each upper eyelid
pi	3.3 3.4	palpebrale inferius	The lowest point in the mid-portion of the free margin of each lower eyelid
os		orbitale superius	The highest point on the lower border of the eyebrow
sci	4.3 4.4	superciliare	The highest point on the upper border in the mid-portion of each eyebrow
n		nasion	The point in the middle of both the nasal root and nasofrontal suture
se		sellion (or subnasion)	Is the deepest landmark located on the bottom of the nasofrontal angle (equivalent to the term “bridge of the nose”)
al	9.1 9.2	alare	The most lateral point on each alar contour
prn	9.3	pronasale	The most protruded point of the apex nasi
sn	9.15	subnasale	The midpoint of the angle at the columella base where the lower border of the nasal septum and the surface of the upper lip meet
sbal		subalare	The point at the lower limit of each alar base, where the alar base disappears into the skin of the upper lip
ac	9.1 9.2	alar curvature (or alar crest) point	The most lateral point in the curved base line of each ala

mf	9.6 9.7	maxillofrontale	The base of the nasal root medially from each endocanthi
cph	8.9 8.10	christa philtri landmark	The point on each elevated margin of the philtrum just above the vermilion line
ls	8.1	labiale (or labrale) superius	The midpoint of the upper vermilion line
li	8.2	labiale (or labrale) inferius	The midpoint of the lower vermilion line
ch	8.3 8.4	cheilion	The point located at each labial commissure
sto		stomion	The imaginary point at the crossing of the vertical facial midline and the horizontal labial fissure between gently closed lips, with teeth shut in the natural position
sa	10.1 10.2	superaurale	The highest point of the free margin of the auricle
sba	10.5 10.6	subaurale	The lowest point of the free margin of the ear lobe
pra	10.9 10.10	preaurale	The most anterior point on the ear, located just in front of the helix attachment to the head
pa		postaurale	The most posterior point on the free margin of the ear
obs	10.3 10.4	otobasion superius	The point of attachment of the helix in the temporal region
obi		obotasion inferius	The point of attachment of the helix in the temporal region
po		porion (soft)	The highest point of the upper margin of the cutaneous auditory meatus
t		tragion	The notch on the upper margin of the tragus

6.10.30. 10.030 DMM / Device Monitoring Mode

This field describes the level of human monitoring that was associated with the biometric sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6.10.31. 10.031 TMC / Tiered Markup Collection

This field shall occur only when IMT = FACE. It specifies feature points that shall be contained in Field 10.029 FFP / 2D Facial Feature Points. If the value of **TMC** = 5, the contours shall be contained in Field 10.033 FEC / Feature Contours.

Condition: Optional when **IMT** = FACE; otherwise omitted.

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 N)

Code	Facial feature points/ Contours	Description
1	Eye centers	2D Feature Points: Centers of eyes: 12.1 and 12.2
2	Eyes, mouth	2D Feature Points: Centers of eyes: 12.1 and 12.2 Center of mouth: sto
3	Eyes, nose, mouth	2D Feature Points for: Corners of eyes: 3.7, 3.11, 3.8, 3.12 Bridge and tip of nose: Se, 9.3 Corners of mouth: 8.3, 8.4
4	Eyes, nose, mouth, and head	2D Feature Points for: Corners of eyes: 3.7, 3.11, 3.8, 3.12 Pupils: 3.5, 3.6 Edges of nostrils: 9.4, 9.5 Corners of mouth: 8.3, 8.4 Tops and bottoms of ears: 10.1, 10.5, 10.2, 10.6 Chin: 2.1 Top of head and/or hair: 11.4, 11.5
5	Facial feature points and contours for eyes, brows, nose, mouth and face outline	Top of upper lip contour Bottom of lower lip contour Left and right eyebrow contours Left and right eye contours Chin contour 2D Feature Points for: Left and right eyes: 3.7, 3.11, 12.1, 3.8, 3.12, 12.2 Nose: 9.1, 9.2, 9.3, 9.15 Mouth corners: 8.3, 8.4 Ear tops and bottoms: 10.1, 10.5, 10.2, 10.6
6-99	Reserved	Reserved for future use
100-999	User-defined	user-defined

6.10.32. 10.032 3DF / 3D Facial Feature Points

The field shall describe special attributes of manually or automatically detected facial feature points of a captured facial image. Each feature point shall be entered as a five-information item feature point block in a subfield. Multiple facial points may be listed using separate additional

subfields. This field contains a z coordinate, unlike Field 10.029 FFP, which is solely a 2D set of feature points.

The 3D facial feature points are noted on a 2D image, since Type-10 records only convey 2D visible light photographic images.

Condition:	Optional when **IMT** = 'FACE', 'HEAD', 'LIP', 'EXTRAORAL' or 'CONDITION', otherwise omitted.
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 88 Subfields; Information Items as described below

Contains:

1) FPT Feature Point Type

The first information item describes the type of attributes used in the subfield, either MPEG4 Feature points with z coordinate or anthropometric landmarks with z coordinate.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '1' (MPEG4 Feature point) or '2' (anthropometric landmark)

2) FPC Feature Point Code

The second information item provides the appropriate landmark code for the feature. If **FPT** = 1, this information item shall be represented as "A.B" with A and B defined in Section 6.10.29.1, MPEG4 feature points and illustrated in Figure 10.

If **FPT** = 2, the codes are entered as shown in the "Feature Point ID" column of Table 45 ISO definitions of the anthropometric landmarks.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Appropriate code as described above. (1-5 ANS)

3) HCX X Coordinate

The third information item denotes the pixel count horizontally to the right from the upper left pixel, which is set to 0.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer < Value of Field 10.006 **HLL.** (1-5 N).

4) HCY Y Coordinate

The fourth information item denotes the pixel count vertically down from the upper left pixel, which is set to 0.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer < Value of Field 10.007 **VLL**. (1-5 N)

5) *HCZ Z Coordinate*

The fifth information item denotes the pixel count from the X-Y plane, which is set to 0.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 99999. (1-5 N)

6.10.33. 10.033 FEC / Feature Contours

This field uses an open path to describe a feature contour. Each subfield refers to a specific contour on the image and contains a minimum of two points. An open path (contour, polyline) is a series of connected points in which there is not an implicit connection between the last and first vertices. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The vertices shall be in consecutive order across the contour from either direction. No two vertices may occupy the same location. The path shall have no sides crossing and no interior holes.

Condition:	Mandatory when **TMC** = 5, otherwise Optional
Occurrence:	1 when Condition above is met; 0-1 otherwise
Value Constraints:	1 to 12 Subfields; Information Items as described below

Contains:

1) *FCC Feature Contour Code*

The first information item describes feature location of the contour path.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from Table 46 Feature contour code descriptions. (4-14A)

Table 46 Feature contour code descriptions

Code	Contour Description
eyetop	Bottom of upper eye lid
eyebottom	Top of lower eye lid
upperliptop	Top of upper lip
upperlipbottom	Bottom of upper lip
lowerliptop	Top of lower lip
lowerlipbottom	Bottom of lower lip
rightnostril	Subject's right nostril
leftnostril	Subject's left nostril
lefteyebrow	Curvature of top of subject's left eye socket
righteyebrow	Curvature of top of subject's right eye socket
chin	Chin
faceoutline	Face outline includes the entire head, all facial hair, and ears

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the path.

Condition: Mandatory

Occurrence: 1

Value Constraints: 2 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order, describe the path bounding this segment. The number of occurrences of this pair of information items shall be equal to the value of **NOP**:

3) *HPO* ***Horizontal Point Offset***

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex

Value Constraints: 0 ≤ integer < Value of Field 10.006 **HLL.** (1-5 N)

4) *VPO* ***Vertical Point Offset***

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** to represent each vertex.

Condition: Mandatory

Occurrence: 1 per vertex

Value Constraints: 0 ≤ integer < Value of Field 10.007 **VLL**. (1-5 N)

6.10.34. 10.034 ICDR / Imagery Capture Date Range Estimate

This is the amount of time from Field 10.005 PHD / Photo Capture Date ± during which the image data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in PHD. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates a date value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. For example, 'P6M' is a range of **PHD ±** 6 months.

Condition:	Optional when **PHD** is an estimated or Partial local date; Omitted otherwise
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	Encoding-specific formatted Duration. (2-9 AN)

6.10.35. 10.035 FSB / Face/SMT/Body Image Quality Components

This field shall specify one or more different measurements that may contribute to the computation of a unified quality score for the image stored in the record. If used, a subfield shall exist for each quality algorithm combination.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *QNQ* ***Native Quality Measure***

The first information item shall contain the output of a quality component assessment algorithm.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

2) *QAV* ***Algorithm Vendor Identification***

The second information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor

Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)

3) *QAP* *Algorithm Product Identification*

The third information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535. (1-5 N)

4) *QPV* *Algorithm Product Version*

The fourth information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* *Algorithm Comments*

The fifth information item contains any comments related to the values in the subfield in which it occurs.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* *Algorithm Model Checksum*

The sixth information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition:	Optional
Occurrence:	0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.10.36. 10.036 TIF / T10 Image Format

This field shall contain information about the type of file and any additional decoding instructions the recipient of the transaction may need to correctly interpret the image.

Condition: Mandatory when **CGA**=MEDIA, Optional otherwise

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *FTY* ***File Type***

If possible, this field should contain a value from the Name column of the IANA Image registry indicating the MediaType, if one exists and the image is a digital file (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

If the value is not listed in the external table, enter the name, and also enter a description of the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats (such as digital tape), enter 'OTHER'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

2) *DEI* ***Decoding Instructions***

The second information item contains any additional decoding instructions beyond file type for recipients.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.10.37. 10.037 Reserved for Future Use Only by ANSI/NIST-ITL

6.10.38. 10.038 COM / Comments

The comment field may be used to insert free text information about the Type-10 record. It is not reserved exclusively for log-related information but has historically often been used for this purpose.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.10.39. 10.039 T10 / Type-10 Reference Number

This field shall only be present if multiple Type-10 records in the transaction contain images of the same SMT or body part. It can be used for any image type specified in Field 10.003 IMT. This field shall be present if VICD / Dental Visual Image Comparison Descriptive Text is present in Field 10.050 VID / Dental Visual Image Data Information.

An example would be to assign a value of '1' to two different Type-10 records, the first of which has an image of a tattoo over the entire chest of a male. A second image of a small portion of the tattoo on the chest showing a gang symbol is contained in another Type-10 with the same value of '1' for T10. Any given value for T10 shall only link such related images. See Section 5.11.3 Type-10 Reference for additional information.

Condition:	Mandatory when **10.050 VID/VICD** occurs, otherwise Optional.
Occurrence:	1 when Condition above is met; 0-1 otherwise
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

6.10.40. 10.040 SMT / NCIC Code

This field is used to identify a general location of the captured scar, mark, tattoo, or other characteristic (including piercings) in an image. The contents of this field shall be from the NCIC code list (See Appendix D: NCIC Code Table). The captured image may encompass an area larger than that specified by a single NCIC body part code for the specific image type. This situation may be accommodated by listing multiple NCIC codes, each in a separate subfield. In this case the primary code is listed first. There need not be more than one subfield.

For the "marks" category, the NCIC code manual lists the common locations for needle track marks. For other body part locations not listed under the "marks" category, use the body location codes listed for scars.

Condition:	Optional when **IMT** = 'SCAR', 'MARK', 'TATTOO', 'CONDITION', 'MISSING' or 'OTHER', otherwise omitted.

Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	1 to 3 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides the NCIC code value describing the body location captured in the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value taken from NCIC Code table. (3-10 AS)

6.10.41. 10.041 SMS / SMT Size of Size of Injury or Identifying Characteristic

This field shall contain the dimensions of the portion of image contained in this record (it may be the entire scar, mark, tattoo, injury or identifying characteristic). Each dimension shall be entered to the nearest centimeter.

Condition:	Optional when **IMT** = ‘SCAR’, ‘MARK’, ‘TATTOO’, ‘CONDITION’, ‘MISSING’, ‘FACE’ or ‘OTHER’, otherwise omitted.
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *HGT* ***Height***

The first information item shall contain the height of the portion of image contained in this record, in centimeters.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 999. (1-3 N)

2) *WID* ***Width***

The second information item shall contain the width of the portion of image contained in this record, in centimeters.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 999. (1-3 N)

6.10.42. 10.042 SMD / SMT Descriptors

This field is used to describe the content of the SMT image to an extent greater than documented in Field 10.040: SMT / NCIC code. Published best practice guidelines on the collection of tattoo images to support image-based tattoo recognition are available at https://doi.org/10.6028/NIST.IR.8109.

An SMT image consisting of several parts or sub-images shall use subfields to fully describe the various parts or features found in the total image. The first subfield shall describe the most predominant feature or sub-image contained in the SMT image. Subsequent repeating subfields shall describe additional portions of the image that are not part of the main or central focal point of the image. For example, a tattoo consisting of a man with a snake on the arm being followed by a dog may contain three subfields: one describing the man, a second describing the snake, and a third describing the dog.

Condition:	Optional when **IMT** = 'SCAR', 'MARK', or 'TATTOO', otherwise omitted.
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	1 to 9 Subfields; Information Items as described below

Contains:

1) *SMI* ***SMT Code Indicator***

The first information item shall identify the type of SMT in the image. The value for this information item is selected from the SMT Code column of the table below, noting the applicable value of **IMT** in the record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	SMT Code value taken from table, below. (3-9 A)

SMT Code	Description	Applies to IMT Code
SCAR	Healed tissue that was the result of an accident or medical procedure	**SCAR**
BIRTHMARK	Tissue that is differentiated from normal tissue but is not the result of an accident or medical procedure, such as a "blood stain" birthmark on part of the face.	**SCAR**
PIERCING	A medical or quasi-medically induced hole in or through the skin – often to allow the insertion of jewelry.	**SCAR**
ZABIBA	Commonly referred to as a "prayer bump"' on the forehead.	**SCAR**
IMPLANT	Sub-dermal implants that are visible as distinct shapes in the skin. This category may also be used to indicate jewelry that has been (semi-)permanently affixed to the body – such as plugs in the earlobes or a microdermal implant that has a jewel above the skin.	**SCAR**
TATTOO	An image on the skin resulting from pricking of the skin with a coloring material. This also includes tattoos that have been removed but still leave a pattern on the skin. Note that some tattoos may be visible only in ultra-violet light.	**TATTOO**

CHEMICAL	Creation of an image on the skin by using chemicals.	**TATTOO**
BRANDED	Creation of an image on the skin by using a branding iron or other form of heat.	**TATTOO**
CUT	Creation of an image resulting from patterned cutting of the skin and resultant healing.	**TATTOO**
MARK	Patterns of needle marks on the skin.	**MARK**

2) *TAC* *Tattoo Class*

The second information item shall be the general class code of tattoo chosen from the "Class Code" column of Table 47. This information item does not apply to scars and marks.

Condition: Optional when **IMT** = TATTOO, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Class Code value taken from Table 47 Tattoo classes and subclasses, below. (4-8 A)

3) *TSC* *Tattoo Subclass*

The third information item shall be the appropriate subclass code selected from Table 47 Tattoo classes and subclasses. For each general class of tattoo, there are several defined subclasses. The subclass must be chosen with respect to the applicable class in **TAC**. This information item does not apply to scars and marks.

Condition: Optional when IMT = TATTOO, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Subclass Code value taken from Table 47, below. (3-11 A)

4) *TDS* *Tattoo Description*

The fourth information item shall be a text string that provides additional qualifiers to describe the image or portion of the image. For example, to fully describe a tattoo, there may be a class description of 'ANIMAL', with a subclass description of 'DOG', and qualified by 'golden retriever with an overbite'. This information item does not apply to scars and marks.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 256 characters from user-specified set as indicated in Field 1.015 DCS. (1-256 U)

Table 47 Tattoo classes and subclasses

Class Code	Subclass Code	Subclass Description
HUMAN	**MFACE**	Male Face
HUMAN	**FFACE**	Female Face
HUMAN	**ABFACE**	Abstract Face
HUMAN	**MBODY**	Male Body
HUMAN	**FBODY**	Female Body
HUMAN	**ABBODY**	Abstract Body
HUMAN	**ROLES**	Roles (Knight, Witch, man, etc.)
HUMAN	**SPORT**	Sports Figures (Football Player, Skier, etc.)

HUMAN	**MBPART**	Male Body Parts
HUMAN	**FBPART**	Female Body Parts
HUMAN	**ABBPART**	Abstract Body Parts
HUMAN	**MHUMAN**	Miscellaneous Human Forms
HUMAN	**SKULL**	Skulls
ANIMAL	**CAT**	Cats & Cat Heads
ANIMAL	**DOG**	Dogs & Dog Heads
ANIMAL	**DOMESTIC**	Other Domestic Animals
ANIMAL	**VICIOUS**	Vicious Animals (Lions, etc.)
ANIMAL	**HORSE**	Horses (Donkeys, Mules, etc.)
ANIMAL	**WILD**	Other Wild Animals
ANIMAL	**SNAKE**	Snakes
ANIMAL	**DRAGON**	Dragons
ANIMAL	**BIRD**	Birds (Cardinal, Hawk, etc.)
ANIMAL	**INSECT**	Spiders, Bugs, and Insects
ANIMAL	**ABSTRACT**	Abstract Animals
ANIMAL	**PARTS**	Animal Parts
ANIMAL	**MANIMAL**	Miscellaneous Animal Forms
PLANT	**NARCOTICS**	Narcotics
PLANT	**REDFL**	Red Flowers
PLANT	**BLUEFL**	Blue Flowers
PLANT	**YELFL**	Yellow Flowers
PLANT	**DRAW**	Drawings of Flowers
PLANT	**ROSE**	Rose
PLANT	**TULIP**	Tulip
PLANT	**LILY**	Lily
PLANT	**MPLANT**	Misc. Plants, Flowers, Vegetables.
OBJECT	**FIRE**	Fire
OBJECT	**WEAP**	Weapons (Guns, Arrows, etc.)
OBJECT	**PLANE**	Airplanes and other Air vehicles (incl. Blimps)
OBJECT	**VESSEL**	Boats, Ships, & Other Water Vessels
OBJECT	**TRAIN**	Trains
OBJECT	**VEHICLE**	Cars, Trucks, and other Land Vehicles (except Trains)
OBJECT	**MYTH**	Mythical (Unicorns, etc.)
OBJECT	**SPORT**	Sporting Objects (Football, Ski, Hurdles, etc.)
OBJECT	**NATURE**	Water & Nature Scenes (Rivers, Sky, Trees, etc.)
OBJECT	**MOBJECTS**	Miscellaneous Objects
SYMBOL	**NATION**	National Symbols
SYMBOL	**POLITIC**	Political Symbols
SYMBOL	**MILITARY**	Military Symbols
SYMBOL	**FRATERNAL**	Fraternal Symbols
SYMBOL	**PROFESS**	Professional Symbols
SYMBOL	**GANG**	Gang Symbols
SYMBOL	**MSYMBOLS**	Miscellaneous Symbols
FLAG	**USA**	American Flag
FLAG	**STATE**	State Flag
FLAG	**NAZI**	Nazi Flag
FLAG	**CONFED**	Confederate Flag
FLAG	**BRIT**	British Flag
FLAG	**MFLAG**	Miscellaneous Flags
ABSTRACT	**FIGURE**	Figure(s)
ABSTRACT	**SLEEVE**	Sleeve
ABSTRACT	**BRACE**	Bracelet
ABSTRACT	**ANKLET**	Anklet
ABSTRACT	**NECKLC**	Necklace
ABSTRACT	**SHIRT**	Shirt
ABSTRACT	**BODBND**	Body Band
ABSTRACT	**HEDBND**	Head Band
ABSTRACT	**MABSTRACT**	Miscellaneous Abstract
OTHER	**WORDING**	Wording (Mom, Dad, Mary, etc.)
OTHER	**FREEFRM**	Freeform Drawings
OTHER	**MISC**	Miscellaneous Images

6.10.43. 10.043 TCL / Tattoo Color

This field is optional, but it can only be used when Field 10.042: **SMD /** SMT Descriptors is in the record. It shall contain one subfield corresponding to each subfield contained in Field 10.042: **SMD** / SMT Descriptors. Each subfield shall contain up to 6 information items that state the color(s) of the tattoo or part of the tattoo. For each subfield entry, the first one shall be the predominant color. Additional colors may be entered as optional subsequent information items of the form tattoo color code 1 through tattoo color code 6. There need not be more than one information item.

Condition: Optional when **SMD** occurs, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: 1 to 9 Subfields; Information Items as described below

Contains:

1) ***TC1*** ***Tattoo Color Code 1***

The first information item shall describe the predominant color of the tattoo.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (3-7 A)

Code	Description
BLACK	Black
BROWN	Brown
GRAY	Gray
BLUE	Blue
GREEN	Green
ORANGE	Orange
PURPLE	Purple
RED	Red
YELLOW	Yellow
WHITE	White
MULTI	Multi-colored
OUTLINE	Outlined

2-6) ***TC2 – TC 6*** ***Tattoo Color Code 2 – Tattoo Color Code 6***

The second through sixth information items shall describe the secondary colors of the tattoo, as required.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table above. (3-7 A)

6.10.44. 10.044 ITX / Image Transform

This field is used in the case when the image in this Type-10 record has been transformed from the original image. The original untransformed image(s) may (optionally) be included in a Type-20 record. The additional subfields may be added if multiple transforms were performed.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 18 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides the code value the type of transformation that was performed on the image in this record. If there are additional transformations, those codes shall also be included in subsequent Subfields.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from table below. (3-11 A)

Code	Description
AGE	Age progressed
AXIS	Off-axis image rectification / Angle correction
COLORSHIFT	Color shifted
CONTRAST	Contrast stretched
CROP	Cropped
DIST	Distortion corrected (e.g., fisheye correction)
DOWNSAMPLE	Downsampled
GRAY	Grayscale from color
ILLUM	Illumination transform
IMGFUSE	Image-level fusion of two or more images
INTERPOLATE	Up sampled
MULTCOMP	Multiply compressed
MULTIVIEW	Multi-view image
POSE	Face-specific pose correction
ROTATE	Rotated (in-plane)
SNIR	Simulated Near IR
SUPERRES	Super-resolution image, derived from multiple lower resolution images
WHITE	White balance adjusted

6.10.45. 10.045 OCC / Occlusions

This field defines the boundary and contents of any occlusions that partially or totally blocks the image of a face.

Condition: Optional when **IMT** = FACE, otherwise omitted.

Occurrence: 0-1

Value Constraints: 1 to 16 Subfields; Information Items as described below

Contains:

1) *OCY* ***Occlusion Opacity***

The first information item shall describe the opacity of the occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 48 Type-10 Occlusion Opacity. (1 A)

Table 48 Type-10 occlusion opacity

Code	Description
T	Total - There is no detail in the area of the occlusion.
I	Interference - The occlusion contains interfering texture such as eyelashes, hair or reflection.
L	Partial light - There is detail in the area of the occlusion that is lighter than the rest of the face or iris.
S	Partial shadow - There is detail in the area of the occlusion that is darker than the rest of the face or iris.

2) *OCT* ***Occlusion Type***

The second information item shall describe the type of occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 49 Type-10 Occlusion Type. (1 A)

Table 49 Type-10 occlusion type

Code	Description
H	Head covering - Hair, hat, veil, burka, or other head covering (face only)
S	Specular - Specularity, reflection of light
C	Shadow - Shadow cast
R	Reflection - Reflection of an object
O	Other - Any other occlusion, such as eyeglass frames blocking the image

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order, describe the path bounding this occlusion. The number of occurrences of this pair of information items shall be equal to the value of **NOP**:

3) *HPO* ***Horizontal Point Offset***

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per vertex (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 10.006 Horizontal Line Length (**HLL).** (1-5 N)

4) ***VPO*** ***Vertical Point Offset***

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per vertex (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 10.007 Vertical Line Length (**VLL).** (1-5 N)

6.10.46. 10.046 SUB / Image Subject Condition

This field describes the status of the record subject. It is useful for images obtained from injuries or deceased persons, but its use is not limited to such circumstances.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) ***SSC*** ***Subject Status Code***

The first information item describes the status information of the subject of the record, as known at the time of collection. If this field value is equal to 'D' the second and third information items shall also appear.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

2) ***SBSC*** ***Subject Body Status Code***

The second information item indicates whether the information relates to an entire corpse or a separate body part. When a detached body part is imaged, IMT would be set to the appropriate code for the body part and SBSC would be set to 2. IMT = MISSING shall be used to image the area of the body from which a body part was separated and SBSC would be set to 1 in that case.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

3) ***SBCC*** ***Subject Body Class Code***

The third information item further describes the condition of a deceased subject's tissue.

Condition:	Mandatory when **SSC** = D, omitted otherwise.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Allowed values are '**1**' (Natural Tissue), '**2**' (Decomposed), or '**3**' (Skeletal). (1 N)

6.10.47. 10.047 CON / Capture Organization

This field contains the name of the organization which captured the image in the current record, for example an agency capturing booking photos would be listed in CON. Note that this can be different from the agency entered in Field 10.004 SRC / Source Agency and Field 10.993 SAN / Source Agency Name, which describe the agency that created the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.10.48. 10.048 Deprecated Field
6.10.49. 10.049 Deprecated Field
6.10.50. 10.050 VID / Dental Visual Image Data Information

This field shall only be used if Field 10.003 IMT / Image Type has a value of 'EXTRAORAL' or 'INTRAORAL'. It may be used in conjunction Field 10.033 FEC / Feature Contours to highlight distinctive features in an image.

Condition:	Optional when **IMT** = 'EXTRAORAL' or 'INTRAORAL', otherwise omitted.
Occurrence:	0-1 when Condition above is met; 0 otherwise.
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *VIVC* ***Visual Image View Code***

The first information item describes the view of the subject captured in the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: View Code value from Table 50 Dental Image Codes

2) *VIDT* ***Visual Image Additional Descriptive Text***

The second information item shall contain any farther description of the image that may be needed.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *VICD* ***Visual Image Comparison Descriptive Text***

The third information item may be used by an analyst to note the results of a comparison against another image. If this information item is present, then Field 10.039: T10 / Type-10 Reference Number shall be present in the record to indicate the image against which the image in this instance of the Record Type-10 is compared.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

Table 50 Dental image codes

View Code	View Position / Type	Description	View Type
EFNS	***Frontal*** **-** Natural state	The subject's face without any incisions performed by the medical examiner or coroner. Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. Both the Frankfort horizon line and the interpupillary line should be at right angles to the image with no rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	EXTRAORAL
EFWI	***Frontal*** -With incisions present	Image taken after incisions made that were part of the examination of the subject. Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. Both the Frankfort horizon line and the interpupillary line should be at right angles to the image with no rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	EXTRAORAL
EFLR	***Frontal*** **-** Lips retracted	Image with device present that retracts the lips. Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. Both the Frankfort horizon line and the interpupillary line should be at right angles to the image with no	EXTRAORAL

		rotation of the head. The image should be centered on the midline of the face both vertically and horizontally.	
EFOL **EFOR**	***Oblique (45º)*** **-** LEFT RIGHT	Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. The subject's head is rotated 45º. This position is independent of the size of the nose in contrast to the alignment of the nose with the cheek. Focus point and center of the picture is on the Frankfort horizontal line at the junction with the lateral acanthus. The lower margin is the steno-clavicular joint.	EXTRAORAL
EFPL **EFPR**	***Profile (90º)*** - LEFT RIGHT	Image should fill at least 90% of the image and extend from above the top of the head to the inferior border of the hyoid bone. The head should be positioned so that the ala-tragus line is parallel to the floor of the jaw in the rest position. The head should be turned so that the contralateral eyebrow is barely visible. The image should be centered midline of the face both horizontally and vertically.	EXTRAORAL
IFJU	***Frontal*** **-** Jaws open – upper (maxillary) teeth	The image is taken from the front of the mouth and shows a view of the upper (maxillary) teeth. This code should be selected when the lower jaw is not present on the subject or there are no upper teeth present on the subject. The lips should be retracted, and the image should be parallel to the occlusal plane. The image should be center between the occlusal plane and the midline of the maxillary central incisors.	INTRAORAL
IFJL	***Frontal*** **-** Jaws open – lower (mandibular) teeth	The image is taken from the front of the mouth and shows a view of the upper (maxillary) teeth. This code should be selected when there are no lower teeth present on the subject. The lips should be retracted, and the image should be parallel to the occlusal plane. The image should be center between the occlusal plane and the midline of the maxillary central incisors.	INTRAORAL
IFJB	***Frontal*** **-** Jaws open – both sets of teeth	The image shows the full set of teeth, including anterior teeth as well as a partial view of the premolar and possibly the first molar region. This is the most common code associated with an intraoral frontal view. The lips should be retracted, and the image should be parallel to the occlusal plane. The image should be center between the occlusal plane and the midline of the maxillary central incisors.	INTRAORAL
IBUR	***Facial (cheek side)*** **-** Subject's upper right (maxillary) teeth	The image should extend from the right maxillary canine to as far distally as possible. Ideally the right maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBUL	***Facial (cheek side)*** **-** Subject's upper left (maxillary) teeth	The image should extend from the left maxillary canine to as far distally as possible. Ideally the left maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBLR	***Facial (cheek side)*** **-** Subject's lower right (mandibular) teeth	The image should extend from the right mandibular canine to as far distally as possible. Ideally the right mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBLL	***Facial (cheek side)*** **-** Subject's lower left (mandibular) teeth	The image should extend from the left mandibular canine to as far distally as possible. Ideally the left mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBRB	***Facial (cheek side)*** **-** Subject's right teeth – both sets	The image should extend from the right canines to as far distally as possible. Ideally the right second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
IBLB	***Facial (cheek side)*** **-** Subject's left teeth – both sets	The image should extend from the left canines to as far distally as possible. Ideally the left second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILUR	***Lingual side*** **-** Subject's upper right (maxillary) teeth	The image should extend from the right maxillary canine to as far distally as possible. Ideally the right maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILUL	***Lingual side*** - Subject's upper left (maxillary) teeth	The image should extend from the left maxillary canine to as far distally as possible. Ideally the left maxillary second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILLR	***Lingual side*** - Subject's lower right (mandibular) teeth	The image should extend from the right mandibular canine to as far distally as possible. Ideally the right mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL

ILLL	***Lingual side*** - Subject's lower left (mandibular) teeth	The image should extend from the left mandibular canine to as far distally as possible. Ideally the left mandibular second molar should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILRB	***Lingual side*** - Subject's right teeth – both sets	The image should extend from the right canines to as far distally as possible. Ideally the right second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILLB	***Lingual side*** - Subject's left teeth – both sets	The image should extend from the left canines to as far distally as possible. Ideally the left second molars should be included. The tongue should be placed so that it is not in the image.	INTRAORAL
ILUF	***Lingual side*** - Subject's upper front teeth	The image should include left maxillary canine to right maxillary canine. The tongue should be placed so that it is not in the image.	INTRAORAL
ILLF	***Lingual side*** - Subject's lower front teeth	The image should include left mandibular canine to right mandibular canine. The tongue should be placed so that it is not in the image.	INTRAORAL
IOUA	***Occlusal*** - Subject's full upper (maxillary) teeth	This view should include all anterior teeth, all premolars and at least the maxillary first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLA	***Occlusal*** - Subject's full lower (mandibular) teeth	This view should include all anterior teeth, all premolars and at least the mandibular first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOUR	***Occlusal*** - Subject's upper right (maxillary) teeth	This view should include all anterior teeth, all premolars and at least the maxillary first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOUL	***Occlusal*** - Subject's upper left (maxillary) teeth	This view should include all anterior teeth, all premolars and at least the maxillary first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLR	***Occlusal*** - Subject's lower right (mandibular) teeth	This view should include all anterior teeth, all premolars and at least the mandibular first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLL	***Occlusal*** - Subject's lower left (mandibular) teeth	This view should include all anterior teeth, all premolars and at least the mandibular first molar. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOUF	***Occlusal*** - Subject's upper front teeth	This image should contain the occlusal surface of the teeth from left maxillary canine to right maxillary canine. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IOLF	***Occlusal*** - Subject's lower front teeth	This image should contain the occlusal surface of the teeth from left mandibular canine to right mandibular canine. The images should be taken perpendicular to the plane of the teeth surface.	INTRAORAL
IPC	***Palatal*** - Subject's palate (including rugae)	This should be a centered view of the palate. The rugae should be in focus with an adequate depth of field, since they may be useful in subject identification. This image should be taken if the subject has a cleft palate or other abnormality. It should also be taken when the palate is tattooed.	INTRAORAL
ITU	***Tongue*** - Upper tongue surface	This view should be taken with the tongue as flat as possible. This view should be used if there is any jewelry, piercing abnormalities of the tongue, (including "ornamental disfiguration") and tattoos.	INTRAORAL
ITL	***Tongue*** - Lower tongue area	This view should be taken with the tongue raised or in retroflex position, centered on the frenulum. This view should be used if there is any jewelry, piercing abnormalities of the tongue (including "ornamental disfiguration") and tattoos.	INTRAORAL
ICR	Subject's right interior cheek	This view should be centered on the right oral linea alba and should include the right parotid papilla. This view should be used if there is any jewelry piercing, abnormalities of the cheek (including "ornamental disfiguration") and tattoos.	INTRAORAL
ICL	Subject's left interior cheek	This view should be centered on the left oral linea alba and should include the left parotid papilla. This view should be used if there is any jeweler piercing, abnormalities of the cheek (including "ornamental disfiguration") and tattoos.	INTRAORAL

IPB	***Pharynx* -** back of mouth	This view is focused upon the soft tissue at the back of the mouth. It should include the uvula and oropharynx regions.	INTRAORAL
ILU	Upper inside lip	This image should be captured of the maxillary vestibule if there is a significant finding (i.e., tattoo. piercing, or oral lesion) or an abnormality of the superior labial frenulum such as connecting to the palate between the front teeth.	INTRAORAL
ILL	Lower inside lip	This image should be captured of the mandibular vestibule if there is a significant finding (i.e., tattoo. piercing, or oral lesion) or an abnormality of the inferior labial frenulum such as connecting to the palate between the front teeth.	INTRAORAL

6.10.51. 10.051 RSP / Ruler or Scale Presence

This field allows the user to state whether a ruler or other known scale is present in the image.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: Information Items as described below.

Contains:

1) *RSU* *Ruler or Scale Units*

The first information item indicates the units of measurement visible on the ruler or measurement scale.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**IN**' (inches), '**MM**' (millimeters), and '**BOTH**' (both inches and millimeters). (2-4 A)

2) *RSM* *Ruler or Scale Make*

The second information item lists the maker of the ruler or scale (if known).

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

3) *RSO* *Ruler or Scale Model*

The third information item lists the model of the ruler or scale (if known).

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

6.10.52. 10.052 – 10.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.10.53. 10.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.10.54. 10.200 – 10.900 UDF / User-Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.10.55. 10.901 Reserved for Future Use Only by ANSI/NIST-ITL

6.10.56. 10.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* *Algorithm Owner*

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* *Process Description*

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.10.57. 10.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with 'M' or 'P' and shall contain only printable ASCII 7-bit characters, i.e., values 32 – 126 inclusive. (13-16 ANS)

6.10.58. 10.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. Optionally it can contain the underlying COTS device information, such as serial number, in the case of a mobile phone running a capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture

the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* ***Device Mobility***

This information item describes the general stability of the capture device.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* ***COTS Designation***

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* ***COTS Serial Number***

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition:	Mandatory if DCT = Y, otherwise Optional

Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.10.59. 10.905 – 10.991 Reserved for Future Use Only by ANSI/NIST-ITL

6.10.60. 10.992 T2C / Record Cross Reference

This is an optional field. When used, it contains the IDC value of the Type-2 record that contains relevant biographic information and other data concerning the subject of this instance of the record, who may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.10.61. 10.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 10.004: Source agency/ SRC.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.10.62. 10.994 EFR / External File Reference

This field allows image data to be referenced at a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 10.999: DATA / Body Part Image. These two fields are mutually exclusive, and one shall be present in all instances of this record type. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Sections 5.7 and 5.8.

Condition:	Mandatory when Field 10.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.10.63. 10.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 10.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *ASP* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.10.64. 10.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 10.999 DATA of this record or at the location specified in Field 10.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.10.65. 10.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 10.999 DATA or 10.994 EFR was derived. An example of the use of this field would be when data is extracted from a representation, such as a group photograph, which is stored in a Type-20 record. The face images could be segmented and placed in separate Type-10 records. See Section 5.11.5 SOR / Source Representation

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* *Reference Segment Position*

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the RSP / Reference Segment Position in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 10.999 (or 10.994) shall be identified in this information item.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.10.66. 10.998 GEO / Geographic Sample Acquisition Location

This field describes the location where the image was acquired – not where it is stored. It specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.10.67. 10.999 DATA / Body Part Image

This field, if present, contains the image described in the other fields of this record. If Field 10.994: EFR / External File Reference is present in this record, then this field shall not appear. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 10.994 **EFR** is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.11. Record Type-11: Voice Data Record

The Type-11 is focused upon the analysis of voice signals. Voice analysis is often divided into two general areas: “Speech Recognition” and “Speaker Recognition.”

Speech recognition involves the interpretation of vocalizations for their linguistic content. Automatic speech recognition may be speaker dependent (based upon enrollment data from the individual speaker) or speaker independent. Speech recognition can also be performed manually, such as when a phonetic transcript or a translation is generated. This content is contained in Field 11.026: VCD / Vocal Content Diary.

Speaker recognition involves determining who is performing the vocalizations. The human voice - generally carrying both speech and non-speech sounds - propagates varying distances through air (principally) or another medium to reach acoustic transducers (usually microphones, when recorded) of varying amplitude and phase response. For purposes of the Type-11 record, a “speaker” is any person producing “vocalizations” from the throat or oral cavity, which may be voiced (activating the vocal folds) or unvoiced (such as aspirations, whispers, tongue clicks and other similar sounds). An automated interlocutor is considered to be a “speaker” for the purposes of this record type, since the intent is to directly mimic human speech, although such a speaker shall not be the primary subject of an ANSI/NIST-ITL transaction.

When voice sounds carry speech, that speech usually occurs within a social context involving more than one speaker. Consequently, a recorded speech signal may contain the voices of multiple speakers. Thus, the Type-11 record accommodates recordings with multiple speakers; can designate whether any of the speakers are already identified; can convey the count of the number of individual speakers; and can convey when the same person is speaking at multiple points during the recording. It can also convey the transcribed linguistic content of each speaker.

An ANSI/NIST-ITL transaction is typically focused upon the identification of one individual. However, in order to effectively perform that identification (or verification of identity), it may be necessary to include information about other persons in the transaction. With voice recordings, it may be necessary to include in a transaction “known” clips of certain persons who are possibly speaking in the recording under investigation, in order to separate out the speech of the known individuals and concentrate on the identification of the remaining speakers. Thus, there may be a difference between the “subject of the transaction” and the “subject of the record.”

Multiple Type-11 records may be contained in a single transaction. The type of action desired by the submitter of the transaction (to be performed by the receiver of the transaction) is specified in a Type-1 record in the TOT field.

There are factors that had to be considered in developing this record type. Some of the most significant ones include:

- Voice signals generally contain both speech and non-speech elements, either of which might be useful in speaker recognition applications.

- Unlike other modalities, voice signals are collected in time - not spatial - dimensions and will not have a single “time of collection”.
- In mobile applications, even a single segment of a voice signal may not be linkable to a single geographic location or to a specific speaker.
- Voice signals containing speech have direct informational content. Unlike other forms of biometric recognition, the speech itself means something and, even if stripped of all personally identifiable information including the acoustic content itself, may require protection for privacy or security reasons.
- Unlike other modalities, voice signals may reflect and depend upon the social and behavioral conditions – as well as the environmental conditions – of the collection environment, including the relationship between the data subject and any interlocutors.

Application profiles of this standard shall specify the applicable upper limit for all elements with an unlimited maximum occurrence (‘*’ or ‘+’).

6.11.1. 11.001 LEN / Record Length

The length of the entire Type-11 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.11.2. 11.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.11.3. 11.003 AOD / Audio Object Descriptor Code

This field shall indicate the type of audio object containing the voice recording which is the focus of this Type-11 record. Code value ‘0’ indicates that the audio object of this record is a digital voice data file in the Field 11.999: DATA / Voice Record Data. Code value ‘1’ indicates that the audio object is a digital voice data file at the location specified in Field 11.994: EFR / External File Reference. Code values 2-4 indicate that the audio object is a physical media object at a location described in Field 11.994.

If the Type-11 record contains only metadata (such as in a response to a voice recording submission), code value '5' shall be selected.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 51 Audio Object Descriptors. (1 N)

Table 51 Audio object descriptors

Code	Audio Object
0	Digital voice data file included within the record
1	Digital voice data file located outside of the transaction
2	Physical Media Object containing digital data
3	Physical Media Object containing analog signals
4	Physical Media Object containing unknown data or signals
5	No audio object associated with this record

6.11.4. 11.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 11.993: SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.11.5. 11.005 VRSO / Voice Recording Source Organization

This field shall contain information about the person, group, site or agency that created the voice recording for this record. In the case of files created from previous recordings, this is not necessarily the source of the original capture of the acoustic vocalizations from the person to whom the Type- 11 record pertains. This need not be the same as the Field 11.004: SRC / Source Agency (which created the record) or Field 1.008: ORI / Originating Agency Identifier (which sent the transaction to the receiving agency).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) ***STC*** ***Source Organization Type Code***

The first information item describes the site or agency that created the voice recording.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

Code	Organization Type
U	Unknown
P	Private individual
I	Industry/Commercial
G	Government
O	Other

2) *SON* *Source Organization Name*

The second information item contains the name of the group, organization or agency that created the voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 400 characters from user-specified set as indicated in Field 1.015 DCS. (1-400 U)

3) *POC* *Point of Contact*

The third information item contains the contact information of the person or persons responsible for the creation of the voice recording, such as the name, telephone number and e-mail address.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

4) *CSC* *Source Organization Country Code*

The fourth information item identifies the country where the voice recording was created – which is not necessarily the nation of the agency entered in Field 11.993: SAN / Source Agency Name. All three formats specified in ISO-3166-1 are allowed (Alpha2, Alpha3 and Numeric).

Condition: Optional

Occurrence: 0-1

Value Constraints: Country Code values from ISO-3166-1 or GENC, as indicated in Field 1.018 GNS / Geographic Name Set. (2-3 AN)

6.11.6. 11.006 VRC / Voice Recording Content Descriptor

This field describes the content of the voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *AVI* ***Assigned Voice Indicator***

The first information item indicates if the voice recording sample was obtained from a known subject.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

Code	Sample Identity Type
A	Subject of this record is "assigned" an identity (whether or not there is biographical information associated with the individual.
N	This record does not have an assigned identity as the subject of the record (such as when it is not known whether the same person is speaking in different segments)
Q	Voice sample is of a "questioned" identity (such as a sample to be compared against a database for identification)

2) *SPC* ***Speaker Plurality Code***

The second information item indicates plurality of speakers represented on voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are 'M' (multiple speakers) and 'S' (single speaker). (1 A)

3) *COM* ***Comments***

The third information item describes methods by which the plurality or other related information about the speakers was determined, along with any supporting text.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.7. 11.007 AREC / Audio Recording Device

This field specifies information about the recording equipment that created the voice recording for this record. Since recordings or data files may be transcoded from previously recorded or broadcast content, this equipment may or may not be the equipment used to capture the original acoustic vocalization of the person to whom the Type-11 record pertains.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *RDD* ***Recording Device Descriptive Text***

The first information item describes the recording device that created the voice recording. An example would be 'Home telephone answering device.'

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *MAK* ***Recording Device Make***

The second information item contains the make of the device that created the voice recording.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *MOD* ***Recording Device Model***

The third information item contains the model of the device that created the voice recording.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *SER* ***Recording Device Serial Number***

The fourth information item contains the serial number of the device that created the voice recording.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.11.8. 11.008 AQS / Acquisition Source

This field specifies and describes the voice recording acquisition source.

Condition: Mandatory when Field **11.003 AOD** ≠ 5; otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) ***AQC*** ***Acquisition Source Code***

The first information item describes the source of the recording.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value taken from Table 52 Voice Acquisition Source Code. (1-2 N)

Table 52 Voice acquisition source code

Code	Acquisition source type
7	Video sequence from an unknown source
8	Video sequence from an analog video camera, stored in analog format
9	Video sequence from an analog video camera, stored in digital format
10	Video sequence from a digital video camera
12	Analog audio recording device; stored in analog form (such as a phonograph record)
13	Analog audio recording device; converted to digital
14	Digital audio recording device
15	Landline telephone audio – both sender and receiver
16	Mobile telephone audio– both sender and receiver
17	Satellite telephone audio – both sender and receiver
18	Telephone audio – unknown or mixed sources
19	Television – NTSC video
20	Television – PAL video
21	Television – Other video
22	Voice-over-internet protocol (VOIP) audio
23	Radio transmission: short-wave audio (specify single side band or continuous wave in FDN)

24	Radio transmission: amateur radio audio (specify lower side band or continuous wave in FDN)
25	Radio transmission: FM (87.5 MHz to 108 MHz) audio
26	Radio transmission: long-wave (150 kHz to 519 kHz) audio
27	Radio transmission: AM (570 kHz to 1720 kHz) audio
28	Radio transmission: Aircraft frequencies audio
29	Radio transmission: Ship and coastal station frequencies audio
30	Vendor specific capture format
31	Other

2) *A2D* *Analog to Digital Conversion Description*

The second information item is a free-text field that describes the analog to digital equipment used to transform the source, if such a conversion was an explicit separate step in preparation of the data and the process is known. to have occurred. Otherwise, it shall be omitted.

This field should be used to enter the make, model and serial number of the analog to digital conversion equipment used. This field should also address parameters used, such as the sampling rate. Additional information about the digital conversion process can be entered in Field 11.902: ANN / Annotation Information.

Condition:	Mandatory when an explicit analog to digital conversion is known to have occurred. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *FDN* *Radio Transmission Format Description*

The third information item is a free-text field. It is mandatory if the **AQC** is 23 or 24. It is optional for other radio transmission codes (**AQC** 25-29).

Condition:	Mandatory when 23 ≤ **AQC** ≤ 24; Optional when 25 ≤ **AQC** ≤ 29; Otherwise omitted.
Occurrence:	0-1 if Conditions above are met, 0 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4) *AQSC* *Acquisition Special Characteristics*

The fourth information item is a free-text field, that is used to describe any specific conditions not mentioned in AQC.

Condition:	Optional
Occurrence:	0-1

Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.9. 11.009 RCD / Record Creation Date

This mandatory field shall contain the date and time of creation of this Type-11 record. This date will generally be different from the voice recording creation date and may be different from the date at which the acoustic vocalization originally occurred.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full, local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime.

6.11.10. 11.010 VRD / Voice Recording Creation Date

This field shall contain the date and time of creation of the voice recording contained in this Type-11. If pre-recorded or transcoded materials were used, this date may be different from the date at which the acoustic vocalization originally occurred.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must be a full, local datetime. For encoding-specific format, see Section5.1.3 Local Datetime.

6.11.11. 11.011 TRD / Total Recording Duration

This field gives the total length of the voice recording time for this Type-11 record. At least one of the three information items must be entered if this field is used. The second and third items of this field only apply to digital audio objects, as indicated by a value of 0, 1, or 2 in Field 11.003: AOD / Audio Object Descriptor Code.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) ***TIM*** ***Voice Recording Time***

The first information item gives the total time of the voice recording in microseconds (μs). The size of this item is limited to 11 digits, limiting the total time duration of the signal to 99,999 seconds, which is approximately 28 hours.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99999999999. (1-11 N)

2) *CBY* ***Compressed Bytes***

The second information item contains the total number of compressed bytes in the digital voice data file. Consequently, this information item applies only to digital voice recordings stored as voice data files. The size of this item limits the total size of the voice data file to 99 terabytes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99999999999999. (1-14 N)

3) *TSM* ***Total Digital Samples***

The third information item gives the number of digital samples in the voice data file after any decompression of the compressed signal. This information item applies only to digital voice recordings stored as voice data files.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99999999999999. (1-14 N)

6.11.12. 11.012 PMO / Physical Media Object

This field identifies the characteristics of the physical media containing the voice recording. There can be only one physical media object per Type-11 record, but multiple Type-11 records can point to the same physical media object. This field only applies if Field 11.003: AOD / Audio Object Descriptor Code has an attribute code of ‘2’, ‘3’ or ‘4’. If this field is used, the location of the physical media object shall be given in Field 11.994 EFR / External File Reference.

Condition:	Optional when AOD indicates a physical media object (values 2-4); omitted otherwise.
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *MTD* ***Media Type Description***

The first information item contains free text describing the general type of media (e.g., analog cassette tape, reel-to-reel tape, CD, DVD, phonograph record) upon which the voice recording is stored. If an analog media is used for storage, and AQC of Field 11.008 AQS / Acquisition Source/ AQC is '14', then a description of the digital to analog conversion procedure should be noted in Field 11.902 ANN / Annotation Information and the reasons for such a conversion noted in COM of this field.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

2) *RSP* ***Recording Speed***

The second information item gives the speed at which the physical media object must be played to reproduce the voice signal content. This value may be integer or floating point and shall not exceed 9 characters (such as '33.33' or '78').

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ number ≤ 999999999. (1-9 NS)

3) *RSU* ***Recording Speed Measurement Units Description Text***

The third information item contains text to indicate the units of measure to which **RSP** refers (such as 'Rotations Per Minute').

Condition:	Mandatory when **RSP** occurs, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise.
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

4) *EQD* ***Equalization Description***

The fourth information item indicates the equalization that should be applied for faithful rendering of the voice recording on the physical media object.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *TRC* ***Track Count***

The fifth information item gives the number of tracks on the physical media object. For example, a stereo phonograph record will have 2 tracks.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 9999. (1-4 N)

6) *STK* *Speaker Track Number*

The sixth information item is a list of integers which indicate which tracks carry the voices of the speaker(s). This information item is defined as a list of integer values. In XML/JSON encoding, this is represented as a group of elements, each with an individual value in the list. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). A value of '0' or no entry for this information item indicates that all tracks contain voice data for the speaker(s).

Condition:	Optional
Occurrence:	0-1 list containing up to 9,999 values
Value Constraints:	1 ≤ integer ≤ 9999 for each value in the list. (1+ NS)

7) *COM* *Comments*

The seventh information item allows for additional free-text comments describing the physical media object.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.13. 11.013 CONT / Container

This field contains information about the digital container format that encapsulates the audio data of the electronic file used to carry the voice data in the digital recording. This field is not needed if the voice recording is stored on a physical media object as an analog signal – so it may only appear if Field 11.003 AOD / Audio Object Descriptor Code = 0, 1, or 2. If present, this field overrides Field 11.014: CDC / Codec. There cannot be multiple container formats specified within a single Type-11 record.

Files having container formats incorporate audio specifications to properly decode the audio, such as the number of channels, sampling rate, bit/byte depth, and whether the data is big/little endian. More generally, container formats can specify an audio format used to encode the data or simply encapsulate one or more audio channels as Linear PCM. For example, the Wave container specification (WAV) has fields such as chunk ID, chunk size, audio format (codec format), sampling rate, number of channels, and space for extra parameters (for the codec or other uses).

All of the audio characteristics required to properly interpret RAW format data (**CONC** = 0) must be provided; therefore, if RAW is specified then Field 11.014: CDC / Codec is mandatory.

If **CONC** has a value other than zero then the presence of Field 11.014: CDC / Codec is dependent upon the type of container format and should be included only when it is meaningful in context. For container types that allow different codecs and codec format, and if the container format does not specify the codec format, then **CDC** should be included in the record. If a container format specifies a codec which cannot be changed, then **CDC** should not be included in the record.

Condition:	Optional when Field 11.003 **AOD** = '0', '1', or '2', otherwise omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *CONC* ***Container Code***

The first information item describes the type of digital container used for the voice sample in this record.

A value of '**1**' ("Container MediaType References") shall be used to indicate the container type is not listed the table below, but is found in the IANA Audio or Video registry (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

A container code of '**2**' ("Other") indicates that the container is in neither table and shall be specified in Field 11.051 COM / Comments.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from Table 53 Audio-Visual Container Codes. (1-2N)

Table 53 Audio-visual container codes

Code	Container Type	Common file extension(s)
0	RAW audio format	undefined
1	Container MediaType Reference	various
2	Other	various
3	WAV (RIFF audio)	.wav
4	3GP and 3G2 mobile video	.3gp .3g2
5	AIFF	.aiff .aif
6	MP3 (MPEG-1, Layer 3 audio)	.mp3
7	NIST Sphere	.sph
8	QuickTime (Apple VBR- audio/video/image) (Note: allows pointers to external files and servers)	.mov .qt
9	Video for Windows	.avi
10	Vorbis (OGG audio)	.ogg
11	Windows Media Type 1	.wmv .wma
12	Windows Media Type 2 (Note: allows pointers to external files and servers)	.asf .asx
13	MPEG-4 Part 14	.mp4 .m4p

2) *ECON External Container Reference Code*

The second information item contains a value from the Name column of the IANA Audio or Video registry at (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles). It shall only be used when **CONC** = 1.

Condition:	Mandatory when **CONC** = 1; otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise
Value Constraints:	3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

3) *COM Comments*

The third information item contains additional information about the container or additional instructions for reconstruction of audio output from the stored digital data. Container parameters shall be specified in this information item when required for unambiguous decoding. This item should include a description of any noise reduction processing or equalization that must be applied to faithfully render the voice recording.

Condition:	Mandatory when **CONC** = 2, otherwise optional.
Occurrence:	1 when Condition above is met, 0-1 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.14. 11.014 CDC / Codec

This field provides information about the codec used to encode the voice and audio data in the digital recording. It may only appear when Field 11.003 AOD / Audio Object Descriptor Code is set to ‘0’, ‘1’ or ‘2’; this field is not used if the voice recording is stored on a physical media object as an analog signal.

The presence of Field 11.014: CDC / Codec is dependent upon the type of digital container format and should be included only when it is meaningful in context. For container types that allow different codecs and codec format, CDC should be included in the record if the container format does not specify the codec format. If a container format in Field 11.013: CONT / Container specifies a codec which cannot be changed, then CDC should not be included in the record. CONT need not be present for RAW files, but CDC is mandatory if CONT indicates RAW. This field should be present if CONT is not present in the record.

Condition:	Mandatory when Field 11.013/**CONC** = 0, otherwise optional.
Occurrence:	1 when Condition above is met, 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *CODC* *Codec Code*

This information item indicates the single codec type used for all audio segments in the record. This standard does not accommodate multiple codec types within a single record. If the codec is identified as "Other" (**CODC** = 2), the final information item (comments / **COM**) shall be used to describe the codec. If the codec code is identified as "Codec Type Reference" (**CODC** = 1), a value shall be chosen from the IANA Audio or Video registry (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles) and shall be entered in external codec reference code (**ECOD).**

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from Table 54 Codec Type Codes. (1 N)

Table 54 Codec type codes

Code	Codec type
0	Linear PCM
1	Codec MediaType reference
2	Other
3	Floating-point linear PCM
4	ITU-T G.711[8] (PCM): μ-law with forward order digital samples
5	ITU-T G.711 (PCM): μ-law with reverse order digital samples
6	ITU-T G.711 (PCM): A-law with forward order digital samples
7	ITU-T G.711 (PCM): A-law with reverse order digital samples

2) *SRTN* *Sampling Rate Number*

This information item indicates the number of digital samples per second that represent a second of analog voice data upon conversion to an acoustic signal. The sampling rate is expressed in Hz and must be an integer value. Acceptable values are between 1 and 100,000,000 Hz, but unknown or variable sampling rates shall be given the value of '0'. Common values of SRTN are 8000, 11025, 16000, 22050, 32000, 44100, and 48000 Hz. The value of '0' shall only be used to indicate unknown or variable sampling rate.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 100000000. (1-9 N)

3) *BITD* *Bit Depth Count*

This information item indicates the number of bits that are used to represent a single digital sample of voice data. Encoders of unknown or variable bit depth shall be given the value of '0'.

[8] ITU-T G.711, Pulse code modulation (PCM) of voice frequencies, is available at http://www.itu.int/rec/T-REC-G.711/e

(This field is not intended to be an indication of the actual dynamic range of the voice data). Changes to the bit depth should be logged in Field 98.900 ALF / Audit Log or 11.902 ANN / Annotation Information audit logs. Common values for BITD are 8, 16, 24, and 32 bits.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 1024. (1-4 N)

4) *ENDC* *Endian Code*

This information item indicates which byte goes first for digital samples containing two or more bytes. ENDC is ignored for digital samples that do not contain two or more integer multiples of bytes.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '0' (big) and '1' (little). (1 N)

5) *NFMT* *Numeric Format*

This information item indicates the numeric format used for the digital encoding. It may be an integer – either signed (e.g., 8s) or unsigned (e.g., 8u), or a floating-point number - either binary (e.g., 32b) or decimal (e.g., 64d). Numeric formats for AIFF encoding[9] may be signified without a letter (e.g., 80).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 9999, optionally followed one of 's', 'u', 'b', or 'd'. (1-5 AN)

6) *CHC* *Channel Count*

This information item contains the integer number of channels of data represented in the digital voice data file. Common values for CHC are 1 and 2 channels.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 9999. (1-4 N)

7) *ECOD* *External Codec Reference Code*

[9] AIFF is based on the 1985 version of IEEE Standard for Floating-Point Arithmetic.
https://www.loc.gov/preservation/digital/formats/fdd/fdd000005.shtml#specs

This information item contains a value from the Name column of the IANA Audio or Video registry (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles). If the codec is not listed in the registry, enter the name, and enter description of the codec in **COM**.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

8) *COM* ***Comments***

This information item can contain additional information about the codec or additional instructions for reconstruction of audio output from the stored digital data. Codec parameters shall be specified in this information item when required for unambiguous decoding. This item should include a description of any noise reduction processing or equalization that must be applied to faithfully render the voice recording.

Condition:	Mandatory when **CODC** = 2, otherwise optional
Occurrence:	1 when Condition above it met, 0-1 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.15. 11.015 – 11.020 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.16. 11.021 RED / Redaction

This field indicates whether the voice recording has been redacted, meaning that some of the audio record has been overwritten or erased to delete speech content without altering the relative timings within, or the length of, the segments. This field is not to be used to indicate that audio content has been snipped with the alteration of the relative timings in, or length of, the recording. This field may be present to indicate that redaction has or has not occurred, even if Field 11.022 RDD / Redaction Diary is not present in the record to provide timings and tracks for the affected segments (if redaction did occur).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *RDI* ***Redaction Indicator***

The first information item indicates whether the voice recording contains overwritten or erased sections intended to remove semantic content deemed not suitable for transmission or storage, without altering the length of the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

Code	Description
0	no redaction occurred
1	redaction has occurred
2	the organization creating this record is not able to assert or does not assert that redaction has occurred or not occurred.

2) *RDA* *Redaction Authority Organization Name*

The second information item contains information about the agency that directed, authorized or performed the redaction. Agencies undertaking redaction activities should log their actions by noting the change of field contents in Field 98.900 ALF / Audit Log and/or Field 11.902 ANN / Annotation Information.

Condition: Optional when **RDI** = 1, Omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

3) *COM* *Comments*

The third information item contains free-text information about the redactions affecting the stored voice recording.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.17. 11.022 RDD / Redaction Diary

This field indicates that redaction has occurred and lists the timings within the voice recording of redacted (overwritten) audio segments. Each redaction is represented by a separate subfield. It may be present even if Field 11.021 RED / Redaction is not in the record, however if **RED** is present, then this field shall not appear if the redaction indicator **RDI ≠ 1**.

Condition: Optional when Field 11.021 **RDI** = 1 or does not exist, otherwise omitted

Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SID* ***Segment Identifier***

The first information item uniquely numbers the redaction to which the subsequent items in the subfield apply. There is no requirement that the redactions be numbered sequentially.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 600000. (1-6 N)

2) *TRK* ***Track and Channel Number List***

The second information item lists all tracks or channels on the recording to which the segment identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo recording where both tracks contain a redaction at the same start and end times, this list will be '1' and '2'. A single value of '0' indicates that all tracks or channels are to be used. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition:	Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or 11.014 **CHC** > 1), Optional otherwise
Occurrence:	1 list containing up to 9,999 values when Conditions above are met, 0-1 list otherwise
Value Constraints:	1 ≤ integer ≤ 9999 for each value in the list. (1+ NS)

3) *RST* ***Relative Start Time***

The third information item indicates in microseconds the time of the start of the redaction relative to the beginning of the voice recording in this Type-11 record (not in the Type-20 original source recording, if such a record exists in this transaction). Redactions on the same track of the audio object should not overlap. If the Type-11 record refers to an analog recording, the method of determining the start time shall be given in the **COM** item of this subfield.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99999999998. (1-11 N)

4) *RET* *Relative End Time*

The fourth information item indicates in microseconds the time of the end of the redaction relative to the beginning of the voice recording. Redactions on the same track of the audio object should not overlap.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	**RST** < integer ≤ 99999999999. (1-11 N)

5) COM* *Comments

The fifth information item contains free-text comments to be made about a redaction.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.18. 11.023 VDD / Voice Data Discontinuities

This field is used to indicate post-recording removal (cutting) of a signal, or non-presence of a useful signal for any reason, from the original recording of the acoustic vocalizations in a way that disrupts time references. Non-presence of a signal can occur, for instance if there is a partial equipment failure – such as for a particular channel. Such a case should be indicated in COM, since the lack of a signal was not caused by a post-recording action upon the recording. Non-presence of a useful signal can be total absence of any recorded data, or a case such as having a constant hum due to failure to correctly connect all of the recording devices. This field may be present to indicate that signals are discontinuous in time, even if Field 11.024: DCD / Discontinuities Diary is not present in the record to provide timings and tracks for the timing discontinuities.

The Mnemonic and name for this field were changed in this version of the standard to disambiguate it from both Field 9.342: CLD (Discontinuities) and Field 9.324: DIS.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *DCI* *Voice Data Discontinuity Indicator*

The first information item indicates whether the voice recording contains temporal discontinuities.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

Code	Description
0	no discontinuities
1	discontinuities
2	the organization creating this record is not able to assert or does not assert that there are or are not discontinuities in the recording

2) *CTA* *Cutting Authority Organization Name*

The second information item contains information about the agency that performed a post-processing cutting upon the original recording (removing signal content). Agencies undertaking post-processing cutting activities should log their actions in Field 98.900 ALF / Audit Log and/or Field 11.902 ANN / Annotation Information of this record.

Condition: Optional when **DCI** = 1, Omitted otherwise

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

3) *COM* *Comments*

The third information is a free-text string that may contain information about the snip activities affecting the voice recording. A practical use of this information item is to log the reasons for discontinuities that occurred during the recording of the signals (such as when the equipment was turned off for 18 ½ minutes).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.19. 11.024 DSD / Voice Data Discontinuities Diary

This field allows the documentation of discontinuities in the voice data signal. Each discontinuity is registered in a separate subfield. It may be present even if Field 11.023 **VDD** is not in the record, however this field shall not appear if the voice data discontinuity indicator **DCI = 0**. If **VDD** is present in the record and **DCI** = 1, it is highly recommended that this field be present.

A practical use of DCD is when an original recording is stored in a Type-20 record and segments relating to a single speaker are combined and conveyed in a Type-11 record. DCD then indicates the locations of the temporal discontinuities within the resulting Type-11 record.

Condition:	Optional when Field 11.023 **VDD** ≠ 0, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SID* ***Segment Identifier***

The first information item uniquely numbers the discontinuity to which the subsequent items in the subfield apply. There is no requirement that the discontinuities be numbered sequentially.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 600000. (1-6 N)

2) *TRK* ***Track and Channel Number List***

The second information item lists all tracks or channels on the recording to which the segment identifier applies. It is mandatory if item **TRC** in 11.012 PMO / Physical Media Object or **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo recording where both tracks have snipped segments (removed signal) at the same start and end times, this list will be '1' and '2'. If a single-track recorder failed for a period of time (such as having the cord accidentally unplugged), then it could be possible to have a list comprised solely of the value '2'. A single value of '0' indicates that all tracks or channels are to be used. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition:	Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or 11.014 **CHC** > 1), Optional otherwise
Occurrence:	1 list containing up to 9,999 values when Conditions above are met, 0-1 list otherwise
Value Constraints:	1 ≤ integer ≤ 9999 for each value in the list. (1+ NS)

3) *RST* ***Relative Start Time***

The third information item indicates in microseconds the time of the start of the discontinuity relative to the beginning of the voice recording in this Type-11 record (not in the Type-20 original source recording, if such a record exists in this transaction). Discontinuities on the same track of the audio object shall not overlap. If the Type-11 record refers to an analog recording, the method of determining the start time shall be given in the **COM** item of this subfield.

Condition:	Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999999999. (1-11 N)

4) *RET* *Relative End Time*

The fourth information item indicates in microseconds the time of the end of the discontinuity relative to the beginning of the voice recording. Discontinuities on the same track of the audio object shall not overlap. It is possible for **RET** to be equal to **RST** (such as when a recording session is stopped and later restarted). If **RET** > **RST**, that indicates that the content has been removed or is not present but not redacted (masked). For instance, a failure to pick up audio signals for a period of time (perhaps only in selected channels or tracks).

Condition: Mandatory

Occurrence: 1

Value Constraints: **RST** ≤ integer ≤ 99999999999. (1-11 N)

5) COM *Comments*

The fifth information item contains free-text comments to be made about a discontinuity. This comment field could contain word or phonic level transcriptions, language translations or security classification markings, as specified in exchange agreements.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.20. 11.025 VOC / Vocal Content

This field indicates whether the voice recording content has been diarized, meaning that time markings are included in Field 11.026 VCD / Vocal Content Diary, to indicate the speech segments of interest pertaining to the subject of this Type-11 record. If content has been extracted from a longer recording, it is referred to as a "snip." This field may be used for individual snips, as well as concatenated snips. If snips are handled in this Type-11 record, it is highly recommended that the original recording be contained in or referenced by a Type-20 record. This field may also be used to indicate diarization of a complete recording that has not been snipped.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *DII* ***Diarization Indicator***

The first information item indicates whether the voice recording is accompanied by a segment diary in Field 11.026 indicating speech segments from the voice signal subject of the Type-11 record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**0**' (no diary) or '**1**' (diary). (1 N)

2) *DAU* ***Diarization Authority Organization Name***

The second information item contains information about the agency that performed the diarization. Agencies undertaking diarization activities on the original speech should log their actions by appending to this item and noting the change of field contents in the Field 98.900 ALF / Audit Log and/or Field 11.902 ANN / Annotation Information of this record. This information item shall only appear if **DII** = 1.

Condition:	Optional when **DII** = 1, Omitted otherwise
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

3) *COM* ***Comments***

The third information item contains text information about the diarization activities undertaken on the voice data.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.21. 11.026 VCD / Vocal Content Diary

This field contains subfields that locate the segments within the voice recording of this Type-11 record that are associated with a single speaker – the subject of the record (not necessarily the subject of the transaction). Although Field 11.025 VOC / Vocal Content need not be present in the record if this field is included in the record, it is highly recommended that it be present. If Field 11.025 is included in the record, then this field shall be present only if **DII** = 1.

Each diarized segment shall contain speech from the subject of this record, although a segment may contain speech collisions. A speaker's involvement in a conversation may be segmented in a way independent of turn taking as the content, speaking style and collection conditions change. Within each Type-11 record, there may be only one segment diary describing a single

speaker within the single voice recording. If additional diarizations of this voice recording are necessary -- for example, to locate segments of speech from a second speaker in the voice recording, additional Type-11 records must be created. The identity of each speaker can be cross-referenced to biographic information contained in a Type-2 record.

This field may be used for individual snips, as well as concatenated snips. If snips are handled in this Type-11 record, it is highly recommended that the original recording be contained in or referenced by a Type-20 record. This field may also be used for a complete recording that has not been snipped.

Condition:	Optional when Field 11.025 **DII** ≠ 0, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SID* ***Segment Identifier***

The first information item uniquely numbers the segment to which the following items in the subfield apply. There is no requirement that the segments be numbered sequentially.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 600000. (1-6 N)

2) *TRK* ***Track and Channel Number List***

The second information item lists all tracks or channels on the recording to which the segment identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo recording where both tracks contain a segment at the same start and end times, this list will be '1' and '2'. A single value of '0' indicates that all tracks or channels are to be used. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition:	Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or 11.014 **CHC** > 1), Optional otherwise
Occurrence:	1 list containing up to 9,999 values when Conditions above are met, 0-1 list otherwise
Value Constraints:	1 ≤ integer ≤ 9999 for each value in the list. (1+ NS)

3) *RST* ***Relative Start Time***

The third information item indicates in microseconds the time of the start of the segment relative to the beginning of the voice recording in this Type-11 record (not in the Type-20 original source recording, if such a record exists in this transaction). Because each segment is expected to be dominated by the primary subject of this Type-11 record, segments should not overlap. The RST of a segment should not occur earlier than the end of a previous segment from the same track, although this is not prohibited. If the Type-11 record refers to an analog recording, the method of determining the start time shall be given in the **COM** item of this subfield.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99999999998. (1-11 N)

4) ***RET*** ***Relative End Time***

The fourth information item indicates in microseconds the time of the end of the segment relative to the beginning of the voice recording. **RET** from different segments in this Type- 11 record should not overlap, although this is not prohibited.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	**RST** < integer ≤ 99999999999. (1-11 N)

5) COM ***Comments***

The fifth information item contains free-text comments about the segment.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

The following information items concern the tagged date and time. These are useful, for instance, if a video recorder did not have the correct date and time set.

6) ***TDT*** ***Tagged Date***

The sixth information item gives the date indicated on the original, contemporaneous capture of the voice recording in the segment identified in this Type-11 record. This item may be different from the value of the **ORD** if the tag is determined to be inaccurate.

Condition:	Optional
Occurrence:	0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date.

7) *TST* *Tagged Start Time*

The seventh information item gives the time tagged on the original, contemporaneous capture of the voice recording in the segment identified.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

8) *TET* *Tagged End Time*

The eighth information item gives the time tagged on original, contemporaneous capture of the voice data at the end of the segment identified.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

9) *ORD* *Original Recording Date*

The ninth information item gives the date of the original, contemporaneous capture of the voice recording in the segment identified. This item may be different from the value of **TDT** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date.

10) *SRT* *Segment Recording Start Time*

The tenth information item gives the local start time of the original, contemporaneous capture of the voice recording in the segment identified. This item may be different from the value of **TST** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

11) *END* *Segment Recording End Time*

The eleventh information item gives the local end time of the original, contemporaneous capture of the voice recording in the segment identified. This item may be different from the value of **TET** if the tag is determined to be inaccurate.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

12) ***TMD*** ***Time Source Description Text***

The twelfth information item gives the reference for the values used in ORD, SRT and END.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

13) ***TCOM*** ***Timing Comments***

The thirteenth information item is an unrestricted text string that allows for comments of any type to be made on the timings of the segment recording, including the perceived accuracy of the values of ORD, SRT and END.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.22. 11.027 OCON / Other Content

This field is optional and indicates whether the recording content has been diarized (in Field 11.028: OCD / Other Content Diary) in order to indicate the segments of the recording that may contain sounds other than the voice of the subject of the record that could assist in the investigation, such as the sound of an automobile accident in a recording.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) ***DII*** ***Diarization Indicator***

The first information item indicates whether the voice recording is accompanied by a segment diary in Field 11.028 from the signal contained in or referred to by the Type-11 record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**0**' (no diary) or '**1**' (diary). (1 N)

2) ***DAU*** ***Diarization Authority Organization Name***

The second information item contains information about the agency that performed the diarization. Agencies undertaking diarization activities on the original speech should log their actions by appending to this item and noting the change of field contents in the Type-98 record and/or Field 11.902 ANN / Annotation Information of this record. This information item shall only appear if **DII** = 1.

Condition:	Optional when **DII** = 1, Omitted otherwise
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

3) ***COM*** ***Comments***

The third information item contains text information about the diarization activities undertaken on the recording.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.23. 11.028 OCD / Other Content Diary

This field contains subfields that locate the segments within the recording of this Type- 11 record that may be of interest for investigatory purposes but are not focused upon speech. Although Field 11.027 OCON / Other Content need not be present in the record if this field is included in the record, it is highly recommended that it be present. If Field 11.027 is included in the record, then this field shall be present only if **DII** = 1.

Condition:	Optional when Field 11.027 **DII** ≠ 0, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SID* ***Segment Identifier***

The first information item uniquely numbers the segment to which the following items in the subfield apply. There is no requirement that the segments be numbered sequentially.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 600000. (1-6 N)

2) *TRK* ***Track and Channel Number List***

The second information item lists all tracks or channels on the recording to which the segment identifier applies. It is mandatory if item **TRC** in Field 11.012 PMO / Physical Media Object or **CHC** of Field 11.014 CDC / Codec is greater than one. No value in this list shall be greater than the value of **TRC** or **CHC**, whichever applies. For example, in the case of a two-track stereo recording where both tracks contain a segment at the same start and end times, this list will be '1' and '2'. A single value of '0' indicates that all tracks or channels are to be used. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each track/channel is a separate value.

Condition:	Mandatory when multiple tracks or channels occur (11.012 **TRC** > 1 or 11.014 **CHC** > 1), Optional otherwise
Occurrence:	1 list containing up to 9,999 values when Conditions above are met, 0-1 list otherwise
Value Constraints:	1 ≤ integer ≤ 9999 for each value in the list. (1+ NS)

3) *RST* ***Relative Start Time***

The third information item indicates in microseconds the time of the start of the segment relative to the beginning of the recording. Segments from the same track of the audio object should not overlap. The RST of a segment should not occur earlier than the end of a previous segment from the same track, although this is not prohibited. If the Type-11 record refers to an analog recording, the method of determining the start time shall be given in the **COM** item of this subfield.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 99999999998. (1-11 N)

4) *RET* ***Relative End Time***

The fourth information item indicates in microseconds the time of the end of the segment relative to the beginning of the recording. **RET** from different segments in this Type- 11 record should not overlap, although this is not prohibited.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	**RST** < integer ≤ 99999999999. (1-11 N)

5) COM Comments

The fifth information item contains free-text comments about the segment.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

The following information items concern the tagged date and time. These are useful, for instance, if a video recorder did not have the correct date and time set.

6) *TDT Tagged Date*

The sixth information item gives the date indicated on the original, contemporaneous capture of the recording in the segment identified. This item may be different from the value of the **ORD** if the tag is determined to be inaccurate.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date

7) *TST Tagged Start Time*

The seventh information item gives the time tagged on the original, contemporaneous capture of the recording in the segment identified.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

8) *TET Tagged End Time*

The eighth information item gives the time tagged on original, contemporaneous capture of the recording at the end of the segment identified.

Condition:	Optional
Occurrence:	0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

9) *ORD* *Original Recording Date*

The ninth information item gives the date of the original, contemporaneous capture of the recording in the segment identified. This item may be different from the value of **TDT** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a full local date. For encoding-specific format, see Section 5.1.1 Local Date

10) *SRT* *Segment Recording Start Time*

The tenth information item gives the local start time of the original, contemporaneous capture of the voice recording in the segment identified. This item may be different from the value of **TST** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

11) *END* *Segment Recording End Time*

The eleventh information item gives the local end time of the original, contemporaneous capture of the recording in the segment identified. This item may be different from the value of **TET** if the tag is determined to be inaccurate.

Condition: Optional

Occurrence: 0-1

Value Constraints: Must be a local datetime. For encoding-specific format, see Section 5.1.3 Local Datetime

12) *TMD* *Time Source Description Text*

The twelfth information item gives the reference for the values used in **ORD**, **SRT** and **END**.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 300 characters from user-specified set as indicated in Field 1.015 DCS. (1-300 U)

13) *TCOM* *Timing Comments*

The thirteenth information item is an unrestricted text string that allows for comments of any type to be made on the timings of the segment recording, including the perceived accuracy of the values of **ORD**, **SRT** and **END**.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.24. 11.029 – 11.031 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.25. Vocal Content Segments

The Fields 11.032 – 11.038 pertain to the vocal content segments individually (or in groups) or to the entire recording. There may be different segment identifier list (SIL) values for the different subfields in each of these fields. Note that Field 11.034 only has one set of values (a list of the segments having voice collision). A value of '0' in SIL indicates that the values in that particular subfield are the default values for the entire recording. Values in other subfields of the same field, with lists of specific segment identifiers, take precedence over any default values.

6.11.26. 11.032 SGEO / Vocal Segment Geographical Information

This field gives the geographical location of the primary subject of the Type-11 record at the beginning of that segment. This field shall only be present if Field 11.026 VCD / Vocal Content Diary is also present.

Condition:	Optional when Field 11.026 **VCD** is present, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) ***SIL*** ***Segment Identifier List***

The first information item lists the segment identifiers to which the values in this subfield pertain. The number of segment identifiers is limited to 600,000, which are represented as integers in a list. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a separate value. A value of '0' in this subfield indicates the segment geographical information in this subfield shall be considered the default value for all segments not specifically identified in other occurrences of this subfield. Values in other subfields of this field, with lists of specific segment identifiers, take precedence over any default values.

Condition:	Mandatory

Occurrence:	1 list, containing up to 600,000 values
Value Constraints:	0 ≤ integer ≤ 600000 for each value in the list. (1+ NS)

2) *SCT* ***Segment Cell Tower Code***

The second information item identifies the cell phone tower, if any, that relayed the audio data at the start of the segment or segments referred to in this subfield.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

3 - 16) *Geographic Sample Acquisition Location*

The third through sixteenth information items contain the location information as described in Section 5.9 Geographic Sample Acquisition Location, omitting the first item, Universal Time Entry (UTE).

6.11.27. 11.033 SQV / Vocal Segment Quality Values

This field describes the quality values of the recording segments. If segments have multiple quality values based on different types of quality assessments, a separate subfield shall be entered for each assessment. This field shall only be present if Field 11.026 **VCD** / Vocal Content Diary is also present.

In previous versions of this standard, the fifth information item was “COM,” used to capture remarks about the segment quality. For this revision, a new set of information items has been added to all the quality value fields, which necessitated the deprecation of “COM” for consistency.

Condition:	Optional when Field 11.026 is present, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *SIL* ***Segment Identifier List***

The first information item lists the segment identifiers to which the values in this subfield pertain. The number of segment identifiers is limited to 600,000, which are represented as integers in a list. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by ‘|’ (vertical bar). For XML/JSON encoding, each identifier is a separate value. A value of ‘0’ in this subfield indicates the quality information in this subfield shall be considered the default value for all segments not specifically identified in other occurrences of this subfield. Values in other subfields of this field, with lists of specific segment identifiers, take precedence over any default values.

Condition:	Mandatory
Occurrence:	1 list, containing up to 600,000 values
Value Constraints:	0 ≤ integer ≤ 600000 for each value in the list. (1+ NS)

2) *QVU* *Quality Value*

This information item shall contain the image quality value assigned to the recording data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality value. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

3) *QAV* *Algorithm Vendor ID*

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality value. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

4) *QAP* *Algorithm Product Identification*

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality value.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

5) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.11.28. 11.034 VCI / Vocal Collision Identifier

This field indicates that a vocal collision (two or more persons talking at once) occurs within the segment. This field has repeating values; each value represents a separate segment. This field shall only be present if Field 11.026 VCD / Vocal Content Diary is also present.

Condition: Optional when Field 11.026 **VCD** is present, otherwise omitted

Occurrence: 0-1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 600,000 Subfields; 1 Information Item as described below

Contains:

The sole information item in each repeating subfield provides the Field 11.026 **SID** for a recording segment that contains a vocal collision.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 600000. (1-6 N)

6.11.29. 11.035 PPY / Vocal Segment Processing Priority

This field indicates the desired processing priority for all segments listed. Segments not identified should be given the lowest priority. The priorities specified in this field do not conflict with that of Field 1.006: PRY / Priority, which indicates the processing priority of the entire transaction. This field has repeating subfields; each subfield represents a separate priority. This field shall only be present if Field 11.025 VOC / Vocal Content is present.

Condition:	Optional when Field 11.025 **VOC** is present, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 9 Subfields; 1 Information Item as described below

Contains:

1) *SIL* ***Segment Identifier List***

The first information item lists the segment identifiers to which the priority in this subfield pertains. The number of segment identifiers is limited to 600,000, which are represented as integers in a list. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a separate value. A value of '0' in this subfield indicates the processing priority information in this subfield shall be considered the default value for all segments not specifically identified in other occurrences of this subfield. Values in other subfields of this field, with lists of specific segment identifiers, take precedence over any default values.

Condition:	Mandatory
Occurrence:	1 list, containing up to 600,000 values
Value Constraints:	0 ≤ integer ≤ 600000 for each value in the list. (1+ NS)

2) *PTY* ***Processing Priority***

The second information item indicates the priority with which the segments identified in this subfield should be processed. Priority values shall be between 1 and 9 inclusive. A value of 1 will indicate the highest priority and 9 the lowest.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 9. (1 N)

6.11.30. 11.036 VSCT / Vocal Segment Content Description

This field gives assessments of the content of the voice data within the identified segment(s) and includes provision for semantic transcripts, phonetic transcriptions and translations of the segment(s). It shall only appear if Field 11.025 VOC / Vocal Content is present in this record. At least one of the information items in addition to **SIL** shall be present in this field.

Condition:	Optional when Field 11.025 **VOC** is present, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SIL* ***Segment Identifier List***

The first information item gives the segment identifiers to which the values in this subfield pertain. The number of segment identifiers listed is limited to 600,000. If multiple segments are identified, they are designated as integers in a list. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a separate value. A value of '0' in this subfield indicates the vocal segment content information in this subfield shall be considered the default value for all segments not specifically identified in other occurrences of this subfield.

Condition:	Mandatory
Occurrence:	1 list, containing up to 600,000 values
Value Constraints:	0 ≤ integer ≤ 600000 for each value in the list. (1+ NS)

2) *TRN* ***Transcript Text***

The second information item contains a semantic transcription of the segment(s).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *LNG* ***Transcript Language***

The third information item is the transcript language. It is optional but shall only be in the subfield if **TRN** is present in the subfield. It states the 3-character ISO 639-3 code for the language of the translation included in this subfield.

Condition:	Optional when **TRN** is present, omitted otherwise
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	Code value selected from ISO 639-3[10]. (3 A)

4) *PTT* ***Phonetic Transcript Text***

[10] https://iso639-3.sil.org/

The fourth information item contains a phonetic transcription of the segment(s). This may use a formal or informal (i.e., based upon the language conventions of the record creator) convention.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *PTC* ***Phonetic Transcript Convention***

The fifth information states the phonetic transcript convention used in **PTT**. It shall only be present if **PTT** is present in the subfield. It is a free-text field, but some recommended entries are:

IPA	International Phonetic Alphabet
Informal	Informal transcription using spelling conventions of the language of the transcriber
American	Americanist phonetic notation
Arpabet	Advanced Research Projects Agency (ARPA) phonetic transcription, also used in the CMU Pronouncing Dictionary
Merriam	Pronunciation symbols defined in the Merriam-Webster dictionary

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 100 characters from user-specified set as indicated in Field 1.015 DCS. (1-100 U)

6) *TLT* ***Translation Text***

The sixth information item contains a translation of the segment into a language other than the one in which the original segment was spoken. If a text is translated into multiple languages, a separate subfield is generated for each language.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *TLG* ***Translation Language***

The seventh information item states the 3-character ISO 639-3 code for the language of the translation text included in this subfield. It shall only be in the subfield if **TLT** is present in the subfield.

Condition:	Optional when **TLT** is present, omitted otherwise
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	Code value selected from ISO 639-3[11]. (3 A)

8) *COM* ***Comments***

The eighth information item contains comments on the content of the segment.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9) *TAC* ***Transcript Authority Comments***

The ninth information item states the authority providing the transcription, translation or comments in **TRN**, **PTT**, **TLT** or **COM**. If an automated process was used to develop the transcript, information about the process (i.e., the automated algorithm used) should be stated.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.31. 11.037 SCC / Vocal Segment Speaker Characteristics

This field gives an assessment of the characteristics of the voice within the segment, including intelligibility, emotional state and impairment. This field shall only appear if Field 11.025 VOC / Vocal Content exists in the record. At least one of the information items in addition to **SIL** shall be present in this field.

Condition:	Optional when Field 11.025 **VOC** is present, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SIL* ***Segment Identifier List***

[11] https://iso639-3.sil.org/

The first information item lists the segment identifiers to which the values in this subfield pertain. The number of segment identifiers is limited to 600,000, which are represented as integers in a list. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a separate value. A value of '0' in this subfield indicates the vocal segment speaker characteristic information in this subfield shall be considered the default value for all segments not specifically identified in other occurrences of this subfield. Values in other subfields of this field, with lists of specific segment identifiers, take precedence over any default values.

Condition:	Mandatory
Occurrence:	1 list, containing up to 600,000 values
Value Constraints:	0 ≤ integer ≤ 600000 for each value in the list. (1+ NS)

2) ***SPL*** ***Speaker List***

The second information item is a list of unique identifiers for the speakers in the segments identified in **SIL**. The identifiers are user-specified and are not in any pre-specified or correlated order of appearance in the information item. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by '|' (vertical bar); therefore, the special character '|' shall not be used in the identifiers. For XML/JSON encoding, each identifier is a separate value. This information item may be used in conjunction with T2C. It is also used when separate Type-2 records are not contained in the transaction for each speaker in a recording, but when it is possible to establish them as separate identities, or as possibly separate identities. The level of certainty of the creator of the record of a truly unique separate identity is not implied by this information item or by T2C.

Condition:	Optional
Occurrence:	0-1 list, containing up to 9,999 values
Value Constraints:	1 to 4 characters from user-specified set as indicated in Field 1.015 DCS for each value in the list. (1+ U)

3) ***T2C*** ***Type-2 Record Cross-Reference***

The third information item contains the IDC value of the Type-2 record that describes relevant biographic information and other data concerning the subject of this instance of the record, who may be different from the subject of the transaction. Its content is similar to Field x.992 in certain other Record types. See Section 5.11.2 T2C / Type-2 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

4) ***IMP*** ***Impairment Level Number***

The fourth information item indicates a subjective, observed level of neurological diminishment, whether from fatigue, disease, trauma, or the influence of medication/substances, across the speech segments identified. No attempt is made to differentiate the sources of impairment. The value shall be an integer between '0' (no noticed impairment) and '5' (significant), inclusive.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 5. (1 N)

5) *DSL* *Dominant Spoken Language Code*

The fifth information item gives the 3-character ISO 639-3 code for the dominant language in the segments identified in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value selected from ISO 639-3[12]. (3 A)

6) *LPS* *Language Proficiency Scale Number*

A sixth information item rates the subjective estimation of the fluency of the language being spoken on a scale of '0' (no proficiency) to '9' (high proficiency).

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 9. (1 N)

7) *STY* *Speech Style Code*

The seventh information item describes the style of speech in the segment(s). There may be no more than one value for each of the segments identified in this subfield and will indicate the dominant style of speech within the segments. If attribute code '12' is chosen to indicate "other", additional explanation should be included in **COM** below.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

Code	Description
0	Unknown
1	Public speech (oratory)
2	Conversational telephone
3	Conversation face-to-face

[12] https://iso639-3.sil.org/

4	Read
5	Prompted/repeated
6	Storytelling/Picture description
7	Task induced speech
8	Interview
9	Recited/memorized
10	Spontaneous/free
11	Variable
12	Other

8) *INT* ***Intelligibility Scale Code***

The eighth information item describes the subjective evaluation of the speech from '0' (unintelligible) to '9' (clear and fully intelligible).

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 9. (1 N)

9) *FDC* ***Familiarity Degree Code***

The ninth information item indicates the perceived degree of familiarity between the data subject and the interlocutor, which ranges from '0' indicating no familiarity to '5' indicating high familiarity/intimacy.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 5. (1 N)

10) *HCM* ***Health Comments***

The tenth information item notes any observable health issues impacting the data subject during the speech segment, such as symptoms of the common cold (hoarse voice, pitch lowering, increased nasality), has emphysema, and/or if the data subject regularly smokes tobacco or uses other products that may affect the voice.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

11) *EMC* ***Emotional State Code***

The eleventh information item gives a subjective estimation of the emotional state of the data subject across the segments identified in this subfield. Only one value for this item is allowed across all of the segments identified in this subfield. If emotional state code '9' or '10' is chosen to indicate "variable" or "other", additional explanation may be included in the information item **COM** below.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

Code	Description
0	Unknown
1	Calm
2	Hurried
3	Happy/joyful
4	Angry
5	Fearful
6	Agitated /Combative
7	Defensive
8	Crying
9	Variable
10	Other

12) *VES* *Vocal Effort Scale Number*

The twelfth information item reports the subjective, perceived vocal effort of the subject across the identified segments. Only one value between '0' (very low vocal effort) and '5' (screaming/crying) is allowed for this item in each subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 5. (1 N)

13) *VSC* *Vocal Style Code*

The thirteenth information item assesses the subjective predominant vocal style of the data subject across the identified segments. Only one value is allowed for this item in each subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

Code	Description
0	Unknown
1	Spoken
2	Whispered
3	Sung
4	Chanted
5	Rapped
6	Mantra
7	Falsetto/Head voice
8	Spoken with laughter
9	Megaphone/Public Address System
10	Shouting/yelling
11	Other

14) *RAI* ***Recording Awareness Indicator***

The fourteenth information item indicates whether the data subject is aware that a recording is being made. '0' indicates unknown, '1' indicates aware and '2' indicates unaware.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0 ≤ integer ≤ 2. (1 N)

15) *SCR* ***Script Text***

The fifteenth information item may be used to give the script used for read, prompted, or repeated speech.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

16) *COM* ***Comments***

The sixteenth information item may be used to give additional information about the characteristic assessment process, including a description of any characteristic assessment algorithms used, notes on any known external stresses applicable to the data subject, such as extreme environmental conditions or heavy physical or cognitive load, and a description of how the values in the items of this subfield were assigned.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.32. 11.038 SCH / Vocal Segment Channel

This field describes the transducer and transmission channel within the identified segments. This field shall only be present if Field 11.025 **VOC** / Vocal Content appears in this record.

Condition:	Optional when Field 11.025 **VOC** is present, otherwise omitted
Occurrence:	0-1 when Condition above is met, 0 otherwise
Value Constraints:	1 to 600,000 Subfields; Information Items as described below

Contains:

1) *SIL* ***Segment Identifier List***

The first information item gives the segment identifiers to which the values in this subfield pertain. The number of segment identifiers listed is limited to 600,000. If multiple segments are identified, they are designated as integers in a list. In Traditional encoding, this list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each identifier is a separate value. A value of '0' in this subfield indicates the vocal segment channel information in this subfield shall be considered the default value for all segments not specifically identified in other occurrences of this subfield.

Condition: Mandatory

Occurrence: 1 list, containing up to 600,000 values

Value Constraints: 0 ≤ integer ≤ 600000 for each value in the list. (1+ NS)

2) *ACD* *Audio Capture Device Type Code*

The second information item describes the audio capture device type. A value of '2' indicates that more than one type of microphone is being used simultaneously to collect the audio signal. For many of the acquisition sources in Field 11.008 AQS / Acquisition Source, the audio capture device type and microphone type code (MTC) shall be unknown.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1-2 N)

Code	Description
0	Unknown
1	Array
2	Multiple style microphones
3	Earbud
4	Body Wire
5	Microphone
6	Handset
7	Headset
8	Speaker phone
9	Lapel Microphone
10	Other

3) *MTC* *Microphone Type Code*

The third information item specifies the transducer type. Transducer arrays using mixed transducer types shall be designated "other".

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from the table, below. (1 N)

Code	Description
0	Unknown

1	Carbon
2	Electret
3	Dynamic
4	Other

4) *ENV* ***Capture Environment Text***

The fourth information item describes the acoustic environment of the recording. Examples of text placed in this item would be “busy restaurant”, “urban street”, “public park during day”.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *DST* ***Transducer Distance***

The fifth information item specifies the approximate distance in centimeters, rounded to the nearest integer number of centimeters, between the speaker in the identified segments and the transducer. A value of ‘0’ shall be used if the distance is less than one centimeter.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 99999. (1-5 N)

6) *AQC* ***Acquisition Source Code***

The sixth information item specifies the source from which the voice in the identified segments was received. Only one value is allowed. Permissible values are given in Table 52 Voice Acquisition Source Code. Any conflict between this value and Field 11.008: AQS / Acquisition source shall be resolved by taking this item to be correct for all segments identified in the relevant subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 52 Voice Acquisition Source Code. (2 N)

7) *VMT* ***Voice Modification Description Text***

The seventh information item is a description of any digital masking between transducer and recording, disguisers or other attempts to change the voice quality. Any processing techniques used on the recording should be indicated, such as Automated Gain Control (AGC), noise reduction, etc.

Condition: Optional

Occurrence: 0-1

Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

8) *COM Comments*

The eighth information item is for additional information to identify or describe the transduction and transmission channels of the identified segments.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.33. 11.039 – 11.050 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.34. 11.051 COM / Comments

This field is an optional unrestricted text string that may contain comments of any type on the Type 11 record as a whole. Comments on individual segments shall be given in the information item COM in Field 11.024 DSD / Voice Data Discontinuities Diary, or Field 11.026 VCD / Vocal Content Diary. This field should record any intellectual property rights associated with any of the segments in the voice recording, any court orders related to the voice recording and any administrative data not included in other fields.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.35. 11.052 – 11.099 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.36. 11.100 – 11.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.11.37. 11.901 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.38. 11.902 ANN / Annotation Information

This field lists the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations. This field logs information pertaining to this Type-11 record and the voice recording pointed to or included herein. This field is not intended

to contain any transcriptions or translations but may contain information about the source of such fields in the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as "Zulu time" or "Zero time" and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.39. 11.903 – 11.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.40. 11.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 11.004 SRC / Source agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.11.41. 11.994 EFR / External File Reference

This field allows voice data to be referenced at a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 11.999 DATA / Voice Data. These two fields are mutually exclusive, and one shall be present in all instances of this record type, except when Field 11.003 AOD / Audio Object Descriptor Code is set to a value of '**5**'. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when Field 11.999 **DATA** is absent, and Field 11.003 **AOD** ≠ 5. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) ***EFL*** ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) ***EFF*** ***External File Format***

The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.11.42. 11.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 11.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) ***ACN*** ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) ***ASP Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's 21.016 SEG / Segments / ASP in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.11.43. 11.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 11.999 DATA of this record or at the location specified in Field 11.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exists in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.11.44. 11.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 11.999 DATA or 11.994 EFR was derived. Note that for voice records the second information item, RSP / Reference Segment Position is not used, since segmentation of an image is not applicable to voice. See Section 5.11.5.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The sole information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

6.11.45. 11.998 Reserved for Future Use Only by ANSI/NIST-ITL

6.11.46. 11.999 DATA / Voice Data

This field, if present, contains the recording described in the other fields of this record. If Field 11.994 EFR / External File Reference is present in this record, then this field shall not appear. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 11.994 EFR is absent **and** Field 11.003 AOD ≠ 5. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.12. Record Type-12: Forensic Dental and Oral Record

Record Type-12 is designed to accommodate oral biometric and forensic data based upon the ANSI/ADA Standard No. 1058 - Forensic Dental Data Set and ANSI/ADA Standard No. 1067 – Standard Functional Requirements for an Electronic Dental Record System. This record type facilitates the exchange of data to agencies that may use different data storage and/or matching systems, such as NCIC, WinID, NamUs, UVIS/UDIM, and FastID.

The Type-12 record shall contain and be used to exchange information that may be used to identify or confirm the identity of persons using dental biometrics and forensic odontological procedures to compare prior data and current data. It is consistent with the ANSI/ADA Standard No. 1058 - Forensic Dental Data Set of the American Dental Association (ADA) and uses the tooth numbering system stated in ANSI/ADA Designation System for Teeth and Areas of the Oral Cavity, Standard No. 3950. The term “current data” refers to the available data for the individual in his/her current state and does not necessarily mean data sampled at the present point in time. “Prior data” refers to data collected when that individual was in a different, previous state/condition than the current condition.

Separate Type-12 records are generated for the prior (e.g., antemortem) and for the current data (e.g., postmortem). Data elements are included in each Type-12 record to clearly distinguish the timeframe of the data collection from the subject of the transaction. To minimize confusion, the word *antemortem* is used in this document instead of prior data and *postmortem* is used instead of current data in those cases where identification only concerns a decedent.

For identification of unknown deceased, as noted by the ADA in Section 6 of Standard No. 1058, the antemortem forensic data set should consist of:

- familial data set (recommended to be contained in Record Type-2)
- dental history data set (contained in Record Type-12)
- tooth data set (contained in Record Type-12)
- mouth data set (contained in Record Type-12)

- visual image data set (contained in Record Type-10)
- radiographic image data set (contained in Record Type-22)

The postmortem forensic dental data set should consist of 4 components:

- tooth data set (contained in Record Type-12)
- mouth data set (contained in Record Type-12)
- visual image data set (contained in Record Type-10)
- radiographic image data set (contained in Record Type-22)

For living persons unable / unwilling to identify themselves, the same sets of data apply but the first group should be viewed as “prior” and the second grouping as “current.” For cases involving the transmission of dental and oral data about an individual for potential law enforcement purposes, the most current data available on that individual should be supplied in a Type-12 record.

It is important to emphasize that lack of specification of a condition in the data for this record does NOT mean that a condition is NOT present, but simply that the sender did not convey the information.

Application profiles of this standard shall specify the applicable upper limit for all elements with unlimited maximum occurrence (denoted as ‘+’ or ‘*’).

While the standard allows Traditional encoding for a Type-12 record, the user should be aware that many forensic dental systems are (or are being) designed to use XML/JSON encoding for ANSI/NIST-ITL transactions.

6.12.1. 12.001 LEN / Record Length

The length of the entire Type-12 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encoding, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.12.2. 12.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. Each IDC may be used to relate information items to the other records in the transaction. Two or more records may share a single IDC solely to identify and link together records that pertain to different representations of the same biometric trait. See Section 5.11.1 IDC / Information Designation Character and Section 5.3.2 Leading Zeroes in Field Values for additional information.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.12.3. 12.003 FDS / Forensic Dental Setting

This field is used to describe the forensic setting that carried out the analysis of the dental and oral data to identify or confirm the identity of the subject. This field is not used when data is gathered and transmitted without forensic analysis.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *FACC* ***Forensic Analyst Category Code***

The first information item shall describe the head of the team that processed the forensic data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 A)

Code	Description
M	Medical Examiner
D	Dental Professional / Forensic Odontologist
A	Forensic Anthropologist
T	Technician
O	Other

2) *FOPC* ***Forensic Organization Primary Contact Information***

The second information item should include the name, telephone number, and e-mail address of the person responsible for the analysis.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1-1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

3) *FSCC* ***Forensic Source Country Code***

The third information item represents the location where the forensic analysis was performed, not the location from which the forensic data or sample were sent for analysis. **FSCC** defaults to

ISO-3166-1 coding. If 1.018 GNS / Geographic Name Set is set to GENC, then **FSCC** is from the GENC list.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Code value from *ISO-3166-1* or GENC. (2-3 AN)

6.12.4. 12.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 12.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.12.5. 12.005 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.6. 12.006 DSI / Dental Subject Information

This field contains data that would not typically be contained in Type-2 records but are very important for identification of unknown deceased or persons unable to identify themselves. Here, the term “subject” refers to the person (alive or dead) to whom the information applies.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *DSC* ***Subject Status Code***

The first information item shall record the status of the individual at the time when the relevant data was recorded. For instance, if data is provided from a dentist’s office to assist in Disaster Victim Identification, the value for DSC would be ‘A’, since the patient was alive at the time of the last dental appointment. For a different instance of a Type-12 record, created by a Medical Examiner, the value for DSC would be ‘D’. Note that separate records shall exist for prior and current information, which may have the same or different DSC value, depending upon the circumstances.

Condition:	Mandatory
Occurrence:	1

Value Constraints: Code value from table, below. (1 A)

Code	Description
X	Status of individual unknown
A	Data obtained from a living person (antemortem)
D	Data obtained from a non-living person (deceased)

2) *DLCD* *Subject – Last Contact Date*

The second information item shall contain the last known date of contact with the subject of the record. This is particularly useful in missing persons cases. This is typically the last examination date if the records are from a dentist's office.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

3) *DRLC* *Subject – Range of Last Contact Date Estimate*

The third information item estimates the amount of time from **DLCD** ± during which the last known date of contact with the subject of the record could have occurred. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in **DLCD**. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates a date value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. For example, 'P6M' is a range of **DLCD ±** 6 months.

Condition: Optional when **DLCD** occurs; Omitted otherwise

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

4) *DPBD* *Subject – Person Birth Date*

The fourth information item should record the subject birthdate, if records are available. In forensic examination, enter an approximate date.

Condition: Optional

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

5) *DRBD* *Subject – Range of Birth Date Estimate*

The fifth information item contains the amount of time from **DPBD** ± during which the subject's birthdate could fall. In Traditional format, it is entered in the format as YyyMmmDdd. It is

possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in **DPBD**. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates a date value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. For example, 'P6M' is a range of **DPBD ±** 6 months.

Condition:	Optional when **DPBD occurs**; Omitted otherwise
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	Encoding-specific formatted Duration. (2-9 AN)

6) *DPET* *Subject – Person Ethnicity Text*

The sixth information item describes the ethnic group to which the subject belongs. This is not selected from a fixed list, since terminology that is useful in one area may not be relevant in another.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1-50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

7) *DRAC* *Subject DNA Records Availability Code*

The seventh information item indicates if DNA records are available for the subject. This need not be specified if a Type-18 record is contained in the transaction, but it is highly suggested to do so.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**1**' (yes) and '**2**' (no). (1 N)

8) *DCLD* *Subject Collection Location Description*

The eighth optional information item describes the location of the data collection. An example is "Lower jaw recovered 4.3 meters from the tip of the left wing of the airplane, in grid 7W. Separated from skull. Four teeth found within 20 centimeters of the lower jaw." This may be a more descriptive entry than that of Field 12.998 GEO / Geographic Sample Acquisition Location, which is typically the geographic location specified in GPS coordinates or with reference to a fixed landmark.

Condition:	Optional

Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

9) *DEDD* ***Subject – Estimated Death Date***

The ninth item contains an estimated date of death. It shall only appear if the subject is deceased, and the data sample was collected postmortem.

Condition:	Optional when **DSC** = D, otherwise omitted
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	Local Datetime or Partial Local Datetime (see Section 5.1 Dates)

10) *DRDE* ***Subject – Range of Death Date Estimate***

The tenth item shall only appear if **DEDD** is present in the field. It contains the amount of time from **DEDD** ± during which the death could have taken place. In Traditional format, it is entered in the format as **Y**yy**M**mm**D**dd**h**hh**m**mm. It is possible to enter only a year, month and/or day range, such as 'h5', meaning that the actual date of collection is estimated to be 5 hours plus or minus from that specified in **DEDD**. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnDTnHnMnS. "P" indicates a datetime value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. "T" indicates the start of a time section (if needed), "nH" indicates the number of hours, "nM" indicates the number of minutes, "nS" indicates the number of seconds. For example, 'PT6H' is a range of **DEDD ±** 6 hours.

Condition:	Optional when **DEDD occurs**; Omitted otherwise
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	Encoding-specific formatted Duration. (2-15 AN)

11) *DTER* ***Subject – Death Time Estimate Rationale Text***

The eleventh item contains the reasoning presented for an estimated time of death. It shall only appear if DRDE is present in the field.

Condition:	Optional when **DRDE** occurs, otherwise omitted
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

12) *DEAT* ***Subject – Death Age Estimate Text***

The twelfth item contains the reasoning presented for an estimated age at death. It shall appear only if **DRDE** is present in the field.

Condition:	Optional when **DRDE** occurs, otherwise omitted
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.7. 12.007 ODES / Original Dental Encoding System Information

This field specifies the rules and definitions that were used to describe the original dental data collection. It need not be a forensic data system or a system capable of formulating an *ANSI/NIST-ITL* conformant record or transaction.

Either this field, or Field 12.008: TDES / Transmittal Dental Encoding System Information, or both shall be present in the record if Field 12.010 TDD / Tooth Data Detail appears in this record.

If the transmitting system is different than the original system, then both Field 12.007 and Field 12.008 should be contained in the record. However, this standard allows a record to be created with only the transmitting system data for cases where the original system data may no longer be available.

Condition:	Mandatory when **TDD** occurs and **TDES** is absent, otherwise Optional
Occurrence:	1 when Condition above is met; 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *OSNC* ***Original System Name Code***

The first information item names the original system used to collect the dental data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Dental System Code value selected from Table 55 Dental System Codes. (3-6 A)

Table 55 Dental system codes

Dental System Code	Description
EDR	Electronic Dental Record System
FastID	Interface for completing the INTERPOL Disaster Victim Identification forms
NamUs	The National Missing and Unidentified Persons System
NCIC	The National Dental Image Repository of the National Crime Information Center (NCIC) run by the Federal Bureau of Investigation (FBI)
PLASS	The DVI System International marketed by Plass Data Software A/S
UDIM	The Unified Dental Identification Module (UDIM) of the Unified Victim Identification System (UVIS)
WinID	Dental Identification System
Other	The coding system is not listed but is formally documented
None	The ANSI/ADA Standard No. 1058 – Forensic Dental Codes are selected and entered directly.

2) *OSVT* *Original System Version Text*

The second information item shall contain the original system version. It specifies version of the data system that was used in the original coding. When OSNC is set to 'Other' or 'EDR', this information item is mandatory and specifies the official brand name of the software utilized, and optionally the version number if known. If information of the location of documentation for the software is available such as a URL / URI it can also be included with a text beginning with the word 'URL:'.

Condition: Mandatory when **OSNC** = 'Other' or 'EDR', otherwise Optional

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OTPC* *Original Tooth Permanence Category Code*

The third information item designates the way permanent and deciduous teeth are coded according to the system used to enter the data.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 56 Tooth Permanency Codes. (1 N)

Table 56 Tooth permanency codes

Tooth Permanency Code	Description
0	Specified by tooth number (e.g., FastID, PLASS). For systems such as WinID and UDIM, which internally list the tooth number with a permanent tooth number but use a deciduous indicator, those two pieces of information shall be combined together to assign the tooth number according to *ANSI/ADA Standard No. 3950* prior to inclusion in this record.
1	Unable to determine if the teeth are permanent or deciduous at the tooth level but the system does allow a marker to indicate that deciduous teeth are present in the dentition (e.g., NCIC). The permanent tooth number shall be used.
2	Coding system incapable of distinguishing deciduous from permanent teeth (e.g., NamUs). The permanent tooth number shall be used.
3	Unknown whether the coding is capable of indicating deciduous and permanent teeth and / or whether the coding was performed using that capability. The permanent tooth number shall be used.

4) *ORDG* *Original Restoration Data Granularity Code*

The fourth information item indicates the type and level of restoration and surface information coded in Field 12.010 TDD / Tooth Data Detail. The codes in the Restoration Data Granularity Codes are entered.

Condition: Mandatory

Occurrence: 1

Value Constraints: Granularity Code value from Table 57 Restoration Data Granularity Codes. (2 N)

Table 57 Restoration data granularity codes

Granularity Codes	Description
11	The system is capable of specifying individual restorations with the restored surface information and material composition coded separately for each restoration on the tooth; however, the submission of restorations with materials specified for each restoration is optional. (e.g., Plass, FastID)
21	The system is capable of specifying individual restorations with the restored surface coded separately; however, all of the individual material compositions are combined into a single code for the tooth. Material specification is optional. Unknown material composition may be implicitly or explicitly coded.
31	The system is capable of coding individual restorations with restored surfaces into a single code. All the materials utilized in all the restorations are combined into a single code when materials are represented. The codes are specified by tooth. (e.g., WinID, UDIM)
41	The presence of restorations without surface information is combined to a single code for the tooth. All materials utilized in all the restorations are combined into a single code for the tooth, when materials are represented. (e.g., NCIC)
51	Only the presence of restorations without surface or material information is included in the coding. (e.g., NamUS)
99	The level of detail contained in Field 12.010: TDD / Tooth data detail concerning restorations, materials and/or surfaces is unknown.

5) *OMPN Original Morphology – Positional Numbering Code*

The fifth information item indicates whether the assignment of tooth numbers was done on a morphological basis (shape of the tooth regardless of the location in the arch) or positional basis (the location of the tooth regardless of the morphology). There is often no distinction, but in certain cases, the result can be different.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 58 Morphology / Positional Numbering Codes. (1 N)

Table 58 Morphology / positional numbering codes

Code	Description
0	Unknown
1	Developer specified morphological coding
2	Developer specified positional coding
3	Coder specified morphological coding independent of developer specification
4	Coder specified positional coding independent of developer specification

6.12.8. 12.008 TDES / Transmittal Dental Encoding System Information

This field describes the dental encoding system that is associated with the transmission of this record.

Either this field, or Field 12.007 ODES, or both shall be present in the record if Field 12.010 TDD / Tooth Data Detail appears in this record. If the transmitting system is different than the original system, then Field 12.007 shall be, and Field 12.008 should be contained in the record.

If there is a chain of systems involved in creating the record, it is highly recommended that 12.902 ANN / Annotation Information be used to log the steps involved from origin to present state. Note that if the record creation organization wishes to transmit the information that was

received from an intermediate organization (before modification), Field 12.010 TDD / Tooth Data Detail allows for this possibility.

Condition:	Mandatory when **TDD** occurs and **TDES ≠ ODES**, otherwise Optional
Occurrence:	1 when Condition above is met; 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *TSNC* ***Transmittal System Name Code***

The first information item names the original system used to collect the dental data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Dental System Code value selected from Table 55 Dental System Codes, above. (3-6 A)

2) *TSVT* ***Transmittal System Version Text***

The second information item specifies the version of the system that was used in the transmitted coding (such as ‘2012 version’ for UVIS/UDIM). When TSNC is set to ‘Other’ or ‘EDR’, this information item is mandatory and specifies the official brand name of the software utilized, and optionally the version number if known. If information for the location of documentation concerning the software is available, such as a URL / URI, it can also be included with a text beginning with the word ‘URL:’.

Condition:	Mandatory when **TSNC** = ‘Other’ or ‘EDR’, otherwise Optional
Occurrence:	1 when Condition above is met; 0-1 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *TTPC* ***Transmittal Tooth Permanence Category Code***

The third information item designates the way permanent and deciduous teeth are coded according to the system used to enter the data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from Table 56 Tooth Permanency Codes, above. (1 N)

4) *TRDG* ***Transmittal Restoration Data Granularity Code***

The fourth information item indicates the type and level of restoration and surface information coded in Field 12.010 TDD / Tooth Data Detail. The codes in the Restoration Data Granularity Codes are entered.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Granularity Code value from Table 57 Restoration Data Granularity Codes, above. (2 N)

5) *TMPN* *Transmittal Morphology – Positional Numbering Code*

The fifth information item indicates whether the assignment of tooth numbers was done on a morphological basis (shape of the tooth regardless of the location in the arch) or positional basis (the location of the tooth regardless of the morphology). There is often no distinction, but in certain cases, the result can be different.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Code value from Table 58 Morphology / Positional Numbering Codes, above. (1 N)

6.12.9. 12.009 HDD / Dental History Data Detail

This field should be included when prior data is available to provide dental history for the subject.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *HARC* *Dental History ADA Reference Code*

The first information item must be a valid code from *ANSI/ADA Standard No. 1058*, Section 8 Each additional code is entered in a separate subfield. If HARC is set to ‘8.1.3.10’ (the ADA code for CHART), the chart is contained in Field 12.999 DATA / Dental Chart Data. If the chart is already in electronic format, it should be converted into Base64 prior to sending to avoid the use of any “reserved” characters in XML or JSON. If the chart is physical, the most common approach is to scan the chart and transmit the PDF or JPEG of the scan, also converted to Base64. However, it is possible to specify an external storage location for the chart using Field 12.994.

Condition:	Mandatory

Occurrence:	1
Value Constraints:	A valid code value corresponding to the data set descriptors in Section 8 of the *ANSI/ADA Standard No. 1058* may be entered. (3-30 NS)

2) *HADT* ***Dental History Additional Descriptive Text***

The second information item shall be used for the text portion of those codes that require text, such as '8.1.1 Name of Practice – *the full name of the practice where the patient was treated'*.

Condition:	Mandatory when HARC value requires additional text, otherwise omitted
Occurrence:	1 when condition above is met; 0 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.10. 12.010 TDD / Tooth Data Detail

If this field is present, then Field 12.007 ODES and / or Field 12.008 TDES shall also be present in the record. For coding systems that combine tooth conditions into a single subfield at the tooth level, one subfield is used per tooth. If information is available separately for conditions on a particular tooth, each condition shall be a separate subfield with the same tooth number. There may be multiple subfields with the same tooth number.

All destination systems should be capable of receiving data relating to a single tooth in multiple subfields, even if tooth conditions in the destination system are expressed jointly at the tooth level. If a destination system that can express tooth conditions separately does receive information from a system that is not capable of expressing tooth conditions separately, the destination system should take care concerning the assignment of *ANSI/ADA Standard No. 1058* codes to individual conditions on the tooth.

For cases when there is no information about a tooth (e.g., even whether it was missing or present), there shall be no field entry. However, if it is known that a tooth was missing, the appropriate *ANSI/ADA Standard No. 1058* – Forensic Dental Codes should be represented, such as '9.3.2.2 – Missing not replaced' – *used regardless of the etiology of the lost (extracted, congenital, unknown) with the exception of the case where the tooth lost was believed to be an avulsion*.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *TDR* ***Tooth Data - Date of Recording***

The first information item corresponds to Section 9.2 of *ANSI/ADA Standard No. 3950*. It is mandatory that this information item appear in at least one subfield. It need not appear in all subfields.

Condition:	Optional, but must occur in at least one subfield
Occurrence:	0-1
Value Constraints:	Full Local date. For encoding-specific format, see Section 5.1.1 Local Date.

2) *TDRR* *Tooth Data - Date of Recording Estimated Accuracy Range*

The second information item estimates the amount of time from **TDR** ± during which the tooth data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in **TDR**. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates that there is a date value range; "nY" is the number of years, "nM" is the numbers of months, and "nD" is the number of days.

Condition:	Optional when **TDR** occurs, otherwise omitted.
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	Encoding-specific formatted Duration. (2-9 AN)

3) *TID* *Tooth ID*

The third information item numbers the tooth utilizing the permanent and deciduous teeth codes in *ANSI/ADA Specification No. 3950* (See Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950). Note that if 12.007 ODES/ **OTPC** indicates that there is no distinction between deciduous teeth and permanent teeth in the original coding, the tooth shall be listed as permanent, even if the transmittal coding is capable of distinguishing between the two types of teeth. The analyst should be aware of this when reviewing the data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Valid tooth code from *ANSI/ADA Specification No. 3950*. (2 N)

Right																Left	
							00										Oral cavity
							01										Maxillary area
							10					20					Quadrant
			03					04					05				Sextant
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28		Permanent teeth
			55	54	53	52	51	61	62	63	64	65					Deciduous teeth
			85	84	83	82	81	71	72	73	74	75					Deciduous teeth
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38		Permanent teeth
			08					07					06				Sextant
							40					30					Quadrant
							02										Mandibular area

Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950

4) *TOET* *Tooth Data - Original System Data Encoding Text*

The fourth information item contains the description of a tooth as recorded by the original data capturing system. It shall be entered unless 12.007 ODES / **OSNC** has a value of 'None' (representing that the coding was performed by using the codes of *ANSI/ADA Standard No. 1058 – Forensic Dental Data Set* without specific reference to a dental forensic processing system's data restrictions).

If data is coming from a dental practice management software system (**OSNC** is set to 'EDR'), this information item shall contain all of the conditions treated and they shall be listed in order, from the most recent to the first treated. The order is critical for the forensic analysis.

Condition:	Mandatory when **OSNC** ≠ None, otherwise **Optional**
Occurrence:	1 when Condition above is met; 0-1 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

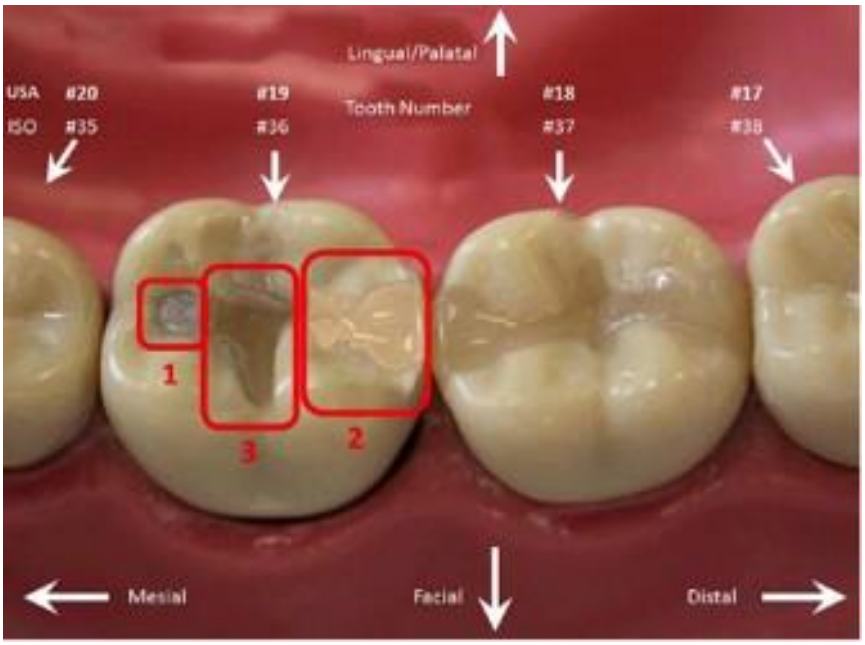


Figure 14 Simulated restorations in tooth 36

A tooth with three restorations (as in Figure 14 Simulated Restorations in Tooth 36) may be described differently by various storage and comparison systems. See the XML/JSON exemplars for the actual coding.

Plass: amf O cef DO tif O

Plass distinguishes each restoration and describes their material content individually. The Plass coding is:

restoration 1 is an amalgam restoration (amf) in occlusal location (O)

restoration 2 is a composite restoration (cef) in distal – occlusal location (DO)

restoration 3 is a tooth-colored restoration (tif) in occlusal location (O)

Note: This would be coded using three subfields.

UDIM: DO mAC

UDIM does not distinguish the number of restorations or describe them individually. The coding indicates the presence of restorations at the distal and occlusal locations (DO) and that the materials (m) are amalgam (A) and composite (C). UDIM has four code types: tooth surface status (required), restoration code – r (optional), condition code – c (optional), material code – m (optional).

WinID: DO ES

WinID does not distinguish the number of restorations or describe them individually. The coding indicates the presence of restorations at the distal and occlusal locations (DO). The fillings are listed as resin (E) and silver (S).

NCIC: OD

NCIC does not distinguish the number of restorations or describe them individually. The required surface sequence for restoration data is MODFL. This coding example indicates the presence of restorations in the distal and occlusal locations (OD).

NamUs: F

NamUs does not distinguish the number of restorations or describe them individually. In addition, NamUs does not directly code the restoration composition, nor does NamUs describe which surfaces are restored. The coding only indicates the presence of a restoration.

5) *TARC Tooth Data - ADA Reference Code List*

The fifth information item is a list of code values from Section 9 of the *ANSI/ADA Standard No. 1058* which pertain to the tooth. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each code is a separate value.

Condition:	Mandatory
Occurrence:	1 list containing up to 100 values
Value Constraints:	One valid code value from Section 9 of the *ANSI/ADA Standard No. 1058* for each value in the list. (3+ NS)

The *ANSI/ADA Standard No. 1058* coding system has a hierarchical arrangement so that codes with more nodes (represented by periods) provide greater specificity of the information concerning a characteristic. Note that if only general information is available, a code with fewer nodes may be entered, such as 9.3.2.5, which corresponds to *present – restored*. If available information is more detailed, a code with more nodes should be entered, such as 9.3.2.5.1.3, which indicates *present – restored; surfaces restored; distal*. The listing of a reference code indicates the presence of the characteristic.

The coding is order independent, so a code of '9.3.2.5.1.3' (Distal) followed by '9.3.2.5.1.2' (Occlusal) is treated identically to an entry of '9.3.2.5.1.2' (Occlusal) followed by a code of '9.3.2.5.1.3' (Distal). If the original system coding is very detailed but the transmitting system coding is at a summary (represented by codes with fewer nodes) level the mapping is straightforward. However, if the converse is true, care must be taken not to introduce "false" information in the mapping of codes.

Using the example for Figure 14 Simulated Restorations in Tooth 36:

Plass: Three subfields describe the tooth.

In the first subfield, for the first condition (restoration 1) (amf O)

TARC = 9.3.2.5.1.2 9.3.2.5.4.1

(present-restored, occlusal location) (present-restored, amalgam material)

In the second subfield, for the second condition (restoration 2) (cef DO)

TARC = 9.3.2.5.1.3 9.3.2.5.1.2 9.3.2.5.4.2

(present-restored, distal location) (present-restored, occlusal location) (present-restored, composite/acrylic material)

In the third subfield, for the third condition (restoration 3) (tif O)

TARC = 9.3.2.5.1.2 9.3.2.5.4.9

(present-restored, occlusal location) (present-restored, other – by report) Note: 'By report' indicates that **TADT** should explain that '9.3.2.5.4.9' here represents tooth colored filling. '9.3.2.5.4.9' is used since the composition of the restorative material is not specified in the code.

UDIM: **TOET** = OD mAC

One subfield that describes the entire tooth:

TARC = 9.3.2.5.1.2 9.3.2.5.1.3 9.3.2.5.4.1 9.3.2.5.4.2

(present-restored, occlusal location) (present-restored, distal location) (present-restored, amalgam material) (present-restored, composite/acrylic material)

WinID: **TOET** = OD ES

One subfield that describes the entire tooth:

TARC = 9.3.2.5.1.2 9.3.2.5.1.3 9.3.2.5.4.1 9.3.2.5.4.2

(present-restored, occlusal location) (present-restored, distal location) (present-restored, amalgam material) (present-restored, composite/acrylic material)

NCIC: **TOET**= OD

One subfield describes the entire tooth:

TARC = 9.3.2.5.1.2 9.3.2.5.1.3

(present-restored, occlusal location) (present-restored, distal location)

NamUs*:* **TOET** = F

One subfield that describes the entire tooth:

TARC = 9.3.2.5

(present-restored)

An example of how a person might code the tooth without reference to a particular system using the *ANSI/ADA Standard No. 1058 – Forensic Dental Codes* could be:

Two subfields with one describing the tooth:

In the first subfield, the restoration is described, but without a location.

TARC = 9.3.2.5.4.1

(present-restored, amalgam material)

In the second subfield, the other restorations are jointly described, again without location associated to the restorations on the tooth.

TARC = 9.3.2.5.4.9

(present-restored, other – by report)

The analyst may have indicated in **TADT** that there are other restorations that appear to be NON-metallic on the same tooth.

6) *TTET* *Tooth Data - Transmitted System Encoding Text*

The sixth information item contains the description of a tooth as recorded by the system transmitting the data. This is important since the record creation systems may be different from the original system where the coding of the test first occurred.

Condition:	Mandatory when **OSNC ≠** 'None' and TDES is present, otherwise Omitted
Occurrence:	1 when Condition above is met; 0 otherwise
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

Using some of the examples above, referring to Figure 14 Simulated Restorations in Tooth 36:

The first subfield for **Plass** would be *amf O;* the second subfield would be *cef DO*

The entry for **UDIM** would be *OD mAC*.

7) *TICC* *Tooth ID Certainty Code*

The seventh information item describes the certainty of the tooth number. If it is not entered, a **TICC** of '0' is assumed.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Code value from table, below. (1 N)

Code	Description
0	Unspecified (the system does not have the capability of stating that there is certainty or uncertainty in the tooth number)
1	Certain
2	Uncertain

8) *TADT* *Tooth Data - Additional Descriptive Text*

The eighth information item is used for those codes that require text, such as 9.3.2.5.3.1.1.5 – *restoration material / Other (by report) – used to describe a restoration material not described by other descriptors*.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.11. 12.011 MDD / Mouth Data Detail

This field allows the entry of information concerning the mouth. For instance, periodontal disease may be noted, as may partial removable dentures.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *MDR* ***Mouth Data - Date of Recording***

The first information item contains the date of the recording of the mouth data. It is mandatory that it appear in at least one subfield of this field.

Condition:	Optional, but must occur in at least one subfield
Occurrence:	0-1
Value Constraints:	Full Local date. For encoding-specific format, see Section 5.1.1 Local Date

2) *MDRR* ***Mouth Data - Date of Recording Estimated Accuracy Range***

The second information item estimates the amount of time from **MDR** ± during which the mouth data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in **MDR**. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates that there is a date value range; "nY" is the number of years, "nM" is the numbers of months, and "nD" is the number of days.

Condition:	Optional when **MDR** occurs, otherwise omitted.
Occurrence:	0-1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

3) *MARC Mouth Data - ADA Reference Code List*

The third information item is a list of code values from Section 10 of the *ANSI/ADA Standard No. 1058* which pertain to the mouth. In Traditional encoding, the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). For XML/JSON encoding, each code is a separate value.

Condition: Mandatory

Occurrence: 1 list containing one or more values

Value Constraints: One valid code value from Section 10 of the *ANSI/ADA Standard No. 1058* for each value in the list. (3+ NS)

The *ANSI/ADA Standard No. 1058* coding system has a hierarchical arrangement so that codes with more nodes (represented by periods) provide greater specificity of the information concerning a characteristic. If only general information is available, a high-level number may be entered, such as '10.3.2.4', which corresponds to Maxillofacial Prosthesis. If more detailed information is available, a lower-level code should be entered, such as '10.3.2.4.1.1', which indicates Maxilla (The prosthesis is used to replace portions of the maxilla). The listing of a code indicates that the characteristic is present. If only general information is available, a code with fewer nodes may be entered, such as '10.3.2.2', which corresponds to Partial Removable Denture. If available information is more detailed, a code with more nodes should be entered, such as '10.3.2.2.1', which indicates Kennedy Class I – This Descriptor is used to describe a removable prosthesis replacing teeth on both sides of the arch where no other teeth exist posterior to the edentulous area.

4) *MADT Mouth Data - Additional Descriptive Text*

The fourth information item is used for those codes that require text, such as '10.3.5.1' Prosthetic / ID Data – used to describe any identifying Serial number on the appliance. Other reference codes, such as '10.5.1.1.8.1' Cleft lip – *used to indicate the non-union of the soft tissue of the lip*, would not have any information recorded in MADT.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.12. 12.012 DSTI / Dental Casts and Impressions

This field is used to transmit information about models fabricated from a dental arch impression or tooth imprints.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *SDR* ***Dental Casts and Impression – Date of Recording***

The first information item provides the date that any dental casts or impressions were recorded. It is mandatory that it appear in at least one subfield of this field.

Condition: Optional, but must occur in at least one subfield

Occurrence: 0-1

Value Constraints: Full Local date. For encoding-specific format, see Section 5.1.1 Local Date

2) *SDRR* ***Dental Casts and Impressions - Date of Recording Estimated Accuracy Range***

The second information item estimates the amount of time from **SDR** ± during which the dental casts and impressions data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in **SDR**. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates that there is a date value range; "nY" is the number of years, "nM" is the numbers of months, and "nD" is the number of days.

Condition: Optional when **SDR** occurs, otherwise omitted.

Occurrence: 0-1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

3) *SRC* ***Dental Casts and Impressions - Reference Code***

The third information item describes the dental study model used. If the model data has been digitally stored, it may be transmitted in a Type-22 record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

Code	Description
1	Dental Study Model – Maxillary arch model only
2	Dental Study Model – Mandibular arch model only
3	Dental Study Model - Maxillary and Mandibular arch models
4	Tooth Impression(s)

4) *SADT* ***Dental Study and Tooth Imprints - Additional Descriptive Text***

The fourth information item provides descriptive text for dental casts and impressions. It may be used to describe the physical location of the tooth imprint or dental study, if not stored in electronic format. If the study (or cast model) is available in 3D electronic format (such as ply or stl), it is transmitted in a Type-22 record. This information item should also be used to describe any special characteristics of note concerning the dental study or tooth imprint. In the case of tooth imprints, the tooth or teeth numbers should be stated, using the tooth numbering specified in Figure 13 Digital designation of the teeth and of the oral cavity as specified in ANSI/ADA Standard No. 3950.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.13. 12.013 – 12.019 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.14. 12.020 COM / Comments

This field is an optional unrestricted text string that may contain comments of any type on the Type-12 record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.15. 12.021 – 12.046 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.16. 12.047 CON / Capture Organization Name

This field contains the name of the organization which captured the dental information in the current record, for example a coroner's office that captures dental information from a decedent's body in a morgue would be listed in CON. Note that this can be different from the agency entered in Field 12.004 SRC / Source Agency and Field 12.993 SAN / Source Agency Name, which describe the agency that created the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.12.17. 12.048 – 12.199 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.18. 12.200 – 12.900 UDF / User-Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.12.19. 12.901 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.20. 12.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a dental record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be the name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.21. 12.903 – 12.989 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.22. 12.990 T10C / Type-10 Record Cross Reference

When used this field contains the IDC value(s) of the Type-10 record(s) that contain images of the oral cavity of the subject of this record. Field 10.003 IMP / Image Type is normally set to 'INTRAORAL', 'EXTRAORAL', 'LIP' or 'FACE' for these photographic images. See Section 5.11.3 Type-10 Reference.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 99 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides the IDC value for a Type-10 record that relates to this dental record. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.12.23. 12.991 T22C / Type-22 Record Cross Reference

When used, this field contains the IDC value of the Type-22 record that contains radiographs or other non-photographic imagery or modeling data for the subject of this record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 99 Subfields; 1 Information Item as described below

Contains:

The sole information item in this field provides the IDC value for a Type-22 record that relates to this dental record. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.12.24. 12.992 T2C / Type-2 Record Cross Reference

When used, this field contains the IDC value of the Type-2 record that contains relevant biographic information and other data concerning the subject of this instance of the record, who may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.12.25. 12.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 12.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.12.26. 12.994 EFR / External File Reference

This field allows dental chart data to be referenced at a storage location that can be separately accessed. When Field 12.009 HDD / Dental History Data Detail indicates that a dental chart is provided (**HARC** = 8.1.3.10) and it is not contained in Field 12.999 DATA / Dental Chart Data, then EFR shall be used to enter the URL/URI or other unique reference to a storage location of the data. The EFR and DATA fields are mutually exclusive; both shall not be present in any instance of this record type.

When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.6 Implementation Domain and Application Profiles.

Condition:	Mandatory when Field 12.999 DATA is absent, and Field 12.009 indicates that a dental chart is provided **(HARC =** 8.1.3.10**)**. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) ***EFL*** ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) ***EFF*** ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.12.27. 12.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 12.999 DATA

but that may be relevant or provide context to the collection of the biometric data. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.12.28. 12.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 12.999 DATA of this record or at the location specified in Field 12.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exists in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.12.29. 12.997 Reserved for Future Use Only by ANSI/NIST-ITL

6.12.30. 12.998 GEO / Geographic Sample Acquisition Location

This information applies to the entire Record Type-12. If different locations are applicable for the collection of the images /samples / data then separate instances of Record Type-12 should be created and transmitted jointly in the same transaction. It specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.12.31. 12.999 DATA / Dental Chart Data

This field, if present, contains the dental chart described in the other fields of this record. If Field 12.994: EFR / External File Reference is present in this record, then this field shall not appear. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 12.994 EFR is absent and Field 12.009 indicates that a dental chart is provided **(HARC =** 8.1.3.10**)**. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.13. Record Type-13: Friction-Ridge Latent Image Record

The Type-13 record shall contain image data acquired from latent captures of friction ridge images. These images may be used by agencies that will automatically extract or require human intervention and processing to extract the desired feature information from the images. Information regarding the scanning resolution used, the image size, and other parameters required to process the image, are recorded as fields within the record. Friction ridge images from deceased individuals are often submitted as latent prints for processing, due to the compromised quality of the image in many circumstances. However, whether all such submissions are handled as Type-13 records is a decision of the implementation domain.

Type-13 image records are used to exchange variable-resolution latent friction ridge image data (fingerprint, palm print and/or plantar) together with fixed and user-defined textual information fields pertinent to the digitized image. In all cases, the scanning resolution for latent images shall be at least 39.37 ppmm (1000 ppi). The variable resolution latent image

data contained in the Type-13 record shall either be uncompressed or the output from a lossless compression algorithm. The number of latent records in a transaction is only constrained by the total number of records that may be contained in a transaction.

6.13.1. 13.001 LEN / Record Length

The length of the entire Type-13 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer. (2+ N)

6.13.2. 13.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information.

Each IDC may be used to relate information items to the other records in the transaction. Two or more records may share a single IDC solely to identify and link together records that pertain to different representations of the same biometric trait. See Section 5.11.1 IDC / Information Designation Character for examples of this use of IDC.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.13.3. 13.003 IMP / Impression Type

The Impression Type describes the manner in which the latent print was obtained.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 59 Type-13 Impression Codes. (1-2 N)

Table 59 Type-13 impression codes

Codes	Description
4	Latent image or impression of friction ridge skin deposited on a surface
43	Contactless capture
28	Other
29	Unknown

6.13.4. 13.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 13.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.13.5. 13.005 LCD / Latent Capture Date

The date that the latent biometric data contained in this record was captured by the Source Agency (SRC).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Full Local Date (see Section 5.1.1 Local Date)

6.13.6. 13.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.13.7. 13.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.13.8. 13.008 SLC / Scale Units

The image sampling frequency (pixel density). If the lifted latent print is transmitted directly from a scanner a value of ‘1’ or ‘2’ shall be used, and the transmitted horizontal and vertical scales shall be the same. If the latent print is contained in a photograph, a value of ‘1’ or ‘2’ shall be entered only if the image of the latent was captured with a scale measurement visible in the image and the pixels across an inch or centimeter can be calculated – given the known

characteristics of the camera and its distance from the latent print. A value of ‘0’ for a latent print indicates that the true pixel density value of the image is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table below. (1 N)

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

6.13.9. 13.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image if SLC has a value of ‘1’ or ‘2’. If SLC has a value of ‘0’, this field shall contain the horizontal component of the pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of THPS could be ‘1000’ for a 1000 ppi sensor.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6.13.10. 13.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image if SLC has a value of ‘1’ or ‘2’, in which case TVPS shall equal THPS. If SLC has a value of ‘0’, this field shall contain the vertical component of the pixel aspect ratio, up to 5 integer digits. For example, if the SLC value = 1, then the value of TVPS could be ‘1000’ for a 1000 ppi sensor.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N) When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used. Any value greater than x.0 and less than x.5 would be rounded down to x, regardless of the number of significant digits to the right of the decimal.

6.13.11. 13.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted grayscale images. All latent imagery, if compressed, shall be compressed using a lossless compression algorithm. Uncompressed imagery is recommended for all latent prints.

Condition: Mandatory

Occurrence: 1

Value Constraints: Label from Table 60 Type-13 Compression Algorithms. (3-5 AN)

Table 60 Type-13 compression algorithms

Label	Description
NONE	Uncompressed
JPEGL	*JPEG (Lossless) – **Legacy** 500ppi Only*
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics)
PNM	Portable Anymap Format (Netpbm)

6.13.12. 13.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel.

Condition: Mandatory

Occurrence: 1

Value Constraints: 8 ≤ integer ≤ 99. (1-2 N) This field shall contain an entry of ‘8’ for normal grayscale values of ‘0’ to ‘255’. Any entry in this field greater than ‘8’ shall be used to represent a grayscale pixel with increased proportion. A maximum of 2 digits is allowed for this field. For color, BPX represents the total number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

6.13.13. 13.013 FGP / Friction Ridge Generalized Position

Each subfield shall contain one possible finger, palm or plantar position that may match the latent image, up to a maximum of 6 possibilities. If the type of friction skin is unknown, each of the possible positions shall be included as separate data entries. Codes ‘0’ (Unknown fingerprint) and ‘20’ (Unknown palm) together address all friction ridge areas on the hands; codes ‘60’ (Unknown sole of foot) and ‘63’ (Unknown toe) together address all friction ridge areas on the feet. Code ‘18’ denotes an unknown friction ridge, from hand or foot. Code ‘19’ shall be used for a latent image that includes substantive portion of the medial or proximal segments of a finger, or the extreme tip of a fingerprint. If code ‘19’ is used, fields 13.014 and 13.015 shall be used. See additional guidance in Section 5.10 Friction Ridge Positions.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 6 Repeating Subfields; information Item as described below

Contains:

1) *FGP* ***Friction Ridge Generalized Position***

Single value representing friction ridge source location from code table below.

Occurrence: 1 per Subfield (max 6)

Condition: Mandatory

Value Constraints: Subset of Table 61 Type-13 Friction Ridge Position Codes. (1-2 N)

Table 61 Type-13 friction ridge position codes

Code	Description
0	Unknown finger
1	Right thumb
2	Right index finger
3	Right middle finger
4	Right ring finger
5	Right little finger
6	Left thumb
7	Left index finger
8	Left middle finger
9	Left ring finger
10	Left little finger
16	Right extra digit
17	Left extra digit
18	Unknown friction ridge
19	EJI or tip
20	Unknown palm
21	Right full palm
22	Right writer's palm
23	Left full palm
24	Left writer's palm
25	Right lower palm
26	Right upper palm
27	Left lower palm
28	Left upper palm
29	Right other
30	Left other
31	Right interdigital
32	Right thenar
33	Right hypothenar
34	Left interdigital
35	Left thenar
36	Left hypothenar
37	Right grasp
38	Left grasp
60	Unknown sole
61	Sole – right foot
62	Sole – left foot
63	Unknown toe
64	Right big toe
65	Right second toe

66	Right middle toe
67	Right fourth toe
68	Right little toe
69	Left big toe
70	Left second toe
71	Left middle toe
72	Left fourth toe
73	Left little toe
74	Front / ball of right foot
75	Back / heel of right foot
76	Front / ball of left foot
77	Back / heel of left foot
78	Right middle of foot
79	Left middle of foot
81	Right carpal delta area
82	Left carpal delta area
83	Right full palm, including writer's palm
84	Left full palm, including writer's palm
85	Right wrist bracelet
86	Left wrist bracelet

6.13.14. 13.014 SPD / Search Position Descriptors

The set of all friction ridge areas against which the latent should be compared, to include finger position, and finger segment or full finger view. To indicate that the latent may have come from any part of the finger, FIC should include both EJI and TIP (in different subfields). If a latent in a Type-13 record is to be compared against different segments of a finger but can be specified more precisely than simply listing EJI, multiple portions of the EJI may be listed – in which the information item FIC indicates the appropriate area of the field. One subfield may, for example, have a PDF of '0' and FIC of 'DST' and another subfield with PDF of '0' and FIC of 'MED'. It is possible to include any combination of PDF and FICs.

Condition:	Mandatory when the finger position code '19' appears in Field 13.013: FGP / Friction Ridge Generalized Position. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 9 Repeating Subfields; Information Items as described below.

Contains:

1) *PDF* ***Probable Decimal Finger Position Code***

The first information item is the probable finger position code.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 9)
Value Constraints:	Code values '0' through '10', '16', or '17', taken from Table 61 Type-13 Friction Ridge Position Codes, above. (1-2 N)

2) *FIC* ***Finger Image Code***

The second information item is finger image code. Latent images of full-length fingers use codes ‘FV1’ through ‘FV4’, as described in Section 5.10.2.2 Joint image segments, finger view codes, and tip codes.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 9)
Value Constraints:	Code value from Table 62 Type-13 Joint Image Segments, Tip, and Finger View Codes. (3 AN)

Table 62 Type-13 joint image segments, tip, and finger view codes

Code	Description
EJI	Entire joint image
TIP	Latent fingertip
FV1	Full finger rolled image
FV2	Full finger plain image – left side
FV3	Full finger plain image – center
FV4	Full finger plain image – right side
PRX	Proximal segment
DST	Distal segment
MED	Medial segment

6.13.15. 13.015 PPC / Print Position Coordinates

This field contains offsets to the locations for the bounding box of the EJI, each of the full finger views, or segments within the EJI. When used, this field shall consist of six mandatory information items describing the type or portion of the image contained in this record and its location within an EJI. Individual full finger or segment definitions may be repeated as repeating sets of information items.

Condition:	Optional if the finger position code ‘19’ appears in Field 13.013: FGP / Friction Ridge Generalized Position. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 12 Repeating Subfields; Information Items as described below.

Contains:

1) *FVC* ***Full Finger View***

The first information item is the full finger view. Values of ‘FV1’ to ‘FV4’ specify the perspective for each full finger view. For a fingertip, the first information item shall be ‘TIP’. FVC will contain the code ‘NA’ if only a proximal, distal or medial segment is available.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)

Value Constraints:	Allowed code values from Table 62 Type-13 Joint Image Segments, Tip, and Finger View Codes are: '**TIP**', '**FV1**', '**FV2**', '**FV3**' or '**FV4**'. Otherwise, it shall contain '**NA**' (not applicable). (2-3 AN)

2) *LOS* ***Location of Segment***

The second information item is used to identify the location of a segment within a full finger view.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	Allowed code values from Table 62 Type-13 Joint Image Segments, Tip, and Finger View Codes are: '**PRX**', '**DST**', or '**MED**'. Otherwise, it shall contain '**NA**' (not applicable). (2-3 AN)

3) *LHC* ***Left Horizontal Coordinate***

The third information item contains the horizontal offset measured in pixels to the left edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	0 ≤ integer ≤ value of Field 13.006 **HLL** (Horizontal Line Length). (1-5 N)

4) *RHC* ***Right Horizontal Coordinate***

The fourth information item contains the horizontal offset in pixels to the right edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	**LHC** < integer ≤ value of Field 13.006 **HLL** (Horizontal Line Length). (1-5 N)

5) *TVC* ***Top Vertical Coordinate***

The fifth information item contains the vertical offset (pixel counts down) to the top of the bounding box.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	0 ≤ integer ≤ value of Field 13.007 **VLL** (Vertical Line Length). (1-5 N)

6) *BVC* ***Bottom Vertical Coordinate***

The sixth information item contains the vertical offset from the upper left corner of the image down to the bottom of the bounding box, measured in pixels.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	**TVC** < integer ≤ value of Field 13.007 **VLL** (Vertical Line Length). (1-5 N)

6.13.16. 13.016 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression providing that the SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that density is directly related to resolution.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.13.17. 13.017 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression providing that the SLC field contains a '1' or '2'. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution. If SLC is '1' or '2' and SHPS is entered, then SVPS shall equal SHPS.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.13.18. 13.018 RSP / Ruler or Scale Presence

This field allows the user to state whether a ruler or other known scale is present in the image, or to note the standard fingerprint form used.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	Information Items as described below. Information Item **4** shall be present only when Information Items 1-3 are absent.

Contains:

1) *RSU* ***Ruler or Scale Units***

The first information item indicates the units of measurement visible on the ruler or measurement scale.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	Allowed values are '**IN**' (inches), '**MM**' (millimeters), and '**BOTH**' (both inches and millimeters). (2-4 A)

2) *RSM* ***Ruler or Scale Make***

The second information item lists the maker of the ruler or scale (if known).

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

3) *RSO* ***Ruler or Scale Model***

The third information item lists the model of the ruler or scale (if known).

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 to 50 characters from user-specified character set as indicated in Field 1.015 DCS. (1-50 U)

4) *RSF* ***Standard Fingerprint Form Number***

The fourth information item permits entry of a standard fingerprint form number such as FD-249, FD-258 or C-216C.

Condition:	Mandatory when none of the other three Information Items (RSU, RSM, or RSO) are specified; Omitted otherwise.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 99 characters from user-specified character set as indicated in Field 1.015 DCS. (1-99 U)

6.13.19. 13.019 REM / Resolution Method

This field states the method used for determining the pixel density of the image. The field consists of eight information items. The second through the seventh information items are mandatory if **MDR** = RULER and are optional if **MDR** = FORM. Otherwise, they shall not occur. When the known scale coordinates are used, the resolution can be calculated as the distance in

pixels between points A and B divided by KSL. The pixel counts used in SXA, SYA, SXB, SYB are zero-based. The top left pixel has coordinates (0,0).

If the transmitted pixel density of an image in Field 13.009 THPS / Transmitted Horizontal Pixel Scale and Field 13.010 TVPS / Transmitted Vertical Pixel Scale differs from the scanned (original) pixel density stated in Field 13.016 SHPS / Scanned Horizontal Pixel Scale and Field 13.017 SVPS / Scanned Vertical Pixel Scale, then the values in this field are with respect to the scanned pixel density and shall not be recalculated to correspond to the transmitted pixel density.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *MDR* *Means of Determining Resolution*

The first information item specifies whether the resolution is calculated (from a ruler or known scale), estimated (by a human or computer), or is from a known source (such as a flatbed scanner or standard form).

Condition: Mandatory

Occurrence: 1

Value Constraints: Code from Table 63 Means of Determining Resolution. (4-9 AS)

Table 63 Means of determining resolution

Code	Definition
FLATBED	Resolution is known since the image was acquired from a flatbed scanner with a fixed resolution
FIXED	Resolution is known since the image was acquired from a fixed-resolution capture device other than a flatbed scanner
RULER	Resolution was calculated based upon a ruler present in the image
FORM	Resolution was calculated based upon the use of a standard form with a known scale
EST-HUMAN	Resolution was estimated by a human
EST-AUTO	Resolution was estimated by an automated process. It is recommended that the process be described in **c**omment / COM

2) *KSL* *Known Scale Length*

The second information item specifies the length of the known scale from point A to point B.

Condition: Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 0.01≤ real number ≤ 999.00 with a precision of 2 decimal places. (1-6 NS)

3) *KSU* *Known Scale Units*

The third information item indicates whether the known scale units are in inches or millimeters.

Condition:	Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Allowed values are '**IN**' (inches) or '**MM**' (millimeters). (2 A)

4) *SXA* ***Known Scale X Coordinate for Point A***

The fourth information item is expressed in number of pixels from the left of the image.

Condition:	Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	0 ≤ integer ≤ 99999. (1-5 N)

5) *SYA* ***Known Scale Y Coordinate for Point A***

The fifth information item is expressed in number of pixels from the top of the image.

Condition:	Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	0 ≤ integer ≤ 99999. (1-5 N)

6) *SXB* ***Known Scale X Coordinate for Point B***

The sixth information item is expressed in number of pixels from the left of the image.

Condition:	Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	0 ≤ integer ≤ 99999. (1-5 N)

7) *SYB* ***Known Scale Y Coordinate for Point B***

The seventh information item is expressed in number of pixels from the top of the image.

Condition:	Mandatory if **MDR** = RULER; Optional if **MDR** = FORM; Omitted otherwise.
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	0 ≤ integer ≤ 99999. (1-5 N)

8) *COM* ***Comments***

The eighth information item is a text comment or description provided by the examiner about the resolution method.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 to 99 characters from user-specified character set as indicated in Field 1.015 DCS. (1-99 U)

6.13.20. 13.020 COM / Comments

This comment field should be used to convey additional information about the Type-13 record or the data within it, such to describe specifics for the finger location.

Condition:	Optional
Occurrence:	0 -1
Value Constraints:	1 to 126 characters from user-specified character set as indicated in Field 1.015 DCS. (1-126 U)

6.13.21. 13.021 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 Color Spaces lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition:	Mandatory when **BPX** > 8, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Value from the Code column of Table 4 Color Spaces. (3-4 A)

6.13.22. 13.022 – 13.023 Reserved for Future Use Only by ANSI/NIST-ITL
6.13.23. 13.024 LQM / Latent Quality Metric

This field is used to specify one or more different metrics of latent image quality score data for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2). If this field is present, a subfield shall exist for each segmented finger and quality algorithm combination.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRMP* ***Friction Ridge Metric Position***

The first information item is the referenced friction ridge position from field 13.013: FGP.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 61 Type-13 Friction Ridge Position Codes (1-2 N)

2) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

3) *QAV* ***Algorithm Vendor ID***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF. (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality value.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535 (1-5 N)

5) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.13.24. 13.025 - 13.028 Reserved for Future Use Only by ANSI/NIST-ITL

6.13.25. 13.029 FQC / Friction Ridge Quality Components

This field shall specify one or more different measurements on the biometric sample that may contribute to the computation of a unified quality score for the image stored in the record. A subfield shall exist for each segmented friction ridge position and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRP* ***Friction Ridge Position***

The first information item is the friction ridge position referenced in this subfield.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code from Table 61 Type-13 Friction Ridge Position Codes (1-2 N)

2) *QNQ* ***Native Quality Measure***

The second information item shall contain the output of a quality component assessment algorithm.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

3) *QAV* ***Algorithm Vendor Identification***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality measure. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality measure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535. (1-5 N)

5) *QPV* ***Algorithm Product Version***

The fifth information item specifies the version of the product assigned by the vendor.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.13.26. 13.030 - 13.045 Reserved for Future Use Only by ANSI/NIST-ITL

6.13.27. 13.046 SUB / Image Subject Condition

This field describes the status of the record subject. It is useful for images obtained from deceased persons, but its use is not limited to such circumstances.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *SSC* *Subject Status Code*

The first information item describes the status information of the subject of the record, as known at the time of collection. If this field value is equal to ‘D’ the second and third information items shall also appear.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

2) *SBSC* *Subject Body Status Code*

The second information item indicates whether the information relates to an entire corpse or a separate body part.

Condition: Mandatory when **SSC** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

3) *SBCC* *Subject Body Class Code*

The third information item further describes the condition of a deceased subject's tissue.

Condition: Mandatory when **SSC** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Natural Tissue) or '**2**' (Decomposed). (1 N)

6.13.28. 13.047 CON / Capture Organization Name

This field contains the identifier for the organization that captured the **biometric**. Note that Field 13.004: SRC / Source Agency describes the agency that created the **record**, and the final **transmitting** organization is listed in Field 1.008: ORI / Originating Agency Identifier. These may or may not be the same agency.

Condition: Optional

Occurrence: 0 -1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.13.29. 13.048 - 13.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.13.30. 13.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.13.31. 13.200 – 13.900 UDF / User-Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.13.32. 13.901 FCT / Friction Ridge Capture Technology

This field signifies the type of technology used to capture the friction ridge image. For specific examples of these technologies, refer to https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	Code value from Table 40 Friction Ridge Capture Technology. (1-2 N)

6.13.33. 13.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the datetime of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* *Algorithm Owner*

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* *Process Description*

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.13.34. 13.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with 'M' or 'P' and shall contain only printable ASCII 7-bit characters, i.e., values 32 – 126 inclusive. (13-16 ANS)

6.13.35. 13.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. This field is mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) ***CRT*** ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) ***DMO*** ***Device Mobility***

This information item describes the general stability of the capture device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) ***DCT*** ***COTS Designation***

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) ***DSR*** ***COTS Serial Number***

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition:	Mandatory if DCT = Y, otherwise Optional
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.13.36. 13.905 – 13.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.13.37. 13.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 13.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.13.38. 13.994 EFR / External File Reference

This field allows a latent print image to be in a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 13.999: DATA / Latent Friction Ridge Image. These two fields are mutually exclusive, and one shall be present in all instances of this record type. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references. See Section 5.8.

Condition:	Mandatory when Field 13.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) ***EFL*** ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.13.39. 13.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 13.999: DATA / Latent Friction Ridge Image but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.13.40. 13.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 13.999 DATA of this record or at the location specified in Field 13.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exists in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.13.41. 13.997 SOR / Source Representation

This field uses values from Field 20.021 **SRN** to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 13.999 **DATA** or 13.994 **EFR** was derived. An example of the use of this field would be when data is extracted from a representation, such as a photograph of a grouping of latent prints, which is stored in a Type-20 record. The latent image could be segmented and placed in separate Type-13 records. See Section 5.11.5 SOR / Source Representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 13.999 (or 13.994) shall be identified in this information item.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.13.42. 13.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.13.43. 13.999 DATA / Latent Friction Ridge Image

This field, if present, contains the latent image described in the other fields of this record. If this field is used, Field 13.994: EFR / External File Reference shall not be set. One of these two fields shall be present in this record.

Condition:	Mandatory when Field 13.994 EFR is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.14. Record Type-14: Fingerprint Image Record

The Type-14 record shall contain and be used to exchange exemplar fingerprint image data, such as a rolled tenprint, an identification flat, or a complete friction ridge exemplar. All fingerprint impressions shall be acquired from a card, a single or multiple-finger flat-capture device, contactless fingerprint sensor that outputs 2D fingerprint images, or a live-scan device. Captured images may be transmitted to agencies that will automatically extract the desired feature information from the images for matching purposes. Textual information regarding the

scanning resolution, the image size and other parameters or comments required to process the image are recorded as fields within the record.

The Type-14 record is also used to exchange identification flats of multiple fingers (simultaneous plain impressions captured on a platen). Two of the image record codes contain the left and right simultaneous four fingers (may include extra digits, if applicable), and a third contains the two thumbs. There are also codes for two and three finger combinations. Offsets to the locations of image segments containing the individual fingers are included with the image records for individual flat prints resulting from segmentation of a multi-finger slap image.

This standard allows simultaneous capture of fingerprint images from adjacent platens that share a common plane and a common side if the relative position of the fingers is maintained and has fidelity to the subject's finger orientations and relative length. Simultaneous capture of multiple fingers from non-adjacent platens or platens that do not share a single plane is also allowed, but the images should be separately transmitted. Field 14.026: SCF / Simultaneous Capture was added as an optional field to the 2011 version of the standard to specifically indicate that the images were simultaneously captured.

Field 14.027: SIF / Stitched Image Flag has been added to designate an image that was artificially created by placing together two or more separate images, either captured separately or captured simultaneously on non-adjacent platens. It is strongly encouraged not to stitch together such images. This field shall be used to mark such stitched images that have already been captured and entered into existing databases, prior to transmission using this standard.

6.14.1. 14.001 LEN / Record Length

The length of the entire Type-14 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.14.2. 14.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.14.3. 14.003 IMP / Impression Type

The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table 65 Type-14 Impression Codes. (1-2 N)

Table 64 Type-14 impression codes

Codes	Description
0	Plain Contact; friction ridge skin presented still on platen
1	Rolled Contact; friction ridge skin rolled on platen
8	Vertical swipe; friction ridge skin swiped on platen
24- 25, 41-42	***Deprecated***
43	Contactless capture
28	Other
29	Unknown

6.14.4. 14.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 14.993: SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.14.5. 14.005 FCD / Fingerprint Capture Date

The date that the biometric data contained in this record was captured by the Source Agency (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

6.14.6. 14.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.14.7. 14.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.14.8. 14.008 SLC / Scale Units

The image sampling frequency (pixel density). For contact exemplar friction ridge images, a value of '1' or '2' shall be specified, and the transmitted horizontal and vertical scales shall be the same. Code '0' shall only be used for **contactless** images.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from the table, below. (1 N)

Code	Description
0	no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio
1	pixels per inch
2	pixels per centimeter

6.14.9. 14.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image when SLC has a value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N)

6.14.10. 14.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image when SLC has a value of '1' or '2'. If SLC is '1' or '2', then TVPS shall equal THPS. For example, if the SLC=1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats,

such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N).

6.14.11. 14.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted grayscale images.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Label value from Table 66 Type-14 Compression Algorithms. (3-5 AN)

Table 65 Type-14 compression algorithms

Label	Description
NONE	Uncompressed
WSQ	WSQ[a] (Version 3.1:2010) *500 ppi Only.* ***Preferred Code for WSQ compression***
WSQ20	***Legacy Use Only***
JPEGB	JPEG (Lossy) ***Legacy Use Only*** *500 ppi Only*
JPEGL	JPEG (Lossless) ***Legacy Use Only*** *500 ppi Only*
JP2	JPEG 2000 (Lossy) *1000 ppi Only*
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

[a] Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

6.14.12. 14.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel. This field shall contain an entry of ‘8’ for normal grayscale values of ‘0’ to ‘255’. Any entry in this field greater than ‘8’ shall be used to represent a grayscale pixel with increased proportion. For color, BPX represents the total number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

Condition: Mandatory when Field 14.999 or 14.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 8 ≤ integer ≤ 99. (1-2 N)

6.14.13. 14.013 FGP / Friction Ridge Generalized Position

This field describes which finger position biometric sample is contained in this record. One subfield with a single information item comprises this field for backwards compatibility in for Traditional Encoding only. Other encodings may represent the field as a single information item.

Condition: Mandatory

Occurrence: 1

Value Constraints: Value from Table 67 Type-14 Friction Ridge Position Codes. (1-2 N)

Table 66 Type-14 friction ridge position codes

Code	Description
0	Unknown finger
1	Right thumb
2	Right index finger
3	Right middle finger
4	Right ring finger
5	Right little finger
6	Left thumb
7	Left index finger
8	Left middle finger
9	Left ring finger
10	Left little finger
11	Plain right thumb
12	Plain left thumb
13	Plain right four fingers, simultaneously captured (may include extra digits)
14	Plain left four fingers, simultaneously captured (may include extra digits)
15	Plain Left & right thumbs, simultaneously captured
16	Right extra digit
17	Left extra digit
18	Unknown friction ridge
19	EJI or tip
33	Right hypothenar
36	Left hypothenar
40	Right index/middle
41	Right middle/ring
42	Right ring/little
43	Left index/middle
44	Left middle/ring
45	Left ring/little
46	Right index / left index
47	Right index/middle/ring
48	Right middle/ring/little
49	Left index/middle/ring
50	Left middle/ring/little
51	Fingertips (4 fingers simultaneously – no thumb – right hand - plain)
52	Fingertips (4 fingers simultaneously – no thumb – left hand - plain)
53	Fingertips (4 fingers and thumb simultaneously – right hand - plain)
54	Fingertips (4 fingers and thumb simultaneously – left hand - plain)
55	Right index/middle / Left index/middle (4 fingers simultaneously)

6.14.14. 14.014 PPD / Print Position Descriptors

This field is used to describe fingerprints that include all or part of the lower joints (medial or proximal segments), or extreme tips of individual fingers. For exemplar fingerprints contained in Type-14 records, if and only if the impression is known to be an entire joint image (EJI), full finger view (FFV), rolled extreme tip (TIP), or flat extreme tip (TPP) of individual fingers, then Field 14.013: FGP / Friction Ridge Generalized Position shall be set to ‘19’, and Field 14.014: PPD / Print Position Descriptors shall be specified; Field 14.015: PPC / Print Position Coordinates may be (optionally) specified.

Condition:	Mandatory when the finger position code ‘19’ appears in Field 14.013: FGP / Friction Ridge Generalized Position. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *DFP* ***Decimal Finger Position Code***

The first information item is the finger position code.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code values ‘0’ – ‘10’, ‘16’, or ‘17’, taken from Table 67 Type-14 Friction Ridge Position Codes, above. (1-2 N)

2) *FIC* ***Finger Image Code***

The second information item is finger image code, which indicates the portion of the finger represented in the Type-14 image. Full-length finger joint images use codes ‘FV1’ through ‘FV4’. Figure 2 Finger Views and Finger Segments is an illustration of the Entire Joint Image for a middle finger with each of the full finger views and constituent parts identified.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from Table 68 Type-14 Joint Image Segments, Tip, and Finger View Codes. (3 AN)

Table 67 Type-14 joint image segments, tip, and finger view codes

Code	Description
EJI	Entire joint image
TIP	Rolled fingertip image
TPP	Plain fingertip image
FV1	Full finger rolled image
FV2	Full finger plain image – left side
FV3	Full finger plain image – center
FV4	Full finger plain image – right side
PRX	Proximal segment
DST	Distal segment
MED	Medial segment

6.14.15. 14.015 PPC / Print Position Coordinates

This field contains offsets to the locations for the bounding box of the EJI, each of the full finger views, or segments within the EJI. When used, this field describes the type or portion of the

image contained in this record and its location within an EJI. Individual full finger or segment definitions may be repeated as repeating sets of information items.

Condition:	Optional if the finger position code '19' appears in Field 14.013: FGP / Friction Ridge Generalized Position. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 12 Repeating Subfields; Information Items as described below.

Contains:

1) *FVC* ***Full Finger View***

The first information item is the full finger view with values of 'FV1' through 'FV4', specifying the perspective for each full finger view. For a fingertip, the first information item shall be 'TIP' or 'TPP'. FVC will contain the code 'NA' if only a proximal, distal or medial segment is available.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	Allowed code values from Table 68 Type-14 Joint Image Segments, Tip, and Finger View Codes are: '**FV1**', '**FV2**', '**FV3**', '**FV4**', '**TPP**', or '**TIP**'. Otherwise, it shall contain '**NA**' (not applicable). (2-3 AN)

2) *LOS* ***Location of Segment***

The second information item is used to identify the location of a segment within a full finger view.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	Allowed code values from the Type-14 Joint Image Segments, Tip, and Finger View Codes table are: '**PRX**', '**DST**', or '**MED**'. Otherwise, it shall contain '**NA**' (not applicable). (2-3 AN)

3) *LHC* ***Left Horizontal Coordinate***

The third information item contains the horizontal offset measured in pixels to the left edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	0 ≤ integer ≤ value of Field 14.006 **HLL** (Horizontal Line Length). (1-5 N)

4) *RHC* ***Right Horizontal Coordinate***

The fourth information item contains the horizontal offset in pixels to the right edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	**LHC** < integer ≤ value of Field 14.006 **HLL** (Horizontal Line Length). (1-5 N)

5) ***TVC*** ***Top Vertical Coordinate***

The fifth information item contains the vertical offset (pixel counts down) to the top of the bounding box.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	0 ≤ integer ≤ value of Field 14.007 **VLL** (Vertical Line Length). (1-5 N)

6) ***BVC*** ***Bottom Vertical Coordinate***

The sixth information item contains the vertical offset from the upper left corner of the image down to the bottom of the bounding box, measured in pixels.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 12)
Value Constraints:	**TVC** < integer ≤ value of Field 14.007 **VLL** (Vertical Line Length). (1-5 N)

6.14.16. 14.016 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression when the SLC field contains a ‘1’ or ‘2’. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 14.999 or 14.994 is present. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.14.17. 14.017 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression when the SLC field contains a ‘1’ or ‘2’, in which case it shall equal the value in SHPS. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 14.999 or 14.994 is present. Otherwise, it shall be omitted
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.14.18. 14.018 AMP / Amputated or Bandaged

This field shall specify if one or more fingers are amputated, bandaged, or completely scarred. It shall consist of one subfield for each amputated or missing finger. Multiple amputated or unprintable finger positions may each be entered as a separate repeating subfield. This field is to be used anytime there are fewer than expected printable fingers in a submission (e.g., less than four in a left or right slap or less than two in a two-thumb slap). If all fingers for a specific slap are missing, the ABC codes for each missing finger shall be specified, and the image shall not be sent. Some legacy systems may require a "placeholder" image for proper operation, in which case this may be sent strictly in accordance with the agreement of the interchanging agencies.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 5 Subfields; Information Items as described below

Contains:

1) ***FRAP*** ***Friction Ridge Amputated or Bandaged Position***

This item conveys the position of the finger that is not captured as expected.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 5)
Value Constraints:	Subset of Table 67 Type-14 Friction Ridge Position Codes. Allowed values are '1'-'10', '16', or '17'. (1-2 N)

2) ***ABC*** ***Amputated or Bandaged Code***

The second item is the Amputated or Bandaged Code / ABC, also known as the AMPCD. A scarred finger should be printed, and the '**SR**' code used. '**XX**' shall be used only when a partial print exists, i.e., the image contains *some* friction ridge detail. '**UP**' shall be used where there is no image in Field 14.994: EFR or Field 14.999: DATA for the record due to a total lack of available friction ridge detail. Some legacy systems may require a "placeholder" image for proper operation, in which case this may be sent strictly in accordance with the agreement of the interchanging agencies.

Condition:	Mandatory

Occurrence: 1 per Subfield (max 5)

Value Constraints: Code value from Table 69 Amputation or Bandaged Fingerprinting Codes. (2 A)

Table 68 Amputation or bandaged fingerprinting codes

Code	Description
XX	Partial print (some friction ridge detail in single finger image)
UP	Unable to print (no friction ridge detail in single finger image)
SR	Scarred (pattern unrecognizable)

3) *MDC Missing Detail Reason Code*

The third information item provides additional detail about the reason for the missing friction ridge detail**.** It may be used where the ABC (AMPCD) code is '**XX**' or '**UP**' but not for '**SR**'. Code '**PA**' is used where there is a partial amputation of the distal phalanx, meaning that some friction ridge detail from above the distal phalangeal joint is captured in the single finger (rolled or plain) image. Code '**FA**' is used where there is a full amputation of the distal phalanx, meaning that no friction ridge detail from above the distal phalangeal joint is captured in the single finger (rolled or plain) image.

Use of the Missing detail reason codes of '**PA**' or '**FA**' indicates that the condition leading to partial or no friction ridge detail is permanent in the subject and will not be reversed at a later capture event. It is recognized that the capture of some friction ridge detail may occur from an amputated digit missing the distal phalanx but with lower phalanges present. This situation can be covered by the combination of the ABC code of '**XX**' and Missing detail reason code of '**FA**'.

Use of the Missing detail code '**BM**' indicates that the condition leading to no friction ridge detail being captured is not permanent for the subject and the detail missing from the current capture event could be present at a later capture event.

If the reason for the missing detail is unknown, this field should be omitted.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 70 Missing Detail Reason Codes. (2 A)

Table 69 Missing detail reason codes

Code	Description
PA	Partial amputation of fingertip (distal phalanx)
FA	Full amputation of fingertip (distal phalanx)
BM	Bandaged or other medical issue

6.14.19. 14.019 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be

sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition:	Mandatory when BPX > 8, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Value from the Code column of Table 4 Color Spaces. (3-4 A)

6.14.20. 14.020 COM / Comments

The comment field may be used to insert free text information about the Type-14 record. It is not reserved exclusively for log-related information but has historically often been used for this purpose.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.14.21. 14.021 SEG / Finger Segment Position

This field shall contain offsets to the locations of image segments containing the individual fingers within the flat images of simultaneous finger captures from each hand or the two simultaneously captured thumbs. The subfield occurs at least once and may be repeated if more than one algorithm is used to segment the image.

Condition:	Mandatory when the value of Field 14.013 FGP is in the range '13'-'15' or '40'-'55'. Otherwise, it is omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 5 Subfields; Information Items as described below

Contains:

1) *FRSP* ***Friction Ridge Segment Position***

The first information item contains the finger position captured in the segment.

Condition:	Mandatory
Occurrence:	1

Value Constraints: Allowed values are ‘1’-‘10’ or ‘16’-‘17’ from Table 67 Type-14 Friction Ridge Position Codes. (1-2 N)

2) *LHC* *Left Horizontal Coordinate Value*

The second information item shall contain the horizontal offset in pixels to the left edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ value of Field 14.006 Horizonal Line Length (HLL). (1-5 N)

3) *RHC* *Right Horizontal Coordinate Value*

The third information item is the horizontal offset in pixels to the right edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition: Mandatory

Occurrence: 1

Value Constraints: ***LHC*** ≤ integer ≤ value of Field 14.006 HLL / Horizonal Line Length. (1-5 N)

4) *TVC* *Top Vertical Coordinate Value*

The fourth information item is the vertical offset (pixel counts down) to the top of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ value of Field 14.007 VLL / Vertical Line Length. (1-5 N)

5) *BVC* *Bottom Vertical Coordinate Value*

The fifth information item is the vertical offset in pixels from the upper left corner of the image down to the bottom of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: ***TVC*** ≤ integer ≤ value of Field 14.007 VLL / Vertical Line Length. (1-5 N)

6.14.22. 14.022 *NQM / Legacy Field*

See ANSI/NIST-ITL 1-2015 for a description of this field. Only to be used for interchange of legacy data; new implementations shall use Field 14.024 FQM / Fingerprint Quality Metric.

6.14.23. 14.023 SQM / Segmentation Quality Metric

This field provides a measure of estimated correctness regarding the accuracy of the location of the segmented finger within the right or left four finger image (which may include extra digits, if applicable) or the two-thumb image. If this field is present, a subfield shall exist for each segmented finger and quality algorithm combination.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *FRQP* ***Friction Ridge Segment Quality Position***

The first information item shall contain a finger position in the set of either the **FRSP** or **FRAS** values contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '1'-'10' or '16'-'17' from the Type-14 Friction Ridge Position Codes table (1-2 N)

2) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or '254', or '255'. (1-3 N)

3) *QAV* ***Algorithm Vendor ID***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality value. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

5) *QPV* ***Algorithm Product Version***

The fifth information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* ***Algorithm Comments***

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* ***Algorithm Model Checksum***

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.14.24. 14.024 FQM / Fingerprint Quality Metric

This field shall specify one or more different metrics of fingerprint image quality metric data for the individual finger(s) derived from the slap impressions or individual rolled fingerprints stored in the record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2). If this field is present, a subfield shall exist for each segmented finger and quality algorithm combination.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRMP* ***Friction Ridge Metric Position***

The first information item is the friction ridge metric position / FRMP which is chosen from a subset of Table 67 Type-14 Friction Ridge Position Codes.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed code values are '1'-'10', '16', or '17' from the Type-14 Friction Ridge Position Codes table (1-2 N)

2) *QVU* ***Quality Value***

This information item shall contain the image quality value assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 100, or 254, or 255. (1-3 N)

3) *QAV* ***Algorithm Vendor ID***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF. (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535 (1-5 N)

5) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.14.25. 14.025 ASEG / Alternate Finger Segment Positions

This field provides an alternate approach to describing the locations for each of the image segments of each of the individual fingers within a flat image containing the capture of four (or more if extra digits exist on the hand) simultaneous fingers or two simultaneous thumbs. This field uses a 3-99 vertex polygon to encompass each finger image segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 5 Subfields; Information Items as described below

Contains:

1) *FRAS* ***Friction Ridge Alternate Segment Position***

The first information item describes the finger position contained in the segment, from Table 67 Type-14 Friction Ridge Position Codes.

Condition: Mandatory

Occurrence: 1 per subfield (max 5)

Value Constraints: Allowed values are '1'-'10', '16' or '17'. (1-2 N)

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the segment.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order, describe the path bounding this segment. The number of occurrences of this pair of information items shall be equal to the value of **NOP** for each segment:

3) *HPO* ***Horizontal Point Offset***

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 14.006 **HLL**. (1-5 N)

4) *VPO* ***Vertical Point Offset***

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 14.007 **VLL**. (1-5 N)

6.14.26. 14.026 SCF / Simultaneous Capture

This field contains a 1-based numeric index that is incremented for each simultaneously captured set of images. This field allows the user to explicitly link finger images that were captured simultaneously on non-contiguous platens, or other image capture technologies that do not preserve the full relative position of the fingers to each other if placed in a single image.

For instance, this field should be used when individual flat prints are captured on different platens simultaneously. Such images should not be stitched together for transmission as a single multiple-finger print image, but they should be coded with the same SCF value to indicate that they were captured simultaneously, and there is little possibility of a mistaken finger position. See also Section 5.11.4.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

6.14.27. 14.027 SIF / Stitched Image Flag

This field signifies that images captured separately were “stitched” together to form a single image. This field is mandatory if an image has been stitched, and the value shall be set to ‘**Y**’. Otherwise, this field shall be omitted. This field is not intended to apply to a single rolled image.

Stitching is not recommended; the individual images should be transmitted in separate Type-14 records using the appropriate position codes and when applicable, correlated by using the same value for Field 14.026: SCF / Simultaneous Capture. If, however, the images had been stitched together to create a single artificial image, such as a “four finger slap image” (FGP = ‘13’ or ‘14’ in Field 14.013: FGP / Friction Ridge Generalized Position), then this field shall appear with a value of ‘**Y**’.

Condition: Mandatory when separately captured images are artificially “stitched” into a single image. Omitted otherwise.

Occurrence: 1 if Condition above is met, 0 otherwise.

Value Constraints: Fixed value = Y. (1 A)

6.14.28. 14.028 Reserved for Future Use Only by ANSI/NIST-ITL

6.14.29. 14.029 FQC / Friction Ridge Quality Components

This field shall specify one or more different measurements on the biometric sample that may contribute to the computation of a unified quality score for the image stored in the record. If used, a subfield shall exist for each segmented finger and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRP* ***Friction Ridge Position***

The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '1'-'10', '16' or '17' from Table 67 Type-14 Friction Ridge Position Codes. (1-2 N)

2) *QNQ* ***Native Quality Measure***

The second information item shall contain the output of a quality component assessment algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

3) *QAV* ***Algorithm Vendor Identification***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535. (1-5 N)

5) *QPV* ***Algorithm Product Version***

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.14.30. 14.030 DMM / Device Monitoring Mode

This field describes the level of human monitoring that was associated with the biometric sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 71 Device Monitoring Code. (7-10 A)

Table 70 Device monitoring code

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6.14.31. 14.031 FAP / Subject Acquisition Profile – Fingerprint

This field lists the FAP levels associated with fingerprint acquisition devices. The Acquisition Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation, Version 2.* See Section 5.14.2 FAP / Subject Acquisition Profile for Fingerprint for detailed information about Acquisition Profiles.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values from Table 8 Subject Acquisition Profiles for Fingerprint are ‘10’, ‘20’, ‘30’, ‘40’, ‘45’, ‘50’, ‘60’, ‘145’, ‘150’ or ‘160’. (2-3 N)

6.14.32. 14.032 – 14.045 Reserved for Future Use Only by ANSI/NIST-ITL

6.14.33. 14.046 SUB / Image Subject Condition

This field describes the condition of the subject at the time of imaging. Different Type-14 records in the same transaction may have different values for SUB. For example, some images may have been acquired antemortem, while others were acquired post-mortem.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *SSC* ***Subject Status Code***

The first information item describes the status of the subject at the time of imaging.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are ‘**X**’ (Status of individual unknown), ‘**A**’ (Data obtained from a living person), or ‘**D**’ (Data obtained from a deceased person). (1 A)

2) *SBSC* ***Subject Body Status Code***

The second information item shall indicate whether the information relates to an entire corpse or a separate body part.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are ‘**1**’ (Whole body) or ‘**2**’ (Body fragment). (1 N)

3) *SBCC* ***Subject Body Class Code***

The third information item indicates the state of the deceased body tissue.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are '**1**' (Natural Tissue) or '**2**' (Decomposed). (1 N)

6.14.34. 14.047 CON / Capture Organization Name

This field contains the name of the organization which captured the fingerprint in the current record, for example a coroner's office that captures friction ridge prints from a decedent's body in a morgue would be listed in CON. Note that this can be different from the agency entered in Field 14.004: SRC / Source Agency and Field 14.993: SAN / Source Agency Name, which describe the agency that created the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.14.35. 14.048 - 14.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.14.36. 14.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.14.37. 14.200 – 14.900 UDF / User-Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.14.38. 14.901 FCT / Friction Ridge Capture Technology

This field signifies the type of technology used to capture the friction ridge image. For specific examples of these technologies, refer to https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/.

Condition:	Mandatory when IMP = 43, otherwise Optional

Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Code value from Table 40 Friction Ridge Capture Technology. (1-2 N)

6.14.39. 14.902 ANN / Annotation Information

This lists the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter ‘N/A’.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* *Process Description*

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.14.40. 14.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character ‘M’, or
- Host processor ID, identified by the first character ‘P’

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with ‘M’ or ‘P’ and shall contain only printable ASCII 7-bit characters, i.e., values 32 – 126 inclusive. (13-16 ANS)

6.14.41. 14.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. This field is mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK* *Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT Capture Device Certification Code*

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* *Device Mobility*

This information item describes the general stability of the capture device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* *COTS Designation*

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* *COTS Serial Number*

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition:	Mandatory if DCT = Y, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.14.42. 14.905 – 14.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.14.43. 14.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 14.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1

Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.14.44. 14.994 EFR / External File Reference

This field allows biometric data to be referenced at a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 14.999: DATA / Fingerprint Image. These two fields are mutually exclusive, and one shall be present in all instances of this record type, except when Field 14.018 AMP indicates that the friction ridge detail is unprintable ('**UP**'). When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when Field 14.999 DATA is absent, and Field 14.018 AMP does not indicate that the friction ridge detail is unprintable ('**UP**'). Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.14.45. 14.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 14.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / Associated Segment Position in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.14.46. 14.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 14.999 DATA of this record or at the location specified in Field 14.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.14.47. 14.997 SOR / Source Representation

This field uses values from Field 20.021 SRN / Source Representation Number to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 14.999 DATA or 14.994 EFR was derived. An example of the use of this field would be when data is extracted from a representation, such as a scanned paper friction ridge card or the raw data from a contactless friction ridge capture, which is stored in a Type-20 record. The data could be segmented or processed and placed in separate Type-14 records. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 14.999 (or 14.994) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.14.48. 14.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.14.49. 14.999 DATA / Fingerprint Image

This field, if present, contains the fingerprint image described in the other fields of this record. If Field 14.994: EFR is present in this record, then this field shall not appear. Neither Field 14.999 nor Field 14.994 need be present in the record when Field 14.018 AMP / Amputated or Bandaged contains an amputation code value of '**UP**'. Some domains and application profiles may still require an image in this field in such cases. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 14.994 EFR is absent, and Field 14.018 AMP does not indicate that the friction ridge detail is unprintable ('**UP**'). Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.15. Record Type-15: Palm Print Image Record

The Type-15 record shall contain and be used to exchange palm print image data together with fixed and user-defined textual information fields pertinent to the digitized image. Information regarding the scanning resolution used, the image size, and other parameters or comments required to process the image are recorded as fields within the record. Palm and wrist print images transmitted to other agencies will be processed by the recipient agencies to extract the desired feature information required for matching purposes.

The image data shall be acquired directly from a subject using a live-scan device, a palm print card, or other media that contains the subject's palm and / or wrist prints. Any method used to acquire the palm print images shall be capable of capturing a set of images for each hand. This set may include the writer's palm as a single scanned image, and the entire area of the full palm extending from the wrist bracelet to the tips of the fingers as one or two scanned images. (See Figure 1 Palm and finger segment positions). The wrist bracelet is the series of lines/creases below and parallel to the carpal delta and thenar / hypothenar areas of the palm.

If two images are used to represent the full palm, the lower image shall extend from the wrist bracelet to the top of the interdigital area (third finger joint) and shall include the thenar, and hypothenar areas of the palm. The upper image shall extend from the bottom of the interdigital area to the upper tips of the fingers. This provides an adequate amount of overlap between the two images.

The standard also provides for encoding the interdigital, thenar, and hypothenar areas separately for each palm. As a palm print transaction may be used for different purposes, it may contain one or more unique image areas recorded from the palm or hand or wrist. For some agencies, a complete palm print record set for one individual will normally include the writer's palm and the full palm image(s) from each hand. A single Type-15 record will be required for each writer's palm and one to three Type-15 records for each full palm. Four to eight Type-15 records may be required to represent the subject's palm prints in a transaction.

6.15.1. 15.001 LEN / Record Length

The length of the entire Type-15 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer. (2+ N)

6.15.2. 15.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.15.3. 15.003 IMP / Impression Type

The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table 73 Type-15 Impression Codes. (1-2 N)

Table 71 Type-15 impression codes

Codes	Description

0	Plain Contact; Friction ridge skin presented still on platen
1	Rolled Contact; Friction ridge skin rolled on platen
8	Vertical swipe; Friction ridge skin swiped on platen
24- 25, 41-42	***Deprecated***
43	Contactless capture
28	Other
29	Unknown

6.15.4. 15.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 15.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.15.5. 15.005 PCD / Palm Print Capture Date

The date that the biometric data contained in this record was captured by the Source Agency (SRC).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

6.15.6. 15.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.15.7. 15.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.15.8. 15.008 SLC / Scale Units

The image sampling frequency (pixel density). A value of '0' in this field indicates that no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 N)

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

6.15.9. 15.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image when SLC has a value of '1' or '2'. For example, if the SLC value = 1, then the value of THPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N)

6.15.10. 15.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image when SLC has a value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N).

6.15.11. 15.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted grayscale images.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Label value from Table 72 Type-15 compression algorithms. (3-5 AN)

Table 72 Type-15 compression algorithms

Label	Description
NONE	Uncompressed
WSQ	WSQ[a] (Version 3.1:2010) *500 ppi Only.* ***Preferred Code for WSQ compression***
WSQ20	***Legacy use only***
JPEGB	JPEG (Lossy) ***Legacy use only*** *500 ppi Only*
JPEGL	JPEG (Lossless) ***Legacy use only*** *500 ppi Only*
JP2	JPEG 2000 (Lossy) *1000 ppi Only*
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

[a] Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

6.15.12. 15.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent a grayscale pixel with increased proportion. For color, BPX represents the total number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

Condition: Mandatory when Field 15.999 or 15.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 8 ≤ integer ≤ 99. (1-2 N)

6.15.13. 15.013 FGP / Friction Ridge Generalized Position

This field describes which palm position biometric sample is contained in this record. One subfield with a single information item comprises this field for backwards compatibility in for Traditional Encoding only. Other encodings may represent the field as a single information item.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code from Table 73 Type-15 Friction Ridge Position Codes. (2 N)

Table 73 Type-15 friction ridge position codes

Code	Description
20	Unknown palm
21	Right full palm
22	Right writer's palm
23	Left full palm
24	Left writer's palm
25	Right lower palm
26	Right upper palm
27	Left lower palm
28	Left upper palm

29	Right other
30	Left other
31	Right interdigital
32	Right thenar
33	Right hypothenar
34	Left interdigital
35	Left thenar
36	Left hypothenar
37	Right grasp
38	Left grasp
81	Right carpal delta area
82	Left carpal delta area
83	Right full palm, including writer's palm
84	Left full palm, including writer's palm
85	Right wrist bracelet
86	Left wrist bracelet

6.15.14. 15.014 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.15. 15.015 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition:	Mandatory when BPX > 8, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Value from the Code column of Table 4 Color Spaces. (3-4 A)

6.15.16. 15.016 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression when the **SLC** field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in THPS / Transmitted Horizontal Pixel Scale. Note that density is directly related to resolution.

Condition:	Optional when either Field 15.999 or 15.994 is present. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.15.17. 15.017 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression when the **SLC** field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 15.999 or 15.994 is present. Otherwise, it shall be omitted
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.15.18. 15.018 AMP / Amputated or Bandaged

This field shall specify if a palmar friction ridge area is amputated or bandaged. Multiple subfields may be entered.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 9 Subfields; Information Items as described below

Contains:

1) *FRAP* ***Friction Ridge Amputated or Bandaged Position***

The first item conveys the position of the friction ridge skin that is not captured as expected. If an entire hand is missing, either '83' (right full palm, including writer's palm) or '84' (left full palm, including writer's palm) shall be entered for FRAP.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 9)
Value Constraints:	Code value from Table 75 Type-15 Friction Ridge Position Codes. (2 N)

2) *ABC* ***Amputated or Bandaged Code***

The second item is the amputated or bandaged code (ABC), also known as the AMPCD. '**XX**' shall be used only when a partial print exists, i.e., the image contains *some* friction ridge detail.

'**UP**' shall be used where there is no image in Field 15.994: EFR or Field 15.999: DATA for the record due to a total lack of available friction ridge detail. Some legacy systems may require a "placeholder" image for proper operation, in which case this may be sent strictly in accordance with the agreement of the interchanging agencies.

A partially scarred palm should be printed but shall not be marked 'XX' or 'UP'.

Condition: Mandatory

Occurrence: 1 per Subfield (max 9)

Value Constraints: Code value from Table 74 Amputation or bandaged palm codes. (2 A)

Table 74 Amputation or bandaged palm codes

Code	Description
XX	Partial print (some friction ridge detail in image)
UP	Unable to print (no friction ridge detail in image)

3) *MDC Missing Detail Reason Code*

The third information item provides additional detail about the reason for the missing friction ridge detail**.** Use of the Missing detail reason codes of '**PA**' or '**FA**' indicates that the condition leading to partial or no friction ridge detail is permanent in the subject and will not be reversed at a later capture event.

Use of the Missing detail code '**BM**' indicates that the condition leading to no friction ridge detail being captured is not permanent for the subject and the detail missing from the current capture event could be present at a later capture event. If the reason for the missing detail is unknown, this field should be omitted.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from Table 75 Missing detail reason codes. (2 A)

Table 75 Missing detail reason codes

Code	Description
PA	Partial amputation of expected friction ridge area
FA	Full amputation of expected friction ridge area
BM	Bandaged or other medical issue

6.15.19. 15.019 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.20. 15.020 COM / Comments

The comment field may be used to insert free text information about the Type-15 record. It is not reserved exclusively for log-related information but has historically often been used for that purpose.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.15.21. 15.021 SEG / Palm Segment Position

This field shall only be present if Field 15.013 **FGP** = ‘20’, ‘21’, ‘23’, ‘37’, ‘38’, ‘83’ or ‘84’. The subfield occurs at least once, and may be repeated if more than one algorithm is used to segment the image.

Condition:	Mandatory when the value of Field 15.013 FGP = ‘20’, ‘21’, ‘23’, ‘37’, ‘38’, ‘83’ or ‘84’. Otherwise, it is omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 17 Subfields; Information Items as described below

Contains:

1) *FRSP* ***Friction Ridge Segment Position***

The first information item contains the Friction Ridge Position Code described in the subfield.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are ‘22’, ‘24’ – ‘36’, ‘81’, ‘82’, ‘85’ or ‘86’ from Table 75 Type-15 Friction Ridge Position Codes. (2 N)

2) *LHC* ***Left Horizontal Coordinate Value***

The second information item shall contain the horizontal offset in pixels to the left edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ value of Field 15.006 **HLL**. (1-5 N)

3) *RHC* ***Right Horizontal Coordinate Value***

The third information item is the horizontal offset in pixels to the right edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	**LHC** ≤ integer ≤ value of Field 15.006 **HLL**. (1-5 N)

4) *TVC* ***Top Vertical Coordinate Value***

The fourth information item is the vertical offset (pixel counts down) to the top of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ value of Field 15.007 **VLL**. (1-5 N)

5) *BVC* *Bottom Vertical Coordinate Value*

The fifth information item is the vertical offset in pixels from the upper left corner of the image down to the bottom of the bounding box.

Condition: Mandatory

Occurrence: 1

Value Constraints: ***TVC*** ≤ integer ≤ value of Field 15.007 **VLL**. (1-5 N)

6.15.22. 15.022 – 15.023 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.23. 15.024 PQM / Palm Quality Metric

This field is used to specify one or more different metrics of the print image quality score data for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2). If this field is present, a subfield shall exist for each friction ridge position and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRMP* *Friction Ridge Measure Position*

The first information item shall be is the referenced friction ridge position for the image stored in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code from Table 75 Type-15 Friction Ridge Position Codes. (1-2 N)

2) *QVU* *Quality Value*

This information item shall contain the image quality value assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of ‘255’ shall indicate a failed attempt to calculate a quality value. An entry of ‘254’ shall indicate that no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

3) *QAV* *Algorithm Vendor ID*

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality value. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF. (4 H)

4) *QAP* *Algorithm Product Identification*

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality value.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535 (1-5 N)

5) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.15.24. 15.025 – 15.028 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.25. 15.029 FQC / Friction Ridge Quality Components

This field shall specify one or more different measurements on the biometric sample that may contribute to the computation of a unified quality score for the image stored in the record. A subfield shall exist for each segmented friction ridge position and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRP* ***Friction Ridge Position***

The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code from Table 75 Type-15 Friction Ridge Position Codes. (1-2 N)

2) *QNQ* ***Native Quality Measure***

The second information item shall contain the output of a quality component assessment algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, ‘Not Calculated’, or ‘Failed’ (1+ ANS)

3) *QAV* ***Algorithm Vendor Identification***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality measure. This is a 4-digit hexadecimal value from the IBIA maintained

Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)

4) *QAP* *Algorithm Product Identification*

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality measure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535. (1-5 N)

5) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in this subfield.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.15.26. 15.030 DMM / Device Monitoring Mode

This field describes the level of human monitoring that was associated with the biometric sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6.15.27. 15.031 PAP / Subject Acquisition Profile – Palm Print

This field lists the PAP levels associated with palm print acquisition devices. The Acquisition Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation, Version 2.* See Section 5.6 for detailed information about Acquisition Profiles.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code from Table 10 Subject Acquisition Profiles for Palm Print. (2-3 N)

6.15.28. 15.032 – 15.045 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.29. 15.046 SUB / Subject Condition

This field describes the condition of the subject at the time of imaging. Different Type-15 records in the same transaction may have different values for SUB. For example, some images may have been acquired antemortem, while others were acquired post-mortem.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *SSC* ***Subject Status Code***

The first information item describes the status of the subject at the time of imaging.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

2) *SBSC* *Subject Body Status Code*

The second information item shall indicate whether the information relates to an entire corpse or a separate body part.

Condition: Mandatory when **SSC** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

3) *SBCC* *Subject Body Class Code*

The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Natural Tissue) or '**2**' (Decomposed). (1 N)

6.15.30. 15.047 CON / Capture Organization Name

This field contains the name of the organization which captured the fingerprint in the current record, for example a coroner's office that captures friction ridge prints from a decedent's body in a morgue would be listed in CON. Note that this can be different from the agency entered in Field 15.004: SRC / Source Agency and Field 15.993: SAN / Source Agency Name, which describe the agency that created the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.15.31. 15.048 – 15.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.32. 15.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.15.33. 15.200 – 15.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.15.34. 15.901 FCT / Friction Ridge Capture Technology

This field signifies the type of technology used to capture the friction ridge image. For specific examples of these technologies, refer to https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/ .

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Code value from Table 40 Friction Ridge Capture Technology. (1-2 N)

6.15.35. 15.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be the name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* *Algorithm Owner*

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* *Process Description*

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.15.36. 15.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with 'M' or 'P' and shall contain only printable ASCII 7-bit characters, i.e., values 32 – 126 inclusive. (13-16 ANS)

6.15.37. 15.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. This field is mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) ***CRT*** ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) ***DMO*** ***Device Mobility***

This information item describes the general stability of the capture device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) ***DCT*** ***COTS Designation***

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) ***DSR*** ***COTS Serial Number***

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition:	Mandatory if DCT = Y, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.15.38. 15.905 – 15.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.15.39. 15.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 15.004: Source agency/ SRC.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.15.40. 15.994 EFR / External File Reference

This field allows biometric data to be referenced at a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 15.999: DATA / Palm Print Image. These two fields are mutually exclusive, and one shall be present in all instances of this record type, except when Field 15.018 AMP indicates that the friction ridge detail is unprintable ('**UP**'). When this field is used, it is required that the user state the format of the external file (EFF). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when Field 15.999 DATA is absent**, <u>and</u>** Field 15.018 AMP does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.15.41. 15.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 15.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.15.42. 15.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 15.999 DATA of this record or at the location specified in Field 15.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.15.43. 15.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 15.999 DATA or 15.994 EFR was derived. An example of the use of this field would be when data is extracted from a representation, such as a scanned paper friction ridge card or the raw data from a contactless friction ridge capture, which is stored in a Type-20 record. The card image could be segmented and placed in separate Type-15 records. See Section 5.11.5 SOR / Source Representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 15.999 (or 15.994) shall be identified in this information item.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.15.44. 15.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.15.45. 15.999 DATA / Palm Image Data

This field, if present, contains the palm image described in the other fields of this record. If Field 15.994: EFR is present in this record, then this field shall not appear. Neither Field 15.999 nor Field 15.994 need be present in the record when Field 15.018: AMP contains an amputation code value of '**UP**'. Some domains and application profiles may still require an image in this field in such cases. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 15.994 EFR is absent, **and** Field 15.018 AMP does not indicate that the friction ridge detail is unprintable ('**UP**'). Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.16. Record Type-16 User-Defined Testing Image Record

The Type-16 record allows the exchange of images not addressed by other record types in the standard. It is intended as the user-defined record to be used for developmental or test purposes; Type-16 records shall not be used for images that can be conveyed using other record types. The image data contained in the Type-16 record may be in a compressed form.

Except for the fields described below, the format, parameters, and types of images to be exchanged are user-defined and shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

An example of the use of the Type-16 could be to send an image of the ear for biometric purposes. Note that Type-99 allows “ear shape” as a biometric code, but to use Type-99 records, there must be a BDB format owner that has specified the BDB format type. See Field 99.103: BFO / BDB Format Owner. At the time of the issuance of this standard, no such formal specification exists.

6.16.1. 16.001 LEN / Record Length

The length of the entire Type-16 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.16.2. 16.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction content. See Section 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.16.3. 16.003 UDI / User Defined Image Type

This field shall contain the type of user-defined image contained in this record. Its content shall be defined by the user and be in accordance with the receiving agency.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 35 characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1-35 U)

6.16.4. 16.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 16.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.16.5. 16.005 UTD / User Defined Image Test Capture Date

This field shall contain the date that the test image contained in the record was captured.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Full Local Date (see Section 5.1.1 Local Date)

6.16.6. 16.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.16.7. 16.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.16.8. 16.008 SLC / Scale Units

The image sampling frequency (pixel density). A value of ‘0’ in this field indicates that no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio.

Condition:	Mandatory
Occurrence:	1

Value Constraints: Code value from table below. (1 N)

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

6.16.9. 16.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image when SLC has a value of '1' or '2'. For example, if **SLC** = 1, then the value of THPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N)

6.16.10. 16.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image when SLC has a value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N).

6.16.11. 16.011 CGA / Compression Algorithm Code

This field specifies the algorithm used to compress transmitted images.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value Table below. (3-5 AN)

Code	Description
NONE	Uncompressed (Lossless)
WSQ	WSQ[a] (Version 3.1:2010) 500 ppi Only. ***Preferred Code for WSQ compression***
WSQ20	***Legacy Code***
JPEGB	JPEG (Lossy)
JPEGL	JPEG (Lossless)
JPEG2	JEPG 2000 (Lossy)
JP2L	JPEG 2000 (Lossless)

PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)
MEDIA	A compression type referenced from the IANA registry (https://www.iana.org/assignments/media-types/media-types.xhtml), only as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles)

[a] Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

6.16.12. 16.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent a grayscale pixel with increased proportion. For color, BPX represents the total number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

Condition: Mandatory

Occurrence: 1

Value Constraints: 8 ≤ integer ≤ 99. (1-2 N)

6.16.13. 16.013 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition: Optional

Occurrence: 0-1

Value Constraints: Value from the Code column of Table 4 Color Spaces. (3-4 A)

6.16.14. 16.014 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.15. 16.015 TFT / Test Image Format

This field shall contain information about the type of file and any additional decoding instructions the recipient of the transaction may need to correctly interpret the image.

Condition: Mandatory when **CGA**=MEDIA, Optional otherwise

Occurrence: 1 when Condition above is met; 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *FTY* ***File Type***

If possible this field should contain a value from the Name column of the IANA Image registry indicating the MediaType, if one exists and the image is a digital file (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

If the value is not listed in the external table, enter the name, and enter a description of the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats (such as digital tape), enter 'OTHER'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

2) *DEI* ***Decoding Instructions***

The second information item contains any additional decoding instructions beyond file type for recipients.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.16.16. 16.016 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression when the SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that density is directly related to resolution.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.16.17. 16.017 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression when the SLC field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used

if the transmission pixel scale differs from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.16.18. 16.018 – 16.019 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.19. 16.020 COM / Comments

The comment field may be used to insert free text information about the Type-16 record. It is not reserved exclusively for log-related information but has historically often been used for that purpose.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.16.20. 16.021 – 16.023 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.21. 16.024 UQS / User-Defined Image Quality Metric

This optional field is used to specify one or more different metrics of the image quality score data for the image stored in this record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *QVU* ***Quality Value***

This information item shall contain the image quality value assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality value was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

2) *QAV* ***Algorithm Vendor ID***

This information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality value. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

3) *QAP* *Algorithm Product Identification*

This information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality value.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

4) *QPV* *Algorithm Product Version*

This information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* *Algorithm Comments*

This information item contains any comments related to the values in the subfield in which it occurs.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* *Algorithm Model Checksum*

This information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition:	Optional
Occurrence:	0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.16.22. 16.025 – 16.028 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.23. 16.029 BQC / Biometric Quality Components

This field specifies one or more different measurements on the biometric sample that may contribute to the computation of a unified quality score for the image stored in the record. A subfield shall exist for each quality algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *QNQ* ***Native Quality Measure***

This information item shall contain the output of a quality component assessment algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

2) *QAV* ***Algorithm Vendor Identification***

This information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality measure. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF (4 H)

3) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality measure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535. (1-5 N)

4) *QPV* ***Algorithm Product Version***

This information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* *Algorithm Comments*

This information item contains any comments related to the values in this subfield.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* *Algorithm Model Checksum*

This information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.16.24. 16.030 DMM / Device Monitoring Mode

This field describes the level of human monitoring that was associated with the biometric sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6.16.25. 16.031 – 16.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.26. 16.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.16.27. 16.200 – 16.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.16.28. 16.901 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.29. 16.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be the name of a physical process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN Algorithm Owner*

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO Process Description*

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.16.30. 16.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Must begin with 'M' or 'P' and shall contain only printable ASCII 7-bit characters, i.e., values 32 – 126 inclusive. (13-16 ANS)

6.16.31. 16.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. This field is mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* *Capture Device Certification Code*

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* *Device Mobility*

This information item describes the general stability of the capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* *COTS Designation*

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* *COTS Serial Number*

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' may be inserted into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.16.32. 16.905 – 16.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.16.33. 16.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 16.004: Source agency/ SRC.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.16.34. 16.994 EFR / External File Reference

This field allows a test image to be in a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 16.999: DATA. These two fields are mutually exclusive, and one shall be present in all instances of this record type. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.6.

Condition:	Mandatory when Field 16.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.16.35. 16.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 16.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* *Associated Context Number*

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* *Associated Segment Position*

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.16.36. 16.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 16.999 DATA of this record or at the location specified in Field 16.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180,*

Secure Hash Standard (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.16.37. 16.997 SOR / Source Representation

This field uses values from Field 20.021 SRN / Source Representation Number to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 16.999 DATA or 16.994 EFR was derived. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 16.999 (or 16.994) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.16.38. 16.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.16.39. 16.999 DATA / Test Data

This field, if present, contains the test image described in the other fields of this record. If this field is used, Field 16.994: EFR shall not be set. One of these two fields shall be present in this record.

Condition:	Mandatory when Field 16.994 EFR is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more Binary or Base64 digits. (1+ B)

6.17. Record Type-17 Iris Image Record

The Type-17 record shall contain and be used to exchange generic iris image data using mandatory fields of this record type. Optional fields may be used to exchange additional information available in the *INCITS 379-2004 – Iris Image Interchange Format standard* and the *ISO/IEC 19794-6 iris image data interchange format standard*. Images may be monochrome or color with 256 or more intensity levels (gray or per-color component) and vary in size depending on field of view and compression. This record type specifies interchange formats for biometric authentication systems that utilize iris recognition.

The formats all store sampled pixel data from rectilinear images. The data shall be encoded as a raw array of intensity values, a raw array of red-green-blue color values, or as losslessly compressed or lossy-compressed versions thereof. Two of the formats are specialized for small record sizes; these are achieved by cropping and masking the images to support efficient compression (see Field 17.032 ISF / Iris Storage Format).

6.17.1. 17.001 LEN / Record Length

The length of the entire Type-17 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.

Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.17.2. 17.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Sections IDC / Information Designation Character and 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.17.3. 17.003 ELR / Eye Label

This field describes which of the subject's eyes is represented by the information in the record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed code values are '0' (undefined), '1' (Right Eye), and '2' (Left Eye). (1 N)

6.17.4. 17.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 17.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.17.5. 17.005 ICD / Iris Capture Date

The date that the biometric data contained in this record was captured by the Source Agency (SRC).

Condition:	Mandatory
Occurrence:	1

Value Constraints: Full Local Date (see Section 5.1.1 Local Date)

6.17.6. 17.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition: Mandatory when Field 17.999 DATA or 17.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N)

6.17.7. 17.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer ≤ 99999. (2-5 N).

6.17.8. 17.008 SLC / Scale Units

The image sampling frequency (pixel density). For contact exemplar friction ridge images, a value of 1 or 2 shall be specified, and the transmitted horizontal and vertical scales shall be the same.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Value from the table below. (1 N)

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

6.17.9. 17.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image when SLC has a value of ‘1’ or ‘2’. For example, if the SLC value = 1, then the value of THPS could be ‘1000’ for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.

Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.17.10. 17.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image when SLC has a value of '1' or '2' in which case, TVPS shall equal THPS. For example, if the SLC value = 1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used

Condition:	Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N).

6.17.11. 17.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted color or grayscale images. The baseline JPEG algorithm (ISO/IEC 10918) shall not be used for Type-17 iris images. It has been shown that both false non-match and false match rates increase due to the presence of tiling artifacts introduced by JPEG's discrete cosine transform. While JPEG was allowed in prior versions of this standard, it shall not be allowed for new images. Implementers may want to support JPEG decoding for handling legacy images. If legacy images were stored in JPEG, they should be converted to PNG prior to transmission, with this transformation noted in Field 17.902 ANN / Annotation Information.

Condition:	Mandatory when Field 17.999 or 17.994 is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Value from Table below. (3-4 AN)

Table 76 Type-17 compression algorithms

Label	Description
NONE	Uncompressed
JP2	JPEG 2000 (Lossy)
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

6.17.12. 17.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent a grayscale pixel with increased proportion. For color, BPX represents the total number of bits

per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

Condition:	Mandatory when Field 17.999 DATA or 17.994 EFR is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	8 ≤ integer ≤ 99. (1-2 N)

6.17.13. 17.013 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field.

Condition:	Mandatory when Field 17.999 or 17.994 is present, otherwise omitted
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Value from the Code column of Table 4 Color Spaces. If Field 17.025 **EAS** = NIR this field shall be set to 'GRAY'. (3-4 A)

6.17.14. 17.014 RAE / Rotation of Eye Angle

This field indicates the in-plane rotation angle of the iris. At the time of iris image capture, the subject eye may be rotated around an axis from the eye to the camera (roll), relative to the nominal horizontal axis of the camera. This can come about from:

- rotation of the camera
- rotation of the subject head
- rotation of the subject eye, within the subject head.

Such rotation can be an important performance issue. Iris recognition algorithms may search a range of rotations when comparing the captured image against a database. That range needs to be large enough to bring the newly captured image into angular alignment with those in the database. If the rotation of the subject eye is known, the search range can be optimized with a corresponding improvement in search speed. For Daugman-like algorithms, details can be found in

> Daugman, John. "The importance of being random: statistical principles of iris recognition." Pattern recognition 36.2 (2003): 279-291.

There is no easy way of estimating the rotation (roll) of the subject eye within the subject head and it is normally a small rotation. For the purpose of this description, we ignore it.

Note that a rotation (roll) of the camera can compensate for a rotation (roll) of the subject head. It is the difference between the two that is important.

The rotation angle of the eye encoded in this field is defined here in terms of roll of the subject's head relative to that of the camera. The angle is defined, and measured in degrees, as the angle between a line joining the pupil or iris centers of the left and right eyes, and the horizontal axis of the imaging system. As shown in Figure 6, an angle is positive for counterclockwise rotation, as seen from the camera, of this line relative to the camera's horizontal axis. The in-plane eye rotation angle shall be recorded as angle = round (65535 * angle / 360) modulo 65535280. The hexadecimal value 'FFFF' indicates that rotation angle of eye is undefined. As an (unrealistic) example of a 90-degree value:

> round (65535 * 90 / 360) modulo 65535 equals 16384. This is 4000 when converted to hexadecimal.

For encoding angular orientation of an eye not directed toward the camera, see Field 17.041 GAZ / Frontal Gaze. It may be difficult to estimate rotation using a monocular camera. In such cases, the rotation uncertainty encoded in 17.015 RAU / Rotation Uncertainty will be appropriately larger.

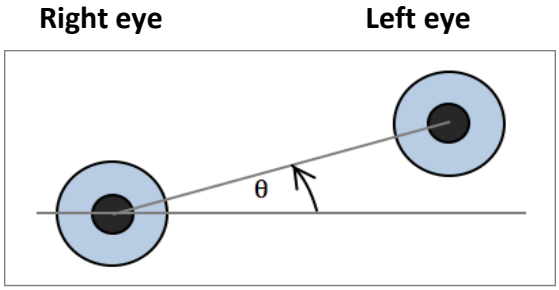


Figure 15 Coordinate system for eye rotation angle

Condition:	Optional
Occurrence:	0-1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

6.17.15. 17.015 RAU / Rotation Uncertainty

This field indicates the uncertainty in the in-plane eye rotation given in Field 17.014: RAE / Rotation Angle of Eye. This field is mandatory if Field 17.014: RAE is present. The rotation uncertainty is non-negative and equal to [round (65535 * uncertainty / 180)]. The uncertainty is measured in degrees and is the absolute value of maximum error. The hexadecimal value 'FFFF' indicates that uncertainty is undefined.

Condition:	Mandatory when 17.014 **RAE** occurs, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

6.17.16. 17.016 IPC / Image Property Code

This field describes the orientation and scanning properties of the image.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) IHO Horizontal Orientation Code

The first information item describes the horizontal orientation of the iris image. The values shall be one of: '**0**' (Undefined), '**1**' (Base), or '**2**' (Flipped). "Base" orientation refers to images corresponding to the view facing the subject, where the nasal side of subject's left eye or outer edge of the subject's right eye is on the left side of the image. "Flipped" orientation refers to images where the orientation is opposite from that described for "Base".

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 2. (1 N)

2) IVO Vertical Orientation Code

The second information item describes the vertical orientation of the iris image. The values shall be one of: '**0**' (Undefined), '**1**' (Base), or '**2**' (Flipped). "Base" orientation refers to images where the superior (top) edge of the eye is at the top of the image. "Flipped" orientation refers to images where the orientation is opposite from that described for "Base."

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 2. (1 N)

3) IST Specific Scan Type

The third information item describes the specific scan type. Code '**1**' (Progressive) is a **legacy** value that shall not be used for new records. "Progressive" indicates that the image was captured using progressive scanning, in which case all image lines are generated sequentially. Interlaced images are prohibited. All modern iris cameras should use progressive readout. However, there are two primary modes for the capture of the image which are related to the way the sensor pixels are exposed.

- Global shutter
- Rolling shutter

For modern iris cameras, the code should be either global or rolling.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from table below. (1 N)

Code	Description
0	Undefined
4	Global shutter
5	Rolling shutter
1	*Progressive (**legacy**)*

6.17.17. 17.017 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition: Optional

Occurrence: 0-1

Value Constraints: Must begin with 'M' or 'P' and shall contain only printable ASCII 7-bit characters, i.e., codes 32 – 126 inclusive. (13-16 ANS)

6.17.18. 17.018 Deprecated

6.17.19. 17.019 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. Optionally it can contain the underlying COTS information, for example, in the case of a commercial digital camera running a specific firmware version.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) ***MOD*** ***Model***

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) ***SER*** ***Serial Number***

This information item contains the serial number of the capture device. If the solution uses a COTS device, **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) ***FSV*** ***Capture Device Firmware/Software Version***

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on a camera which is used to capture the iris image. Software in this context can include the code which operates on the image captured from the device sensor and transforms that data into a cropped and compressed representation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) ***CRT*** ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, 'NONE' shall be inserted into this field.

Condition:	Optional
Occurrence:	0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* *Device Mobility*

This information item describes the general stability of the capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* *COTS Designation*

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* *COTS Serial Number*

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if **DCT** = Y, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.17.20. 17.020 ECL / Eye Color

This field describes the eye color of the subject as seen in the image. If unusual or unnatural, or the "real" eye color cannot be ascertained from the image, then the color shall be labeled as 'XXX'. Values for these fields shall be the alphabetic entries in the Code column of the table below.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (3 A)

Code	Eye Color

BLK	Black
BLU	Blue
BRO	Brown
GRY	Gray
GRN	Green
HAZ	Hazel
MAR	Maroon
MUL	Multicolored
PNK	Pink
XXX	Unknown

6.17.21. 17.021 COM / Comments

The field may be used to insert free-text information about the Type-17 record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.17.22. 17.022 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression when the SLC field contains a ‘1’ or ‘2’. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 17.999 or 17.994 is present. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.17.23. 17.023 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression when the SLC field contains a ‘1’ or ‘2’, in which case it shall equal the value in SHPS. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 17.999 or 17.994 is present. Otherwise, it shall be omitted
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.17.24. 17.024 IQS / Image Quality Score

This field is used to specify one or more different metrics of the image quality score data for the image stored in this record. If this field is present, a subfield shall exist for each quality algorithm.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 one or more Subfields; Information Items as described below

Contains:

1) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or 254 or 255. (1-3 N)

2) *QAV* ***Algorithm Vendor ID***

This information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

3) *QAP* ***Algorithm Product Identification***

This information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

4) *QPV* *Algorithm Product Version*

This information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* *Algorithm Comment*

This information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* *Algorithm Model Checksum*

This information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.17.25. 17.025 EAS / Effective Acquisition Spectrum

This field indicates the effective acquisition spectrum used in capturing the iris image. This is limited by both the lighting spectrum and the spectrum limitations of the acquisition device: it is defined by the overlap of the two spectra.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (3-9 A)

Code	Description	Spectrum
NIR	Near-infrared acquisition	Approx. 700–900[282] nm
DEFINED	Defined acquisition spectrum, in range of nanometers rounded to the nearest 10 nm, e.g., 828 to 830. This option provides the means to specify the acquisition spectrum when known with precision. When this value is used, Field 17.027: SSV / Specified Spectrum Values shall accompany it. The format of the two information items in that field shall be a 3 or 4-digit integer specifying the minimum of the spectrum range in nanometers, followed by a 3 or 4-digit integer specifying the maximum of the spectrum range in nanometers. The minimum value shall be less than or equal to the maximum value.	

VIS	Visible full-spectrum acquisition NOTE: Visible images cannot usually be matched against near- infrared images because either no detail, or different detail, of the iris texture is present in a visible light image. Interoperability between VIS and NIR images remains a research issue. VIS images are supported by this standard for supplemental, forensic, and research purposes only. Such use cases may extend to the periocular region.	Approx. 380–750 nm
RED	Red portion of visible full-spectrum illumination NOTE: Red light visible images cannot usually be matched against near-infrared images because no detail, noisy detail, or different detail, of the iris texture is present in a red-light image. Interoperability between VIS and RED images remains a research issue. RED images are supported by this standard for supplemental, forensic, and research purposes only. Such use cases may extend to the periocular region.	Approx. 620–750 nm
UNDEFINED	This value shall be used when the effective spectrum is unknown or unavailable and is not better described by one of the other values.	

6.17.26. 17.026 IRD / Iris Diameter

This optional field shall specify the expected iris diameter in pixels. This value may assist the processing algorithm(s) in the automated examination of the image. IRD need not be the measured value of the diameter.

Condition: Optional

Occurrence: 0-1

Value Constraints: 10 ≤ integer ≤ 9999. (2-4 N)

6.17.27. 17.027 SSV / Specified Spectrum Values

This field describes the upper and lower bounds for the acquisition spectrum. It shall only be present if Field 17.025 EAS / Effective Acquisition Spectrum has a value of ‘DEFINED’.

Condition: Mandatory when 17.025 **EAS** = DEFINED, otherwise omitted

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) *LOW* ***Spectrum Lower Bound***

The first information item indicates the lower frequency bound in nm (rounded to the nearest 10 nm).

Condition: Mandatory

Occurrence: 1

Value Constraints: 500 ≤ integer ≤ 9990. (3-4 N)

2) *HIG* ***Spectrum Upper Bound***

The second information item indicates the upper frequency bound in nm (rounded to the nearest 10 nm).

Condition: Mandatory

Occurrence: 1

Value Constraints: 510 ≤ integer ≤ 9990. (3-4 N)

6.17.28. 17.028 DME / Damaged or Missing Eye

This field shall specify if the eye described in this record is unable to provide a usable iris image. The eye position is specified in Field 17.003 ELR / Eye Label. 'UC' should be entered if the eye is physically present, but a usable iris image cannot be captured, for example if the eye is swollen shut due to injury.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (2 A)

Code	Description
MA	Missing or artificial eye
UC	Unable to capture image

6.17.29. 17.029 IQC / Iris Quality Components

This field shall specify one or more different measurements on the biometric sample that may contribute to the computation of a unified quality score for the image stored in the record. A subfield shall exist for each quality algorithm.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *QNQ* ***Native Quality Measure***

The first information item shall contain the output of a quality component assessment algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

2) *QAV* ***Algorithm Vendor Identification***

The second information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF (4 H)

3) *QAP* ***Algorithm Product Identification***

The third information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535. (1-5 N)

4) *QPV* ***Algorithm Product Version***

The fourth information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* ***Algorithm Comments***

The fifth information item contains any comments related to the values in the subfield in which it occurs.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* ***Algorithm Model Checksum***

The sixth information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition:	Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.17.30. 17.030 DMM / Device Monitoring Mode

This field describes the level of human monitoring that was associated with the biometric sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table, below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6.17.31. 17.031 IAP / Subject Acquisition Profile – Iris

This field lists the IAP level associated with the iris acquisition device. The Acquisition Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation, Version 2.* See Section 5.14.3 for detailed information about Acquisition Profiles.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values from Table 9 Subject acquisition profiles for iris are ‘10’, ‘11’, ‘12’, ‘20’, ‘30’, or ‘40’. (1-2 N)

6.17.32. 17.032 ISF / Iris Storage Format

This field indicates the storage format of the iris image. Image storage formats 1 and 2 might be the native output of an iris camera. ISF format code 1 is designated for high resolution outputs. ISF level 2 is the format output in most commercial iris acquisition systems and corresponds to the dimensions of the Video Graphics Array (VGA). Image storage formats 3 and 7 are typically prepared by client software: ISF 3 images are cropped; and ISF 7 images are both cropped and masked. These operations, used in conjunction with the standardized compression schemes, afford reduced record sizes. All of the formats establish geometric specifications. For ISF = 1 and 2, there are minimum margin requirements specified in terms of the estimated iris radius, R (see Figure 16 Examples of ISF image formats and Table 80 Iris storage formats). For ISF = 3 and 7, there are exact margin requirements. These requirements support accurate localization of the iris boundaries.

In order to be considered acceptable as non-intrusive and to avoid excessive geometric distortion, the minimum distance between the iris capture device's lens and the subject's eye must be at least 100 millimeters.

Table 77 Iris storage formats

Code	Description	Iris Centering	Iris Margin Horizontal Requirement [a]	Iris Margin Vertical Requirement
1	Unconstrained image size	Recommended	≥ 0.6R	≥ 0.2R
2	Raw: 640 x 480	Recommended	≥ 0.6R	≥ 0.2R
3	Cropped	Required	= 0.6R	= 0.2R
7	Cropped and Masked	Required	= 0.6R	= 0.2R

[a] R is radius of the iris

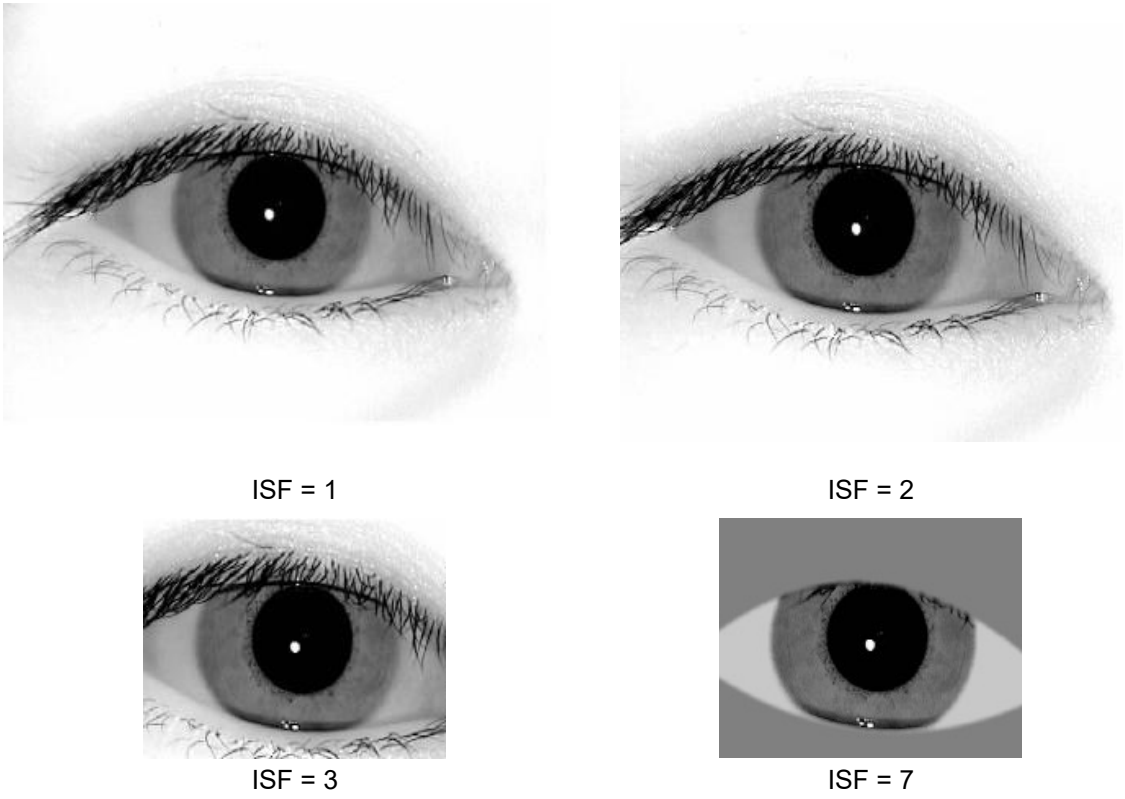


Figure 16 Examples of ISF image formats

In order to provide an acceptable level of usability and ease of alignment, the camera must allow for some variability in the position of the iris center relative to the camera. This is consistent with ISO/IEC 19794-6 and ISO/IEC 29794-6 specification concerning image margin requirements. The vertical margin shall be > 0.2 times the radius of the iris. The horizontal margin shall be > 0.6 times the radius. See Figure 17 Image Margin Requirements.

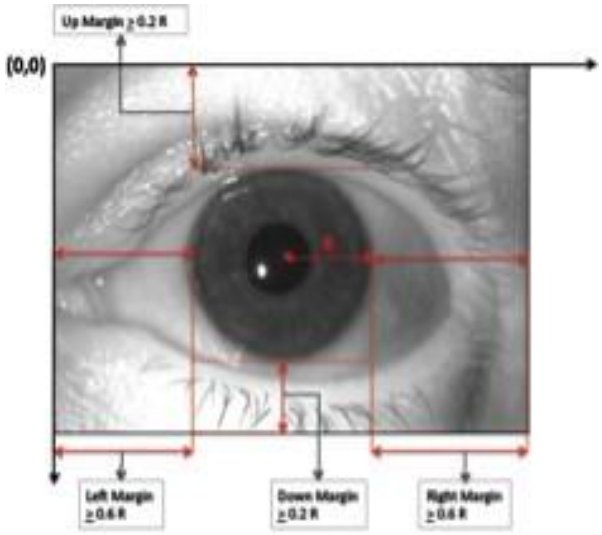


Figure 17 Image margin requirements

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Code value from Table 80 Iris storage formats. (1 N)

6.17.33. 17.033 IPB / Iris Pupil Boundary

This field defines the pupillary boundary, between the iris and pupil. This path is a field containing a set of coordinates, which may be defined as a circle, ellipse, an open path, or closed path polygon. A circle or open path requires a minimum of 2 points to define it; an ellipse or polygon requires a minimum of 3 points.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *BYC* ***Boundary Code***

The first information item describes the shape of the boundary path.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code values ‘C’, ‘E’ or ‘P’ from Table 78 Boundary definition codes. (1 A)

Table 78 Boundary definition codes

Code	Minimum Vertices	Description
C	2	Circle - The boundary is defined by two points: the center is defined in the first point, and any point on the circle is defined as the second point.
E	3	Ellipse - The boundary is defined by three points: both endpoints of one of the ellipse’s axes are defined in the first and second points, and one endpoint from the other axis is defined in the third item.
P	N (up to 99)	Polygon - The boundary is defined as a n-vertex, where ‘n’ is between 3 and 99. The order of the vertices must be in consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last point and the first point shall complete the polygon. The polygon must be a single plane figure with no sides crossing and no interior holes.
O	N (up to 99)	Open path – The boundary is defined as n-vertex, where ‘n’ is between 2 and 99. An open path is a series of connected line segments that do not close or overlap. The order of the vertices shall be in their consecutive order along the length of the path, either clockwise or counterclockwise. (A straight line of only two points may start at either end). A path may not have any sides crossing, and no two vertices shall occupy the same position.

2) *NOP* *Number of Points*

The second information item shall contain the number of vertices defining the boundary.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	2 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order describe the path bounding the pupil. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the path, either clockwise or counterclockwise. No two vertices may occupy the same location. The path shall define a simple plane figure with no sides crossing and no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

3) *HPO* *Horizontal Point Offset*

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 17.006 **HLL**. (1-5 N)

4) *VPO* ***Vertical Point Offset***

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 17.007 **VLL**. (1-5 N)

6.17.34. 17.034 ISB / Iris Sclera Boundary

This optional field defines the limbic boundary, between the iris and sclera. This path is a field containing a set of coordinates, which may be defined as a circle, ellipse, or closed path (polygon). A circle requires a minimum of 2 points to define it; an ellipse or polygon requires a minimum of 3 points.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *BYC* ***Boundary Code***

The first information item describes the shape of the boundary path.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code values ‘C’, ‘E’, or ‘P’ from Table 81 Boundary definition codes. (1 A)

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the boundary.

Condition:	Mandatory
Occurrence:	1

Value Constraints: 2 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order, describe the path of the limbic boundary. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the path, either clockwise or counterclockwise. No two vertices may occupy the same location. The path shall define a simple plane figure with no sides crossing and no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

3) *HPO* ***Horizontal Point Offset***

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 17.006 **HLL**. (1-5 N)

4) *VPO* ***Vertical Point Offset***

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 17.007 **VLL**. (1-5 N)

6.17.35. 17.035 UEB / Upper Eyelid Boundary

This field defines the boundary between the upper eyelid and the eye. This is an open path.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described below.

Contains:

1) *BYC* ***Boundary Code***

The first information item describes the shape of the boundary path.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed value is 'O' from Table 81 Boundary definition codes. (1 A)

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the boundary.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	2 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order describe the path of the boundary. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the path, either clockwise or counterclockwise. No two vertices may occupy the same location. The path shall define a simple plane figure with no sides crossing and no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

3) *HPO* ***Horizontal Point Offset***

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 17.006 **HLL**. (1-5 N)

4) *VPO* ***Vertical Point Offset***

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 17.007 **VLL**. (1-5 N)

6.17.36. 17.036 LEB / Lower Eyelid Boundary

This field defines the boundary between the lower eyelid and the eye. This is an open path.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *BYC* ***Boundary Code***

The first information item describes the shape of the boundary path.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed value is 'O' from Table 81 Boundary definition codes. (1 A)

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the boundary.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	2 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order describe the path of the boundary. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the path, either clockwise or counterclockwise. No two vertices may occupy the same location. The path shall define a simple plane figure with no sides crossing and no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

3) *HPO* ***Horizontal Point Offset***

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 17.006 **HLL**. (1-5 N)

4) *VPO* *Vertical Point Offset*

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 17.007 **VLL**. (1-5 N)

6.17.37. 17.037 NEO / Non-Eyelid Occlusions

This field defines the outline and contents of any non-eyelid occlusions that partially or totally block the image of the iris. Each point on this polygon is represented by a pair of information items.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below.

Contains:

1) *OYC* *Occlusion Opacity*

The first information item describes the occlusion opacity.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 79 Occlusion opacity. (1 A)

Table 79 Occlusion opacity

Code	Description
T	Total - There is no detail in the area of the occlusion.
I	Interference - The occlusion contains interfering texture such as eyelashes, hair or reflection.
L	Partial light - There is detail in the area of the occlusion that is lighter than the rest of the face or iris.
S	Partial shadow - There is detail in the area of the occlusion that is darker than the rest of the face or iris.

2) *OCT* *Occlusion Type*

The second information item describes the type of occlusion.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 80 Occlusion type. (1 A)

Table 80 Occlusion type

Code	Description
L	Lashes - Eyelashes or reflections of eyelashes (iris only)
S	Specular - Specularity, reflection of light
C	Shadow - Shadow cast
R	Reflection - Reflection of an object
O	Other - Any other occlusion, such as eyeglass frames blocking the image

3) *NOP* *Number of Points*

The third information item shall contain the number of vertices defining the boundary.

Condition: Mandatory

Occurrence: 1

Value Constraints: 3 ≤ integer ≤ 99. (1-2 N)

The following are repeating pairs of information items to indicate each (x,y) coordinate, which taken in order describe the path of the boundary. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the path, either clockwise or counterclockwise. No two vertices may occupy the same location. The path shall define a simple plane figure with no sides crossing and no interior holes. The number of occurrences of this pair shall be equal to the value of **NOP**:

4) *HPO* *Horizontal Point Offset*

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 17.006 **HLL**. (1-5 N)

5) *VPO* *Vertical Point Offset*

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition: Mandatory

Occurrence: 1 per Subfield (max **NOP)**

Value Constraints: 0 ≤ integer < Value of Field 17.007 **VLL**. (1-5 N)

6.17.38. 17.038 – 17.039 Reserved for Future Use Only by ANSI/NIST-ITL

6.17.39. 17.040 RAN / Range

This optional field contains the estimated distance from the lens of the camera to the iris, measured in whole centimeters.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 9999999. (1-7 N)

6.17.40. 17.041 GAZ / Frontal Gaze

This field estimates the degree of the eye(s) sight-angle relative to the camera. The angle shall be reported in degrees and defined as between the optical axis of the eye, and a line connecting the optical center of the eye and the optical center of the camera.

This measure is inclusive of both head angular orientation and eye-gaze angle relative to the head. The inclusive approach for gaze direction is not intended to be representative of the possible difficulty with iris segmentation due to non-frontal head orientation. Hence, two images with the same frontal gaze, but significantly different frontal head orientation may perform differently with different segmentation and matching algorithms. Note that iris image recognition systems typically rely upon having a small gaze angle in the image. While not prohibited in this standard, it is strongly discouraged that gaze angles greater than 15 degrees be used for enrollment or matching.

Condition: Optional

Occurrence: 0-1

Value Constraints: 0 ≤ integer ≤ 90. (1-2 N)

6.17.41. 17.042 – 17.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.17.42. 17.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition: Optional

Occurrence: 0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.17.43. 17.200 – 17.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.17.44. 17.901 Reserved for Future Use Only by ANSI/NIST-ITL
6.17.45. 17.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.17.46. 17.903 – 17.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.17.47. 17.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 17.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.17.48. 17.994 EFR / External File Reference

This field allows biometric data to be referenced at a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 17.999: DATA. These two fields are mutually exclusive, and one shall be present in all instances of this record type, except when Field 17.028 DME / Damaged or Missing Eye occurs in this record (indicating an eye is missing or is unable to provide a usable iris image). When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when both Field 17.999 DATA and Field 17.028 DME are absent. Otherwise, it shall be omitted.

Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.17.49. 17.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 17.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition:	Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.17.50. 17.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 17.999 DATA of this record or at the location specified in Field 17.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.17.51. 17.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 17.999 DATA or 17.994 EFR was derived. This field would be used when data is extracted from a representation, which is stored in a Type-20 record. The data could be segmented or processed and placed in separate Type-17 records. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 17.999 DATA (or 17.994 EFR) shall be identified in this information item.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.17.52. 17.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in 5.9 Geographic Sample Acquisition Location Field.

6.17.53. 17.999 DATA / Iris Image Data

This field contains the iris image. If Field 17.994: EFR is present in this record, then this field shall not appear. Neither this field nor Field 17.994: EFR should be present in this record when Field 17.028: DME / Damaged or Missing Eye is in this record (indicating an eye is missing or is unable to provide a usable iris image); however, some domains and application profiles may require a field with a "substitute image" such as the words 'Missing Eye'.

Condition:	Mandatory when Field 17.994 EFR is absent, and Field 17.028: DME does not occur in this record. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more Binary or Base64 digits. (1+ B)

6.18. Record Type-18 DNA Record

The DNA Record is undergoing an extensive realignment with current ISO standards. The volume of this work necessitates an extended timeline to bring it to fruition.

As a result, the content of the Type-18 record will not be revised in this update, except in the replacement of the *normative* static DNA Locus List (18.016 / DLR) and DNA Kit List (18.016 / KID) on the ITL webpage with the continuously maintained *informative* STRBase lists on the NIST website (https://strbase.nist.gov/Information/Type-18_Record), and the resulting field size and format changes. These changes to Field 18.016 are shown below. Please refer to ANSI/NIST-ITL 1-2015 for the current record requirements.

6.18.1. 18.016 STR / Autosomal STR, X-STR and Y-STR

This optional field may be comprised of as many subfields as there are combinations of data type and locus type reported. This field is only present if Field 18.011: STI / Sample Typing Information has a subfield with the value '0'.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

…

2) *DLR* ***DNA Locus Reference***

The second information item shall contain the Locus ID/Name for Autosomal, Y or X-STRs described in the subfield. The current *informative* loci IDs are maintained by NIST and are available at https://strbase.nist.gov/Information/Type-18_Record. The Locus ID should be chosen from this list; however, other loci are permitted for both backward and forward compatibility.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 20 characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1-20 U)

…

12) *KID* ***Kit ID***

The twelfth information item shall specify the ID of the DNA Kit used to process the DNA described in this record. The current informative Kit IDs are maintained by NIST and are available at https://strbase.nist.gov/Information/Type-18_Record. It is strongly recommended

that the Kit ID be chosen from this list, however, the KID value shall be represented as '0' for a non-listed kit. If a non-listed kit is used (KID = 0), then the following three information items are mandatory.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

…

6.19. Record Type-19 Plantar Print Image Record

Type-19 image records shall contain and be used to exchange variable-resolution plantar print image data together with fixed and user-defined textual information fields pertinent to the digitized image. Information regarding the scanning resolution used, the image size, and other parameters or comments required to process the image are recorded as fields within the record. Plantar print images transmitted to other agencies will be processed by the recipient agencies to extract the desired feature information required for matching purposes. Plantars are defined in this standard to be friction ridge prints from the foot. The areas are the individual toes, ball/inter-digital area, arch, and heel for each foot.

It should be noted that as the resolution is increased, more detailed ridge and structure information becomes available in the image. While the Type-19 record may be used for the exchange of 19.69 ppmm (500 ppi) images, it is strongly recommended that the class resolution for plantar images be 39.37 ppmm (1000 ppi). However, in all cases the scanning resolution used to capture a plantar image shall be at least as great as the minimum scanning resolution of 19.69 ppmm (500 ppi). The variable-resolution plantar image data contained in the Type-19 record may be in a compressed form.

6.19.1. 19.001 LEN / Record Length

The length of the entire Type-19 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.19.2. 19.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction, see Section 5.11.1 IDC / Information Designation Character.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.19.3. 19.003 IMP / Impression Type

The Impression Type describes the manner in which the friction ridge image was obtained.

Condition: Mandatory when Field 19.999 DATA or 19.994 EFR is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table 81 Type-19 impression codes. (1-2 N)

Table 81 Type-19 impression codes

Codes	Description
0	Plain Contact; Friction ridge skin presented still on platen
1	Rolled Contact; Friction ridge skin rolled on platen
8	Vertical Swipe; Friction ridge skin swiped on platen
24- 25, 41-42	*Deprecated*
43	Contactless capture
28	Other
29	Unknown

6.19.4. 19.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 19.993: SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.19.5. 19.005 PCD / Plantar Capture Date

The date that the biometric data contained in this record was captured by the Source Agency (**SRC**).

Condition: Mandatory

Occurrence: 1

Value Constraints: Full Local Date (see 5.1.1 Local Date)

6.19.6. 19.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of the image.

Condition:	Mandatory when Field 19.999 DATA or 19.994 EFR is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.19.7. 19.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of the image.

Condition:	Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.19.8. 19.008 SLC / Scale Units

The image sampling frequency (pixel density). A value of ‘0’ in this field indicates that no scale is provided, and the quotient of THPS/TVPS shall provide the pixel aspect ratio.

Condition:	Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Code value from table below. (1 N)

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

6.19.9. 19.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of the image when SLC has a value of ‘1’ or ‘2’. For example, if the SLC value = 1, then the value of THPS could be ‘1000’ for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition:	Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.19.10. 19.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of the image when SLC has a value of '1' or '2', in which case TVPS shall equal THPS. For example, if the SLC value = 1, then the values of THPS and TVPS could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N).

6.19.11. 19.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted grayscale images.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from Table 85 Type-19 Compression Algorithms. (3-5 AN)

Table 82 Type-19 compression algorithms

Code	Description
NONE	Uncompressed
WSQ	WSQ[a] (Version 3.1:2010) *500 ppi Only.* ***Preferred Code for WSQ compression***
WSQ20	***Legacy use only***
JPEGB	JPEG (Lossy) ***Legacy use*** *500 ppi Only*
JPEGL	JPEG (Lossless) ***Legacy use*** *500 ppi Only*
JP2	JPEG 2000 (Lossy) 1000 ppi Only
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)

[a] Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

6.19.12. 19.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel. This field shall contain an entry of '8' for normal grayscale values of '0' to '255'. Any entry in this field greater than '8' shall be used to represent a grayscale pixel with increased proportion. For color, BPX represents the total number of bits per pixel (not per color). For instance, BPX=24 represents a 24-bit RGB image using 8 bits for each color.

Condition: Mandatory when Field 19.999 or 19.994 is present, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 8 ≤ integer ≤ 99. (1-2 N)

6.19.13. 19.013 FGP / Friction Ridge Generalized Position

This field describes which plantar position biometric sample is contained in this record. One subfield with a single information item comprises this field for backwards compatibility in for Traditional Encoding only. Other encodings may represent the field as a single information item.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	60 ≤ FGP ≤ 79; Code from Table 86 Type-19 Friction Ridge Position Codes. (2 N)

Table 83 Type-19 friction ridge position codes

Code	Description
60	Unknown sole
61	Sole – right foot
62	Sole – left foot
63	Unknown toe
64	Right big toe
65	Right second toe
66	Right middle toe
67	Right fourth toe
68	Right little toe
69	Left big toe
70	Left second toe
71	Left middle toe
72	Left fourth toe
73	Left little toe
74	Front / ball of right foot
75	Back / heel of right foot
76	Front / ball of left foot
77	Back / heel of left foot
78	Right middle of foot (corresponds to the arch and/or outside (fibular hypothenar) areas of the feet.
79	Left middle of foot (corresponds to the arch and/or outside (fibular hypothenar) areas of the feet.

6.19.14. 19.014 Reserved for Future Use Only by ANSI/NIST-ITL

6.19.15. 19.015 CSP / Color Space

Image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of ‘RGB’ shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition:	Mandatory when BPX > 8, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Code value from Table 4 Color Spaces. (3-4 A)

6.19.16. 19.016 SHPS / Scanned Horizontal Pixel Scale

The horizontal pixel density used for the scanning of the original image / impression when the SLC field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 19.999 or 19.994 is present. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.19.17. 19.017 SVPS / Scanned Vertical Pixel Scale

The vertical pixel density used for the scanning of the original image / impression when the SLC field contains a '1' or '2', in which case it shall equal the value in SHPS. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 19.999 or 19.994 is present. Otherwise, it shall be omitted
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.19.18. 19.018 AMP / Amputated or Bandaged

This field shall specify if a plantar friction ridge area is amputated or bandaged. Multiple subfields may be entered.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 8 Subfields; Information Items as described below

Contains:

1) ***FRAP*** ***Friction Ridge Amputated or Bandaged Position***

The first item conveys the position of the friction ridge skin that is not captured as expected. If an entire foot is missing, either '61' (sole and toes – right foot) or '62' (sole and toes – left foot) shall be entered for **FRAP**.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 8)
Value Constraints:	Code value from Table 86 Type-19 Friction Ridge Position Codes. Allowed values are 60-79. (2 N)

2) *ABC Amputated or Bandaged Code*

The second item is the amputated or bandaged code (ABC), also known as the AMPCD. '**XX**' shall be used only when a partial print exists, i.e., the image contains *some* friction ridge detail.

'**UP**' shall be used where there is no image in Field 19.994: EFR or Field 19.999: DATA for the record due to a total lack of available friction ridge detail. Some legacy systems may require a "placeholder" image for proper operation, in which case this may be sent strictly in accordance with the agreement of the interchanging agencies.

A partially scarred foot should be printed but shall not be marked 'XX' or 'UP'.

Condition:	Mandatory
Occurrence:	1 per Subfield (max 8)
Value Constraints:	Code value from Table 87 Amputation or Bandaged Plantar Codes. (2 A)

Table 84 Amputation or bandaged plantar codes

Code	Description
XX	Partial print (some friction ridge detail in image)
UP	Unable to print (no friction ridge detail in image)

3) *MDC Missing Detail Reason Code*

The third information item provides additional detail about the reason for the missing friction ridge detail**.** Use of the Missing detail reason codes of 'PA' or 'FA' indicates that the condition leading to partial or no friction ridge detail is permanent in the subject and will not be reversed at a later capture event.

Use of the Missing detail code 'BM' indicates that the condition leading to no friction ridge detail being captured is not permanent for the subject and the detail missing from the current capture event could be present at a later capture event. If the reason for the missing detail is unknown, this field should be omitted.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Code value from Table 88 Missing Detail Reason Codes. (2 A)

Table 85 Missing detail reason codes

Code	Description
PA	Partial amputation of expected friction ridge area
FA	Full amputation of expected friction ridge area
BM	Bandaged or other medical issue

6.19.19. 19.019 FSP / Friction Ridge - Toe Segment Position(s)

This field describes the locations for each of the image segments of up to five individual toes within a flat image. The segmentation for each toe is represented in a different subfield. The number of information items within each subfield depends on the number of vertices (points). There need not be more than one subfield present. Additional toes (beyond five per foot) shall be grouped together with either the big toe or the little toe, depending upon the side of the foot upon which they appear.

This field uses a polygon with at least three and at most 99 vertices to encompass each toe image segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 5 Subfields; Information Items as described below

Contains:

1) *FRAS* ***Friction Ridge Alternate Segment Position***

The first information item describes the plantar position described in the segment, from Table 86 Type-19 Friction Ridge Position Codes, above.

Condition:	Mandatory
Occurrence:	1 per subfield (max 5)
Value Constraints:	Allowed code values are 64-73. (2 N)

2) *NOP* ***Number of Points***

The second information item shall contain the number of vertices defining the segment.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	3 ≤ integer ≤ 99. (1-2 N)

The following are two paired (x,y) information items, which taken in order describe the path bounding this segment. The number of occurrences of this pair shall be equal to the value of **NOP** for each segment:

3) *HPO* *Horizontal Point Offset*

The third information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 19.006 **HLL**. (1-5 N)

4) *VPO* *Vertical Point Offset*

The fourth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition:	Mandatory
Occurrence:	1 per Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 19.007 **VLL**. (1-5 N)

6.19.20. 19.020 COM / Comments

The comment field may be used to insert free text information about the Type-19 record. It is not reserved exclusively for log-related information but has historically often been used for that purpose.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.19.21. 19.021 SEG / Plantar Segment Position

This field shall only be present if Field 19.013 **FGP** = 60, 61 or 62. The subfield occurs at least once, and may be repeated if more than one algorithm is used to segment the image. Note that this field does not restrict segmentation to toes, as Field 19.019 **FSP** does.

Condition:	Mandatory when the value of Field 19.013 FGP = 60, 61, or 62. Otherwise, it is omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 17 Subfields; Information Items as described below

Contains:

1) *FRSP* ***Friction Ridge Segment Position***

The first information item contains the Friction Ridge Position Code captured in the segment.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '63'-'79', from Table 86 Type-19 Friction Ridge Position Codes. (2 N)

2) *LHC* ***Left Horizontal Coordinate Value***

The second information item shall contain the horizontal offset in pixels to the left edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ value of Field 19.006 **HLL**. (1-5 N)

3) *RHC* ***Right Horizontal Coordinate Value***

The third information item is the horizontal offset in pixels to the right edge of the bounding box relative to the origin positioned in the upper left corner of the image.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	***LHC*** ≤ integer ≤ value of Field 19.006 **HLL**. (1-5 N)

4) *TVC* ***Top Vertical Coordinate Value***

The fourth information item is the vertical offset (pixel counts down) to the top of the bounding box.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ value of Field 19.007 **VLL**. (1-5 N)

5) *BVC* ***Bottom Vertical Coordinate Value***

The fifth information item is the vertical offset in pixels from the upper left corner of the image down to the bottom of the bounding box.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	***TVC*** ≤ integer ≤ value of Field 19.007 **VLL**. (1-5 N)

6.19.22. 19.022 – 19.023 Reserved for Future Use Only by ANSI/NIST-ITL

6.19.23. 19.024 FQM / Friction Ridge – Plantar Print Quality Metric

This field is used to specify one or more different metrics of plantar print image quality score data for the image stored in this record, such as the ISO/IEC 29794-4 unified quality scores (i.e., NFIQ 2). If this field is present, a subfield shall exist for each segmented area and quality algorithm combination.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *FRMP* ***Friction Ridge Measure Position***

The first information shall be the friction ridge measure position for the image stored in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value 60 – 79 from Table 86 Type-19 Friction Ridge Position Codes. (1-2 N)

2) *QVU* ***Quality Value***

This information item shall contain the image quality value assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of '255' shall indicate a failed attempt to calculate a quality score. An entry of '254' shall indicate that no attempt to calculate a quality score was made.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

3) *QAV* ***Algorithm Vendor ID***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 65535 (1-5 N)

5) *QPV* ***Algorithm Product Version***

The fifth information item specifies the version of the product assigned by the vendor.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* ***Algorithm Comments***

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* ***Algorithm Model Checksum***

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.19.24. 19.029 FQC / Friction Ridge Quality Components

This field shall specify one or more different measurements on the biometric sample that may contribute to the computation of a unified quality score for the image stored in the record. If this field occurs, a subfield shall exist for each segmented friction ridge position and quality algorithm combination.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *FRP* ***Friction Ridge Position***

The first information item is the friction ridge position referenced in this subfield.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 86 Type-19 Friction Ridge Position Codes. (1-2 N)

2) *QNQ* ***Native Quality Measure***

The second information item shall contain the output of a quality component assessment algorithm.

Condition: Mandatory

Occurrence: 1

Value Constraints: Allowed values: real number, 'Not Calculated', or 'Failed' (1+ ANS)

3) *QAV* ***Algorithm Vendor Identification***

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF (4 H)

4) *QAP* ***Algorithm Product Identification***

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535. (1-5 N)

5) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

7) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this component quality measure.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.19.25. 19.030 DMM / Device Monitoring Mode

This field describes the level of human monitoring that was associated with the biometric sample capture.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code value from table below. (7-10 A)

Code	Description
CONTROLLED	Operator physically controls the subject to acquire the biometric sample
ASSISTED	Person available to provide assistance to subject submitting the biometric
OBSERVED	Person present to observe operation of the device but provides no assistance
UNATTENDED	No one is present to observe or provide assistance
UNKNOWN	No information is known

6.19.26. 19.031 TAP / Subject Acquisition Profile – Toe and Plantar Print

This field lists the **TAP** levels associated with plantar print acquisition devices. The Acquisition Profiles levels are based upon those listed in the *Mobile ID Best Practice Recommendation, Version 2.* See Section 5.14.5 for detailed information about Acquisition Profiles.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values from Table 11 Subject Acquisition Profiles for Toe and Foot (Plantar) are '70', '80', '170' or '180'. (2-3 N)

6.19.27. 19.032 – 19.045 Reserved for Future Use Only by ANSI/NIST-ITL

6.19.28. 19.046 SUB / Subject Condition

This field describes the condition of the subject at the time of imaging. Different Type-19 records in the same transaction may have different values for **SUB**. For example, some images may have been acquired antemortem, while others were acquired post-mortem.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *SSC* ***Subject Status Code***

The first information item describes the status of the subject at the time of imaging.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

2) *SBSC* ***Subject Body Status Code***

The second information item shall indicate whether the information relates to an entire corpse or a separate body part.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

3) *SBCC* ***Subject Body Class Code***

The third information item indicates the state of the deceased body tissue.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are '**1**' (Natural Tissue) or '**2**' (Decomposed). (1 N)

6.19.29. 19.047 CON / Capture Organization Name

This field contains the name of the organization which captured the fingerprint in the current record, for example a coroner's office that captures friction ridge prints from a decedent's body in a morgue would be listed in CON. Note that this can be different from the agency entered in Field 19.004 SRC / Source Agency and Field 19.993 SAN / Source Agency Name, which describe the agency that created the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.19.30. 19.048 – 19.198 Reserved for Future Use Only by ANSI/NIST-ITL

6.19.31. 19.199 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition:	Optional
Occurrence:	0 - 1
Value Constraints:	1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.19.32. 19.200 – 19.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.19.33. 19.901 FCT / Friction Ridge Capture Technology

This field signifies the type of technology used to capture the friction ridge image. For specific examples of these technologies, refer to https://biometrics.nist.gov/ansi-nist-itl/1/2025/fct/.

Condition:	Mandatory when IMP = 43, otherwise Optional

Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	Code value from Table 40 Friction Ridge Capture Technology. (1-2 N)

6.19.34. 19.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as "Zulu time" or "Zero time" and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory

Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* *Process Description*

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.19.35. 19.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character ‘M’, or
- Host processor ID, identified by the first character ‘P’

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with ‘M’ or ‘P’ and shall contain only printable ASCII 7-bit values, i.e., codes 32 – 126 inclusive. (13-16 ANS)

6.19.36. 19.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. This field is mandatory when a contactless impression type is specified (IMP = 43). Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK* *Make

This information item contains the make, or manufacturer, of the capture device. A value of ‘0’ in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD* ***Model***

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER* ***Serial Number***

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV* ***Capture Device Firmware/Software Version***

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition:	Mandatory when IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* *Device Mobility*

This information item describes the general stability of the capture device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* *COTS Designation*

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition: Mandatory when IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* *COTS Serial Number*

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.19.37. 19.905 – 19.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.19.38. 19.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 19.004: Source agency/ SRC.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.19.39. 19.994 EFR / External File Reference

This field allows biometric data to be referenced at a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 19.999 DATA. These two fields are mutually exclusive, and one shall be present in all instances of this record type, except when Field 19.018 AMP indicates that the friction ridge detail is unprintable ('UP'). When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when Field 19.999 DATA is absent, **and** Field 19.018 AMP does not indicate that the friction ridge detail is unprintable ('**UP**'). Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.19.40. 19.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 19.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating

subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered here.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.19.41. 19.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 19.999 DATA of this record or at the location specified in Field 19.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.19.42. 19.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 19.999 DATA or 19.994 EFR was derived. An example of the use of this field would be when data is extracted from a representation, such as a scanned paper friction ridge card or the raw data from a contactless friction ridge capture, which is stored in a Type-20 record. The data could be segmented or processed and placed in separate Type-19 records. See Section 5.11.5

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 19.999 DATA (or 19.994 EFR) shall be identified in this information item.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.19.43. 19.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.19.44. 19.999 DATA / Plantar Image

This field, if present, contains the plantar image described in the other fields of this record. If Field 19.994: EFR is present in this record, then this field shall not appear. Neither Field 19.999 nor Field 19.994 need be present in the record when Field 19.018: AMP contains an amputation code value of '**UP**'. Some domains and application profiles may still require an image in this field in such cases. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 19.994 EFR is absent, **and** Field 19.018 does not indicate that the friction ridge detail is unprintable ('UP'). Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.20. Record Type-20 Source Representation Record

The Type-20 record contains the source representation(s) from which other biometric Record Types were or will be derived. Examples include an image of multiple latent prints of interest, which were segmented and prepared for sending in a Type-13 record; or a source representation record that includes a video which provided, or will provide, individual facial images for Type-10 records. There are many more occasions when it may be appropriate to use a Type-20 record.

The Type-20 record may be used by contactless capture device vendors as a mechanism by which they can transmit the original raw sensor data (e.g., point cloud information, image stack, etc.) for archiving by stakeholders. The raw sensor data can be stored in Field 20.999 DATA and consists of all data and metadata collected by the contactless capture device collection sensor that is used by the contactless solution vendor to algorithmically render the contact-compatible image, and thereby serves as the source representation for the contact-compatible imagery. This optional data is intended to be archived by stakeholders for possible use in the future; new algorithms can be used to reprocess the archived original sensor data to render improved contact compatible images without having to recapture the subject. While there are no constraints for the format and organization of this data beyond compliance to this standard and any applicable Application Profiles, it is required that the vendor employ aggressive lossless compression when encoding this data to minimize the impact of this archival information in the transmission package. Furthermore, the included data must contain any and all information the vendor may need to render the contact-compatible image(s) again. The software needed to reprocess the images can be obtained from the vendor by the stakeholder(s) when available/as

needed. The ANSI/NIST-ITL transaction shall not be used to transmit executable binary code to support this purpose.

It should be noted that the inclusion of Type-20 may incur a significant impact on resources for all parties involved in the processing pathway. Given this, stakeholders in the processing pathway may impose restrictions on the inclusion, retention or processing of Type-20 as a system operation decision in their Application Profiles.

6.20.1. 20.001 LEN / Record Length

The length of the entire Type-20 record measured in bytes, including this field.

Condition: Mandatory for Traditional Encodings, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 10 ≤ integer. (2+ N)

6.20.2. 20.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Sections 5.11.1 IDC / Information Designation Character and 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: 00 ≤ integer ≤ 99. (2 N)

6.20.3. 20.003 CAR / SRN Cardinality

This field indicates how this record relates to other record(s) within the transaction.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from the table below. (1 A)

Code	Description
S	The representation in this Type-20 record is the source of another Type-20 record
D	The representation in this Type-20 record is the source of one or more biometric type records, excluding Type-4 and Type-9, which have been derived from it
M	A single biometric type record, excluding Type-4 and Type-9, has been prepared from multiple Type-20 records
N	The representation in this Type-20 record is not the source of another biometric record

6.20.4. 20.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 20.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.20.5. 20.005 SRD / Source Representation Date

The date that the source data contained in this record was captured by the Source Agency (SRC). It may not always be possible to know the exact date of Source Representation imagery capture. In such a case, specify the date to the level known. For traditional encoding, fill the unknown portions of the date with zeros. For XML/JSON, use a date element with the correct level of precision. Field 20.022 ICDR / Imagery Capture Date Range Estimate should be used in conjunction with this field in such cases.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Local Date or Partial Local Date (see Section 5.1)

6.20.6. 20.006 HLL / Horizontal Line Length

The number of pixels contained on a single horizontal line of a 2D image.

Condition:	Mandatory when Field 20.999 DATA or 20.994 EFR is present and represents a 2D still image, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.20.7. 20.007 VLL / Vertical Line Length

The number of pixels contained on a single vertical line of a 2D image.

Condition:	Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer ≤ 99999. (2-5 N)

6.20.8. 20.008 SLC / Scale Units

The sampling frequency (pixel density) of a 2D image. A value of '0' in this field indicates that no scale is provided, and the quotient of **THPS**/**TVPS** shall provide the pixel aspect ratio.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: Code value from table below. (1 N)

Code	Description
0	no scale is provided
1	pixels per inch
2	pixels per centimeter

6.20.9. 20.009 THPS / Transmitted Horizontal Pixel Scale

This is the integer pixel density used in the horizontal direction of a 2D image when **SLC** has a value of '1' or '2'. For example, if **SLC** = 1, then the value of **THPS** could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N)

6.20.10. 20.010 TVPS / Transmitted Vertical Pixel Scale

This is the integer pixel density used in the vertical direction of a 2D image when **SLC** has a value of '1' or '2', in which case **TVPS** shall equal **THPS**. For example, if the **SLC** value = 1, then the values of **THPS** and **TVPS** could be '1000' for a 1000 ppi sensor. When using certain formats, such as PNG, conversion from ppm (or other scales) may result in a decimal value. Since these fields require integer values, rounding should be used.

Condition: Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.

Occurrence: 1 if Condition above is met, 0 otherwise

Value Constraints: 1 ≤ integer ≤ 99999. (1-5 N).

6.20.11. 20.011 CGA / Compression Algorithm

This field specifies the algorithm used to compress the transmitted 2D images.

Condition:	Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Code value from Table 90 Type-20 Compression Algorithms. (3-5 AN)

Table 86 Type-20 compression algorithms

Code	Description
NONE	Uncompressed
WSQ	WSQ[a] (Version 3.1:2010) *500 ppi Only*. ***Preferred Code for WSQ compression***
WSQ20	***Legacy use only***
JPEGB	JPEG (Lossy) ***Legacy use*** *500 ppi Only*
JPEGL	JPEG (Lossless) ***Legacy use*** *500 ppi Only*
JP2	JPEG 2000 (Lossy) 1000 ppi Only
JP2L	JPEG 2000 (Lossless)
PNG	PNG (Portable Network Graphics) (Lossless)
PNM	Portable Anymap Format (Netpbm)
MEDIA	A compression type referenced from the IANA registry (https://www.iana.org/assignments/media-types/media-types.xhtml), only as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles)

[a] Usage of WSQ 2.0 is allowable for rolled prints. Versions prior to 3.1 shall not be used for other impression types.

6.20.12. 20.012 BPX / Bits Per Pixel

The number of bits used to represent a pixel for a 2D image. This field shall contain an entry of '8' for normal grayscale values from 0 to 255. Any entry in this field greater than '8' shall be used to represent a grayscale pixel with increased proportion. For color, BPX represents the total number of bits per pixel (not per color). For instance, **BPX**=24 represents a 24-bit RGB image using 8 bits for each color.

Condition:	Mandatory when Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	8 ≤ integer ≤ 99. (1-2 N)

6.20.13. 20.013 CSP / Color space

2D image data may be transmitted in either compressed or uncompressed form. The transmission of uncompressed color images shall consist of RGB pixels, each component of which shall be quantized to at least 256 levels (8 bits). For each pixel, the three components shall be sequentially formatted for transmission on a pixel-by-pixel basis. Table 4 lists the codes and their descriptions for each of the available color spaces used within this standard. All other color spaces are to be marked as undefined. If the color image type cannot be determined, an entry of 'RGB' shall be entered in this field. See Section 5.12.4 Color Space for more information.

Condition:	Mandatory when **BPX** > 8 and Field 20.999 or 20.994 is present and represents a 2D still image, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	Value from the Code column of Table 4 Color Spaces. (3-4 A)

6.20.14. 20.014 AQS / Acquisition Source

This field shall specify and describe the acquisition source(s).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 9 Subfields; Information Items as described below

Contains:

1) *AQT* ***Acquisition Source Type***

The first information item shall properly categorize the source of the original acquisition.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code from Table 91 Type 20 Acquisition Source Types. (1-2 N)

Table 87 Type 20 acquisition source types

Code	Acquisition source type
0	Unspecified or unknown
1	Static digital 2D image from an unknown source
2	Static digital 2D image from a digital still-image camera
3	Static digital 2D image from a scanner
4	Single video frame (2D) from an unknown source
5	Single video frame (2D) from an analog video camera
6	Single video frame (2D) from a digital video camera
7	Video sequence from an unknown source
8	Video sequence from an analog video camera, stored in analog format
9	Video sequence from an analog video camera, stored in digital format
10	Video sequence from a digital video camera
11	Computer screen 2D image capture
12	Analog audio recording device; stored in analog form (such as a phonograph record)
13	Analog audio recording device; converted to digital
14	Digital audio recording device
15	Landline telephone audio – both sender and receiver
16	Mobile telephone audio– both sender and receiver
17	Satellite telephone audio – both sender and receiver
18	Telephone audio – unknown or mixed sources
19	Television – NSTC video
20	Television – PAL video

21	Television – Other video
22	Voice-over-internet protocol (VOIP) audio
23	Radio transmission: short-wave audio (specify single side band or continuous wave in FDN)
24	Radio transmission: amateur radio audio (specify lower side band or continuous wave in FDN)
25	Radio transmission: FM (87.5 MHz to 108 MHz) audio
26	Radio transmission: long-wave (150 kHz to 519 kHz) audio
27	Radio transmission: AM (570 kHz to 1720 kHz) audio
28	Radio transmission: Aircraft frequencies audio
29	Radio transmission: Ship and coastal station frequencies audio
30	Vendor specific capture format
31	Other

2) *A2D* *Analog to Digital Conversion*

The second information item shall describe the analog to digital equipment used to transform the source if the acquisition source is analog, and the data is stored in digital format. This field should address parameters used, such as sample rate, if known.

Condition: Mandatory if an analog to digital transformation occurred, omitted otherwise

Occurrence: 1 when Condition above is met, 0 otherwise

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

3) *FDN* *Radio Transmission Format Description*

The third information item describes the format of the radio format, when **AQT** indicates a radio transmission (codes 23-29)

Condition: Mandatory if **AQT** = 23 or 24;

Optional if **AQT** = – 25 through 29;

Otherwise omitted

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

4) *AQSC* *Acquisition Special Characteristics*

The fourth information item describes any specific conditions not mentioned in the **AQT** table. An example would be a near-infrared camera outputting images in visible wavelengths.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

6.20.15. 20.015 SFT / Source Representation Format

This field shall contain information about the type of file and any additional decoding instructions the recipient of the transaction may need to correctly interpret the source.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *FTY* ***File Type***

If possible, this field should contain a value from the Name column of the IANA Image, Audio, or Video registry indicating the MediaType, if one exists and the source representation is a digital file (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

If the value is not listed in the IANA registry, enter the name, and also enter a description of the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats (such as digital tape), enter 'OTHER'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

2) *DEI* ***Decoding Instructions***

The second information item contains any additional decoding instructions beyond file type for recipients.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.20.16. 20.016 SEG / Segments

This field shall consist of a separate subfield for each segment of a 2D image to be defined, describing the locations for each. The number of information items within each subfield depends on the number of vertices (points). There need not be more than one subfield present.

Each subfield uses a polygon with at least three and at most 99 vertices to encompass one image segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the

origin. The order of the vertices shall be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 99 Subfields; Information Items as described below

Contains:

Information Items comprising the First Subfield Set:

1) *RSP* ***Reference Segment Position***

The first information item assigns a unique index to each segment described in this field.

Condition:	Mandatory
Occurrence:	1 per subfield
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

2) *IPT* ***Internal File Reference Pointer***

The second information item shall contain the reference to the particular instance, such as page, video frame, or slide number used to derive the image transmitted in other record types. It is set to '0' if the source representation is a single file. If a particular frame is chosen and there is no further image segmentation needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present. This entry is free text..

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable 7-bit ASCII values, codes 32 – 126 inclusive. (1-15 ANS)

3) *NOP* ***Number of Points***

The third information item shall contain the number of vertices defining the segment, if one exists.

Condition:	Mandatory when segmentation has been made, Omitted otherwise
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	3 ≤ integer ≤ 99. (1-2 N)

The following are two paired (x,y) information items, which taken in order describe the path bounding this segment. If a single frame is chosen and there is no further image segmentation needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present. The number of occurrences of this pair shall be equal to the value of **NOP** for each segment:

4) *HPO* *Horizontal Point Offset*

The fourth information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory when segmentation has been made, Omitted otherwise
Occurrence:	1 per repeating Subfield (max **NOP**)
Value Constraints:	0 ≤ integer < Value of Field 20.006 **HLL**. (1-5 N)

5) *VPO* *Vertical Point Offset*

The fifth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding HPO in this subfield to represent each vertex.

Condition:	Mandatory when segmentation has been made, Omitted otherwise
Occurrence:	1 per repeating Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 20.007 **VLL**. (1-5 N)

6.20.17. 20.017 SHPS / Scanned Horizontal Pixel Scale

This field contains the horizontal pixel density used for the scanning of the original 2D image / impression when the **SLC** field contains a '1' or '2'. Otherwise, this shall indicate the horizontal component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as listed in Transmitted horizontal pixel scale (THPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 20.999 or 20.994 describes a 2D still image. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.20.18. 20.018 SVPS / Scanned Vertical Pixel Scale

This field contains the vertical pixel density used for the scanning of the original 2D image / impression when the **SLC** field contains a '1' or '2', in which case it shall equal the value in **SHPS**. Otherwise, this shall indicate the vertical component of the pixel aspect ratio, up to 5 integer digits. This field is used if the transmission pixel scale differs from the original image scale, as

listed in Transmitted vertical pixel scale (TVPS). Note that density is directly related to resolution.

Condition:	Optional when either Field 20.999 or 20.994 describes a 2D still image. Otherwise, it shall be omitted.
Occurrence:	0-1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 99999. (1-5 N)

6.20.19. 20.019 TIX / Time index

This field shall contain the start and end times measured in milliseconds (hh:mm:ss.sss) of segments within the file if the record contains video or audio. For instance, if **AQT** has a value between 1 and 7 or equal to 11, this field would not be used.

Condition:	Mandatory when either Field 20.999 or 20.994 describes a video or audio recording. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 99 Subfields; Information Items as described below

Contains:

1) *TIS* ***Time Index Start***

The first information item shall contain the start time of the specified segment within a video or audio file, measured in milliseconds (hh:mm:ss.sss).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00:00:00.000 ≤ **TIS** < **TIE**. (12 NS)

2) *TIE* ***Time Index End***

The second information item shall contain the end time of the specified segment within a video or audio file, measured in milliseconds (hh:mm:ss.sss).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	**TIS** < **TIE** ≤ 23:59:59.999. (12 NS)

6.20.20. 20.020 COM / Comments

The comment field may be used to insert free-text information about the Type-20 record.

Condition:	Optional

Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.20.21. 20.021 SRN / Source Representation Number

This field contains a unique reference number for the source representation stored in this record. The SRN is numbered sequentially beginning at one and incremented by one for each instance of Record Type-20. This value for SRN corresponds to the SRN that may be referenced as the first information item in the SOR field of other Record Types. Note that the *segment* references (RSP) for SOR are contained in 20.016 SEG / Segments if they exist. Records that do not contain an **SOR** field shall not be created from Type-20 records. See Section 5.11.5.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

6.20.22. 20.022 ICDR / Imagery Capture Date Range Estimate

This is the amount of time ± from Field 20.005 SRD during which the image data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, such as 'D5', meaning that the actual date of collection is estimated to be 5 days plus or minus from that specified in SRD. Leading zeros need not be entered.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates a date value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. For example, 'P6M' is a range of **SRD ±** 6 months.

Condition:	Optional when **SRD** occurs; Omitted otherwise
Occurrence:	0-1 when Condition above is met; 0 otherwise
Value Constraints:	Encoding-specific formatted Duration. (2-9 AN)

6.20.23. 20.023 – 20.098 Reserved for Future Use Only by ANSI/NIST-ITL

6.20.24. 20.099 BRI / Biometric Record Identifier

This field contains a permanent unique identifier for the biometric record.

Condition:	Optional
Occurrence:	0 - 1

Value Constraints: 1 or more characters from user-specified character set as indicated in Field 1.015 DCS. (1+ U)

6.20.25. 20.100-20.900 UDF / User Defined fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.20.26. 20.901 Reserved for Future Use Only by ANSI/NIST-ITL

6.20.27. 20.902 ANN / Annotation information

This field lists the operations performed on the original source in order to prepare it for inclusion in a biometric record type. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition: Mandatory

Occurrence: 1

Value Constraints: Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.20.28. 20.903 DUI / Device unique identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with 'M' or 'P' and shall contain only printable 7-bit ASCII characters, i.e., codes 32 – 126 inclusive. (13-16 ANS)

6.20.29. 20.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

This field is mandatory when this record contains the raw sensor data for a contactless friction ridge capture, that is, when a contactless impression type is specified (IMP = 43) in the biometric record linked to this source record (e.g., a Type-14 record).

Condition:	Mandatory when linked to a biometric record with IMP = 43, otherwise Optional
Occurrence:	1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** (below) shall be 'Y', and the COTS device serial number shall be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the fingerprint from the device sensor. Software in this context can include the code which operates on the fingerprint captured from the device sensor and transforms that data into a contact-compatible representation.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* ***Capture Device Certification Code***

This information item contains the certification authority of the capture device (for example, FBI assigned certificate code) If a certification identifier is not available, NONE shall be inserted into this field.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* ***Device Mobility***

This information item describes the general stability of the capture device.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* ***COTS Designation***

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition: Mandatory when linked to a biometric record with IMP = 43, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: Allowed values are '**Y**' (Solution is app on COTS device, i.e., mobile phone, tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* ***COTS Serial Number***

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' shall be inserted into this field.

Condition: Mandatory if DCT = Y, otherwise Optional

Occurrence: 1 if Condition above is met, 0-1 otherwise

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.20.30. 20.905 – 20.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.20.31. 20.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 20.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.20.32. 20.994 EFR / External File Reference

This field allows a data file to be in a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in Field 20.999 DATA / Source Representation Data. These two fields are mutually exclusive, and one shall be present in all instances of this record type. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when Field 20.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.20.33. 20.995 ASC / Associated context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data represented in Field 20.999 DATA or 20.994 EFR but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. See Section 5.11.6.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.20.34. 20.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 20.999 DATA of this record or at the location specified in Field 20.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180,*

Secure Hash Standard (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.20.35. 20.997 SOR / Source Representation

This field shall only appear when the data in this Type-20 record has been derived from ***another Type-20 Record*** in the transaction. It uses values from Field 20.021 SRN ***in the source record*** to link this record to its source Type-20 Record. An example of a Type-20 record being derived from another Type-20 record could be a single still image of a person which has been extracted from a video stored in another Type-20 record. See Section 5.11.5

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the ***source*** instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in ***source*** Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 20.999 DATA (or 20.994 EFR) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.20.36. 20.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the data sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.20.37. 20.999 DATA / Source Representation Data

If this field is used, Field 20.994: EFR / External File Reference shall not be set. However, one of the two fields shall be present in all instances of this record type. This field, if present, contains the source image described in the other fields of this record. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 20.994 **EFR** is absent. Otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.21. Record Type-21 Associated Context Record

The Type-21 record may be used to convey associated contextual information, such as a crime scene image of the area where evidence was collected, photographs of “pocket litter,” or facial images that are synthetic or “morphed”. This information does NOT contain information used to derive biometric information contained in other records. Record Type-20 serves that function.

6.21.1. 21.001 LEN / Record Length

The length of the entire Type-21 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.21.2. 21.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Section 5.3.2 Leading Zeroes in Field

Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.21.3. 21.003 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.4. 21.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 21.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.21.5. 21.005 ACD / Associated Context Date

The date that the associated context data contained in this record was captured by the Source Agency (21.004 SRC). It may not always be possible to know the exact date of Associated Context imagery capture. In such a case, specify the date to the level known. For traditional encoding, fill the unknown portions of the date with zeros. For XML, use a date element with the correct level of precision. Field 21.022 ICDR / Image Capture Date Range Estimate should be used in conjunction with this field in such cases.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Local Date or Partial Local Date (see Section 5.1)

6.21.6. 21.006 MDI / Medical Device Information

This field is designed to transmit information concerning medical devices found on or with an unidentified person which may assist in the person's identification. Each subfield describes a single device. At least one information item shall be present in each subfield.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *TYP* *Type of Device*

The first information item contains a text description of the type of device, such as a pacemaker or artificial knee.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015 DCS. (1-500 U)

2) *MFG* *Device Manufacturer*

The second information item contains the name of the manufacturer

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015 DCS. (1-500 U)

3) *MAK* *Device Make*

The third information item contains the "make," or specific brand of the device.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015 DCS. (1-500 U)

4) *MOD* *Device Model*

The fourth information item contains the model of the device.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015 DCS. (1-500 U)

5) *SER* *Device Serial Number*

The fifth information item contains the serial number of the device.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 500 characters from user-specified set as indicated in Field 1.015 DCS. (1-500 U)

6) *COM* *Comments*

The sixth information item contains any additional comment concerning the device.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.21.7. 21.007 – 21.014 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.8. 21.015 AFT / Associated Context Format

This field shall contain information about the type of file and any additional decoding instructions the recipient of the transaction may need to correctly interpret it.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) ***FTY*** ***File Type***

If possible, this information item should contain a value from the Name column of the IANA Image, Audio, or Video registry indicating the MediaType, if one exists and the source representation is a digital file (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles).

If the value is not listed in the IANA registry, enter the name, and also enter a description of the codec in **DEI**. If it is an analog file, enter 'ANALOG'. For digital data stored in other formats (such as digital tape), enter 'OTHER'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	3 to 127 characters from user-specified set as indicated in Field 1.015 DCS. (3-127 U)

2) ***DEI*** ***Decoding Instructions***

The second information item contains any additional decoding instructions beyond file type for recipients.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.21.9. 21.016 SEG / Segments

This field shall consist of a subfield for each segment of a 2D image to be defined, describing the locations for each. The segmentation for each segment is represented in a different subfield. The number of information items within each subfield depends on the number of vertices (points). There need not be more than one subfield present.

Each subfield uses a polygon with at least three and at most 99 vertices to encompass each image segment. Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The order of the vertices shall be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple plane figure with no sides crossing and no interior holes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 99 Subfields; Information Items as described below

Contains:

1) *ASP* ***Associated Segment Position***

The first information item assigns a unique index to each segment described in this field.

Condition:	Mandatory
Occurrence:	1 per subfield
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

2) *IPT* ***Internal File Reference Pointer***

The second information item shall contain a reference to the particular instance, such as page, video frame, or slide number used to derive the image transmitted in other record types. It is set to ‘0’ if the source representation is a single file. If a particular frame is chosen and there is no further image segmentation needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present. This entry is free text with any special characters allowed, except for the reserved characters and the control characters listed in Character types.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Shall contain only printable 7-bit ASCII values, codes 32 – 126 inclusive. (1-15 ANS)

3) *NOP* ***Number of Points***

The third information item shall contain the number of vertices defining the segment, if one exists.

Condition:	Mandatory when segmentation has been made, Omitted otherwise
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	3 ≤ integer ≤ 99. (1-2 N)

The following Repeating Subfield consists of two paired (x,y) information items, which taken in order, describe the path bounding this segment. If a single frame is chosen and there is no further image segmentation needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present. The number of occurrences of this pair for each segment shall be equal to the value of **NOP** for each segment:

4) *HPO* ***Horizontal Point Offset***

The fourth information item contains the horizontal offset from the origin positioned in the upper left corner of the image. The horizontal offsets (x) are the pixel counts to the right. It shall be paired with the corresponding **VPO** in this subfield to represent each vertex.

Condition:	Mandatory when segmentation has been made, Omitted otherwise
Occurrence:	1 per repeating Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 21.006 (**HLL).** (1-5 N)

5) *VPO* ***Vertical Point Offset***

The fifth information item contains the vertical offset from the origin positioned in the upper left corner of the image. The vertical offsets (y) are the pixel counts down from the origin. It shall be paired with the corresponding **HPO** in this subfield to represent each vertex.

Condition:	Mandatory when segmentation has been made, Omitted otherwise
Occurrence:	1 per repeating Subfield (max **NOP)**
Value Constraints:	0 ≤ integer < Value of Field 21.007 (**VLL).** (1-5 N)

6.21.10. 21.017 – 21.018 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.11. 21.019 TIX / Time index

This field shall contain the start and end times measured in milliseconds (hh:mm:ss.sss) of segments within the file if the record contains video or audio. For instance, if **AQT** has a value between 1 and 7 or equal to 11, this field would not be used.

Condition:	Mandatory when either Field 21.999 DATA or 21.994 EFR represents a video or audio recording. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 to 99 Subfields; Information Items as described below

Contains:

1) *TIS* ***Time Index Start***

The first information item shall contain the start time of the specified segment within a video or audio file, measured in milliseconds (hh:mm:ss.sss).

to the seconds and milliseconds.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00:00:00.000 ≤ **TIS** < **TIE**. (12 NS)

2) *TIE* ***Time Index End***

The second information item shall contain the end time of the specified segment within a video or audio file, measured in milliseconds (hh:mm:ss.sss).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	**TIS** < **TIE** ≤ 23:59:59.999. (12 NS)

6.21.12. 21.020 COM / Comments

The comment field may be used to insert free-text information about the Type-21 record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 126 characters from user-specified set as indicated in Field 1.015 DCS. (1-126 U)

6.21.13. 21.021 ACN / Associated Context Number

This field contains a reference number for the context representation stored in this record. This number corresponds to the ACN that may be referenced as the first information item in the ASC field of other Record Types. See Section 5.11.6. The ACN uniquely refers to a particular instance of Record Type-21. It is numbered sequentially beginning at one and incremented for each instance of Record Type-21. Note that the *segment* references are contained in Field 21.016 SEG / Segments if they exist.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

6.21.14. 21.022 ICDR / Image Capture Date Range Estimate

This is the amount of time ± from Field 21.005 ACD during which the image data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, for example 'D5' indicates that the actual date of collection is estimated to be 5 days plus or minus from that specified in ACD. Leading zeros are unnecessary.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates a date value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. For example, 'P6M' is a range of **ACD ±** 6 months.

Condition:	Optional when **ACD** occurs; Omitted otherwise
Occurrence:	1 when Condition above is met; 0 otherwise
Value Constraints:	Encoding-specific formatted Duration. (2-9 AN)

6.21.15. 21.023 – 21.045 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.16. 21.046 SUB / Image Subject Condition

This field describes the condition of the subject at the time of imaging. Different Type-21 records in the same transaction may have different values for SUB. For example, some images may have been acquired antemortem, while others were acquired post-mortem.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *SSC* ***Subject Status Code***

The first information item describes the status of the subject at the time of imaging.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

2) *SBSC* ***Subject Body Status Code***

The second information item shall indicate whether the information relates to an entire corpse or a separate body part.

Condition:	Mandatory when **SSC** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

3) ***SBCC*** ***Subject Body Class Code***

The third information item indicates the state of the deceased body tissue.

Condition: Mandatory when **SSC** = D, otherwise omitted.

Occurrence: 1 when Condition above is met, 0 otherwise.

Value Constraints: Allowed values are '**1**' (Natural Tissue) or '**2**' (Decomposed). (1 N)

6.21.17. 21.047 CON / Capture Organization Name

This field contains the name of the organization which captured the associated context in the current record, for example a coroner's office that captures general images of the placement of a decedent's body at a crime scene or in a morgue would be listed in CON. Note that this can be different from the agency entered in Field 21.004 SRC / Source Agency which describes the agency that created the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.21.18. 21.048 – 21.099 Reserved for Future Use Only by ANSI/NIST-ITL
6.21.19. 21.100 – 21.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in this record shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.21.20. 21.901 Reserved for Future Use Only by ANSI/NIST-ITL
6.21.21. 21.902 ANN / Annotation Information

This field lists the operations performed on the original source in order to prepare it for inclusion in this record. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as "Zulu time" or "Zero time" and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4.

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.21.22. 21.903 – 21.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.23. 21.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 21.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.21.24. 21.994 EFR / External File Reference

This field allows a data file to be in a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location if the data is not contained in Field 21.999: DATA. These two fields are mutually exclusive, and one shall be present in all instances of this record type. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.6 Implementation Domain and Application Profiles).

Condition:	Mandatory when Field 21.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1

Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.21.25. 21.995 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.26. 21.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 21.999 DATA of this record or at the location specified in Field 21.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.21.27. 21.997 Reserved for Future Use Only by ANSI/NIST-ITL

6.21.28. 21.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the context data was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field.

6.21.29. 21.999 DATA / Associated Context Data

If this field is used, Field 21.994: EFR shall not be set. However, one of the two fields shall be present in all instances of this record type. This field, if present, contains the source image described in the other fields of this record. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 21.994 **EFR** is absent. Otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.22. Record Type-22 Non-Photographic Imagery Data Record

The Type-22 record shall contain and be used to exchange imagery that is **not** standard 2D photography captured with a camera using visible light. Original Source images are handled in Type-20 records and Associated context images in Type-21, regardless of the imaging method.

The Type-22 record type may be used in conjunction with the Type-12 record for transmission of imagery stored using DICOM. Specialized medical imagery used for 3D printing of cast models is another example of data that may be transmitted using this record type[13]. It can also transmit scanned radiographs, as commonly used in dentistry.

6.22.1. 22.001 LEN / Record Length

The length of the entire Type-22 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.22.2. 22.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Sections 5.11.1 IDC / Information Designation Character and 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.22.3. 22.003 ICD / Imagery Capture Date

The date that the imagery data contained in this record was captured by the Source Agency (SRC). It may not always be possible to know the exact date of imagery capture. In such a case, specify the date to the level known. For traditional encoding, fill the unknown portions of the date with zeros. For XML, use a date element with the correct level of precision. Field 22.005 ICDR / Image Capture Date Range Estimate should be used in conjunction with this field in such cases.

Condition:	Optional

[13] The American Board of Orthodontics (ABO) states: "Digital model files must be one of three universal file formats: PLY, STL, or OBJ." in *The American Board of Orthodontics (ABO) Digital Model Requirements*. https://www.americanboardortho.com/media/1157/abo-digital-model-requirements.pdf

Occurrence: 0-1

Value Constraints: Local Date or Partial Local Date (see Section 5.1 Dates)

6.22.4. 22.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 22.993 SAN / Source Agency Name.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.22.5. 22.005 ICDR / Image Capture Date Range Estimate

This is the amount of time from Field 22.003 ICD ± during which the image data could have been originally collected. In Traditional format, it is entered in the format as YyyMmmDdd. It is possible to enter only a year, month and/or day range, for example 'D5' indicates that the actual date of collection is estimated to be 5 days plus or minus from that specified in ICD. Leading zeros are unnecessary.

For XML/JSON implementations, this element is represented using a duration type with the format PnYnMnD, "P" indicates a date value range, "nY" is the number of years, "nM" is the numbers of months, "nD" is the number of days. For example, 'P6M' is a range of **ICD ±** 6 months.

Condition: Optional when **ICD** occurs; Omitted otherwise

Occurrence: 1 when Condition above is met; 0 otherwise

Value Constraints: Encoding-specific formatted Duration. (2-9 AN)

6.22.6. 22.006 BIC / Body Image Code

This field may be used to indicate the type of image contained in this record, if this record contains an image of a human body. It shall contain a character string from the "Image Code" column of Table 41 Image Type Codes to indicate the appropriate image type.

For instance, if an X-Ray image of a chest is to be transmitted, BIC = CHEST. For dental radiographs, BIC = INTRAORAL and Field 22.103 DRID / Dental Radiograph Image Data shall be contained in the record.

Condition: Optional

Occurrence: 0-1

Value Constraints: Code Value taken from Table 41 Image Type Codes (3-11 AS)

6.22.7. 22.007 – 22.019 Reserved for Future Use Only by ANSI/NIST-ITL

6.22.8. 22.020 COM / Comments

The comment field may be used to insert free-text information about the Type-22 record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.22.9. 22.021 – 22.045 Reserved for Future Use Only by ANSI/NIST-ITL

6.22.10. 22.046 SUB / Image Subject Condition

This field describes the condition of the subject at the time of imaging. Different Type-22 records in the same transaction may have different values for SUB. For example, some images may have been acquired antemortem, while others were acquired post-mortem.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *SSC* ***Subject Status Code***

The first information item describes the status of the subject at the time of imaging.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**X**' (Status of individual unknown), '**A**' (Data obtained from a living person), or '**D**' (Data obtained from a deceased person). (1 A)

2) *SBSC* ***Subject Body Status Code***

The second information item shall indicate whether the information relates to an entire corpse or a separate body part.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are '**1**' (Whole body) or '**2**' (Body fragment). (1 N)

3) *SBCC* ***Subject Body Class Code***

The third information item indicates the state of the deceased body tissue.

Condition:	Mandatory when **SSC** = D, otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	Allowed values are '**1**' (Natural Tissue), '**2**' (Decomposed) or '**3**' (Skeletal). (1 N)

6.22.11. 22.047 CON / Capture Organization Name

This field contains the name of the organization which captured the associated context in the current record, for example a coroner's office that captures general images of the placement of a decedent's body at a crime scene or in a morgue would be listed in CON. Note that this can be different from the agency entered in Field 22.004 SRC / Source Agency which describes the agency that created the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

6.22.12. 22.048 – 22.100 Reserved for Future Use Only by ANSI/NIST-ITL

6.22.13. 22.101 ITYP / Non-Photographic Imagery Type Code

This field describes the type of imagery contained in the record. If code for the particular image type is listed in the following table, enter that code. If it is not listed, enter a description of the image type.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Code value from table below, or 1 to 1000 characters from user-specified set as indicated in Field 1.015 DCS. (1-1000 U)

Code	Description
XRAY	Radiographs (X-rays)
Sonogram	Sonogram
CT	CT Scan
CONE	Cone Beam
MRI	Magnetic Resonance Image
3DCM	3D Cast Model
IR	Infrared
UV	Ultraviolet
Multiple	Multiple (such as is possible in a DICOM record)
Enter text description	Other Image Type

6.22.14. 22.102 IFMT / Non-Photographic Imagery Data Format Code

This field describes the format of the data contained in Field 22.999 DATA / Non-Photographic Imagery Data or Field 22.994 EFR / External File Reference. DICOM is a commonly used medical imaging data format. Cast data (such as used for 3D printing of models of a patient's dentition by orthodontists) are often in PLY or STL format. If possible, this field should contain a value from the Name column of the IANA Image, Application, or Model registry indicating the MediaType (https://www.iana.org/assignments/media-types/media-types.xhtml), as permitted by the receiving agency (see Section 5.6 Implementation Domain and Application Profiles). If the value is not listed in the IANA registry, enter the name and a description. If specific known parameters were chosen to store / save the data that could affect the use or interpretation of the data, they should be stated. It is recommended that the system, algorithm, and version that generated the data also be listed.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.22.15. 22.103 DRID / Dental Radiograph Image Data

This field contains information specific to dental radiographic imagery.

Condition:	Mandatory when **BIC** = INTRAORAL and **ITYP** = XRAY. Otherwise omitted.
Occurrence:	1 when Condition above is met, 0 otherwise.
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) *RGS* ***Radiograph Size***

The first information item shall contain a code value from Section 12.5 of the ANSI/ADA Standard No. 1058. Note that only one value may be entered. Each image requires a separate record within the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Valid code from ANSI/ADA Standard No. 1058, Section 12.5. (3-30 NS)

2) *RIS* ***Radiograph Image Series***

The second information item shall contain a code value from Section 12.6 of the ANSI/ADA Standard No. 1058.

Condition:	Mandatory

Occurrence: 1

Value Constraints: Valid code from ANSI/ADA Standard No. 1058, Section 12.6. (3-30 NS)

3) *RIIS* *Radiograph Image in Series Text*

The third information item is used to specify an individual image in a particular series. This is a text field of up to 50 characters.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *RIIT* *Radiograph Image Information Text*

The fourth information item is used to specify the practitioner's name, address and telephone or other contact information. This corresponds to code '12.6.13' of the ANSI/ADA Standard 1058, but also allows additional explanatory text, such as any unique features associated with the radiograph.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.22.16. 22.104 – 22.199 Reserved for Future Use Only by ANSI/NIST-ITL
6.22.17. 22.200 – 22.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.22.18. 22.901 Reserved for Future Use Only by ANSI/NIST-ITL
6.22.19. 22.902 ANN / Annotation Information

This is an optional field, listing the operations performed on the original source in order to prepare it for inclusion in this record. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as "Zulu time" or "Zero time" and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.22.20. 22.903 DUI / Device Unique Identifier

This field uniquely identifies the data acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with 'M' or 'P' and shall contain only printable 7-bit ASCII characters, i.e., codes 32 – 126 inclusive. (13-16 ANS)

6.22.21. 22.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. Optionally it can contain the underlying COTS device serial number, for example, in the case of a computer running a capture device.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK Make

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a commercial computer), **DCT** should be 'Y', and the COTS device serial number should be included in **DSR** as well.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV* ***Capture Device Firmware/Software Version***

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the imagery from the device sensor. Software in this context can include the code which operates on the imagery captured from the device sensor and transforms that data into a standard representation.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* ***Capture Device Certification Code***

This information item contains the certification authority of the capture device. If a certification identifier is not available, NONE may be inserted into this field.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* ***Device Mobility***

This information item describes the general stability of the capture device.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* ***COTS Designation***

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition:	Optional

Occurrence:	0-1
Value Constraints:	Allowed values are '**Y**' (Solution is app on COTS device, i.e., tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) ***DSR COTS Serial Number***

This information item contains the serial number of the underlying COTS device (such as a commercial computer) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' may be inserted into this field.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.22.22. 22.905 – 22.991 Reserved for Future Use Only by ANSI/NIST-ITL

6.22.23. 22.992 T2C / Type-2 Record Cross Reference

When used, this field contains the IDC value of the Type-2 record that contains relevant biographic information and other data concerning the subject of this instance of the record, who may be different from the subject of the transaction. See Section 5.11.2 T2C / Type-2 Record Cross Reference and Section 5.3.2 Leading Zeroes in Field Values.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.22.24. 22.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 22.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.22.25. 22.994 EFR / External File Reference

This field allows a data file to be in a storage location that can be separately accessed. It shall be used to enter the URL/URI or other unique reference to a storage location if the data is not contained in Field 22.999 DATA / Non-Photographic Imagery Data. These two fields are

mutually exclusive, and one shall be present in all instances of this record type. When this field is used, it is required that the user state the format of the external file (**EFF**). This new information item is not backwards compatible with older versions of the EFR field. Application Profiles may restrict or limit the use of external file references, as well as their size, format, and character set. See Section 5.8.

Condition:	Mandatory when Field 22.999 DATA is absent. Otherwise, it shall be omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 Subfield; Information Items as described below.

Contains:

1) *EFL* ***External File Location***

The first information item shall be used to enter the URL/URI or other unique reference to a storage location of a digital representation if the data is not contained in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

2) *EFF* ***External File Format***

The second information item shall describe the format of the external data.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.22.26. 22.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 22.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.22.27. 22.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 22.999 DATA of this record or at the location specified in Field 22.994 EFR. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.22.28. 22.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 22.999 DATA or 22.994 EFR was derived. See Section 5.11.5.

Condition:	Optional
Occurrence:	0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 22.999 DATA (or 22.994 EFR) shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.22.29. 22.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the data was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field

6.22.30. 22.999 DATA / Non-Photographic Imagery Data

If this field is used, Field 22.994 EFR / External File Reference shall not be set. However, one of the two fields shall be present in all instances of this record type. This field, if present, contains the source image described in the other fields of this record. See Sections 5.7 and 5.8 for additional information about DATA and EFR.

Condition:	Mandatory when Field 22.994 **EFR** is absent. Otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

6.23. Record Type-98: Information Assurance Record

The Type-98 record shall contain security information that assures the authenticity and/or integrity of the transaction, possibly utilizing such techniques as binary data hashes, and/or digital signatures. Two mandatory fields in the Information Assurance (IA) Header are Field 98.003 DFO / IA Data Format Owner and Field 98.005 DFT / IA Data Format Type. The IA data format owner field denotes the vendor, standards body, working group, or industry consortium that has defined the format of the IA data. The values in the IA data format type field are assigned by the format owner and represent a specific IA Data format as specified by the format owner. This may be a non-standard, unpublished data format or a data format that has been standardized by an industry group, consortium, or standards body. It is the combined IA Data Format Owner / IA Data Format Type value that uniquely identifies the IA Data format. There may be many instances of this Record Type per transaction. The records that are protected by a Type-98 are all records other than the Type-98 itself.

6.23.1. 98.001 LEN / Record Length

The length of the entire Type-98 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.23.2. 98.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Sections 5.11.1 IDC / Information Designation Character and 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.23.3. 98.003 DFO / IA Data Format Owner

This field shall contain a four-digit hex value which denotes the vendor, standards body, working group, or industry consortium that has defined the format of the information assurance data. NIST maintains a voluntary table of format owners and the four-digit hex values that they have chosen, available at http://www.nist.gov/itl/iad/ig/ansi_standard.cfm. The IA data format owner and Field 98.005 DFT / IA Data Format Type, when used in combination with one another uniquely identify the specific format of the IA content. This IA data format definition may be published (public) or unpublished (non-public).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	4 Hexadecimal characters (4 H)

6.23.4. 98.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 98.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.23.5. 98.005 DFT / IA Data Format Type

This field shall be used to identify the value assigned by the format owner (**DFO**) to represent the IA data format as specified by the format owner. This may be a nonstandard, unpublished data format or a data format that has been standardized by an industry group, consortium, or standards body.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 20 characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1-20 U)

6.23.6. 98.006 DCD / IA Data Creation Date

This field shall contain the date and time that IA data was created. The date and time shall appear in UTC datetime format.

Condition:	Mandatory

Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

6.23.7. 98.007 – 98.199 Reserved for Future Use Only by ANSI/NIST-ITL

6.23.8. 98.200 – 98.899 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.23.9. 98.900 ALF / Audit Log

This field consists of a series of change statements, each describing a discrete change made to a referenced logical record since the previous Type-98 record was created (note that this does not include the Type 98 record itself). Best practices dictate that every change made to an ITL record should be logged in the ALF in order to preserve chain of custody and support reconstruction of previous versions. Moreover, if a given entity wishes to construct multiple Type-98 records for different target domains, each record must have identical ALFs with identical revision numbers.

One complete audit statement (subfield of ALF) shall be completed for each modified datum, such as a change in biographic data or an addition of a new record. If this field appears, then Field 98.901 ARN / Audit Revision Number shall also be in the record.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *EVT* ***Event***

The first information item shall contain textual information describing the event that occurred to the ANSI/NIST-ITL record/field, and shall be chosen from the following controlled vocabulary:

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed values are '**Added**', '**Modified**', '**Deleted**', or '**Corrupted**'. (5-9 A)

2) *EVR* ***Event Reason***

The second information item contains the rationale behind the Event that occurred.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

3) ***IID*** ***Information Identifier***

The third information item identifies the field/subfield/information item that has been affected by the Event. It is defined as the concatenation of the affected **IDC**, a comma, the **Field Number** in the standard, a comma, the **repeat count** of the subfield (default = 'NA'), a comma, and the **information item mnemonic** (if it exists). If a repeating subfield or information item does not exist, enter 'NA'. For repeating pairs of information items, the repeat count of the information item may follow the mnemonic. This value is also used to specify an item in a list. This position need not be filled with 'NA' if it is not relevant. A removed datum is preceded by a negative. When an optional field is removed, the field number is preceded by a minus. Even though subfields and information items may have been in the field, the field number is followed by 'NA,NA' so that the subfields and information items do not have to be individually listed.

Examples (spaced for clarity):

IDC,	**Field,**	**Subfield Repeat,**	**Mnemonic,**	**Information Item Repeat**
17,	10.014,	NA,	BBC	
3,	9.373,	4,	NA	
8,	10.024,	2,	QVU	
5,	10.033,	1,	HPO,	3 (3rd pair for the element)
29,	12.011,	1,	MARC, 15 (15th item in list)	
12,	10.024,	-2,	NA	
6,	18.016,	NA,	-AL3	
5,	-14.024,	NA,	NA	

Note that for Record Type-1 the IDC value is NA. If two records of the same type have the same IDC, then the IDC value can be suffixed by an indicator of the sequence of the affected record with the transaction. For example, if there were two Type-14 records with the same IDC (indicating that it is identical content as explained in Section 5.11.1), the second one within the transaction sequentially would be referenced as 7-2 for the IDC. A reference of 7 is equivalent to 7-1.

Condition:	Mandatory

Occurrence:	1
Value Constraints:	12 or more characters in a comma-separated list (12+ U)

4) *AGT* *Agent*

The fourth information item shall contain information describing the entity (Agent) responsible for the **EVT** that affected the object identified by the **IID**.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 200 characters from user-specified set as indicated in Field 1.015 DCS. (1-200 U)

5) *OLD* *Old Reference*

The fifth information item contains the original value of the location in the transaction referenced in **IID** before it was affected by the event (**EVT**).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more characters (1+ U)

6.23.10. 98.901 ARN / Audit Revision Number

This field contains a unique reference to the revision within the revision history of the transaction. For example, Revision 1 shall be encoded as 1; Revision 88 as 88. A Revision may contain multiple events, each of which is recorded as a discrete modification (requiring a separate subfield in ARN). A different Revision, with its corresponding log of modifications (recorded in ARN) requires a separate Type-98 record.

Condition:	Mandatory if Field 98.900 ALF appears; otherwise omitted
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	1 ≤ integer ≤ 999. (1-3 N)

6.23.11. 98.902 – 98.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.23.12. 98.993 SAN / Source Agency Name

This field contains the name of the agency referenced in Field 99.004 SRC / Source Agency.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.23.13. 98.994 – 98.999 Reserved for Future Use Only by ANSI/NIST-ITL

6.24. Record Type-99: CBEFF Biometric Data Record

The Type-99 record shall contain and be used to exchange biometric data that is not supported by other ANSI/NIST-ITL records. This data is exchanged in a format that conforms to INCITS 398-2008 (R2023), the Common Biometric Exchange Formats Framework.

The CBEFF conformant Biometric Information Record (BIR) used by the Type-99 record includes a common Header and a Biometric Data Block (BDB). Two mandatory fields in the CBEFF Header are Format Owner and Format Type. The Format Owner field denotes the vendor, standards body, working group, or industry consortium that has defined the format of the biometric data (the data contained in the BDB). A CBEFF requirement is that format owners register with the IBIA for an assigned identifier of the format owner.

The BDB format is specified by the format owner. This may be a non-standard, unpublished data format or a data format that has been standardized by an industry group, consortium, or standards body. It is the combined CBEFF Format Owner/Format Type value that uniquely identifies the BDB format. The Type-99 record provides the CBEFF fields necessary for users to send, receive, and interpret biometric data in any registered BDB format (with the exception of biometric data which is exchanged using the other records in this standard). The data carried in Field 99.999 DATA / Biometric Data Block is the BDB. The field's BDB Format Owner identifies the format of that data and BDB Format Type as described by the CBEFF standard.

6.24.1. 99.001 LEN / Record Length

The length of the entire Type-99 record measured in bytes, including this field.

Condition:	Mandatory for Traditional Encodings, otherwise omitted.
Occurrence:	1 if Condition above is met, 0 otherwise
Value Constraints:	10 ≤ integer. (2+ N)

6.24.2. 99.002 IDC / Information Designation Character

This field shall contain the IDC assigned to this record as listed in the information item IDC for this record in Field 1.003: CNT / Transaction Content. See Sections 5.11.1 IDC / Information Designation Character and 5.3.2 Leading Zeroes in Field Values for additional information. Each IDC may be used to relate information items to the other records in the transaction.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	00 ≤ integer ≤ 99. (2 N)

6.24.3. 99.003 Reserved for Future Use Only by ANSI/NIST-ITL

6.24.4. 99.004 SRC / Source Agency

The identifier of the agency that created this record and supplied the information herein. The source agency name may be entered in Field 99.993 SAN / Source Agency Name.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified character set encoding as indicated in Field 1.015 DCS. (1+ U)

6.24.5. 99.005 BCD / Biometric Capture Date

The date that the biometric data contained in this record was captured by the Source Agency (SRC).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Full Local Date (see Section 5.1.1 Local Date)

6.24.6. 99.006 – 99.099 Reserved for Future Use Only by ANSI/NIST-ITL

6.24.7. 99.100 HDV / CBEFF Header Version

This field shall be used to identify the version of CBEFF specification to which this record conforms. The format is two characters for major version number followed by two characters for minor version. The version of CBEFF in INCITS 398-2008 (R2023) is represented by the string ‘0102’ (major version ‘01’ and minor version ‘02’). See Section 5.3.2 for information concerning leading zeros.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Allowed Value is ‘0101’ or ‘0102’. (4 N)

6.24.8. 99.101 BTY / Biometric Type

This field adopts the values presented in CBEFF with the addition of two leading zeros for future expansion. See Section 5.3.2 Leading Zeroes in Field Values for information concerning leading zeros.

Only biometric types not covered in this standard with specific Record Types are allowed in this record. Previous versions of the standard included biometric types with record types now included in the standard and have therefore been removed from this version. For those Biometric Type Codes, refer to the applicable version of ANSI/NIST-ITL.

Condition: Mandatory

Occurrence: 1

Value Constraints: Code value from Table 92 CBEFF Biometric Types. (8 N)

Table 88 CBEFF biometric types

Code	Biometric Type Name
00000000	No Information Given
00000001	Multiple Biometrics Used
00000020	Retina
00000040	Hand Geometry
00000080	Signature Dynamics
00000100	Keystroke Dynamics
00000200	Lip Movement
00000400	Thermal Face Image
00000800	Thermal Hand Image
00001000	Gait
00002000	Body Odor
00008000	Ear Shape
00010000	Finger Geometry
00040000	Vein Pattern

6.24.9. 99.102 BDQ / Biometric Data Quality

This field is used to specify quality values for the biometric data stored in Field 99.999 DATA / Biometric Data Block of this record.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more Subfields; Information Items as described below

Contains:

1) *QVU* ***Quality Value***

This information item shall contain the image quality score assigned to the image data by a quality algorithm on a scale of 0 to 100. Higher values indicate better quality. An entry of ‘255’ shall indicate a failed attempt to calculate a quality score. An entry of ‘254’ shall indicate that no attempt to calculate a quality score was made.

Condition: Mandatory

Occurrence: 1

Value Constraints: 0 ≤ integer ≤ 100, or '254' or '255'. (1-3 N)

2) *QAV* *Algorithm Vendor ID*

The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This is a 4-digit hexadecimal value from the IBIA maintained Vendor Registry of CBEFF Biometric Organizations, which maps the value in this field to a registered organization. (See https://www.ibia.org/cbeff/iso/biometric-organizations.)

Condition: Mandatory

Occurrence: 1

Value Constraints: 0000 ≤ hexadecimal ≤ FFFF. (4 H)

3) *QAP* *Algorithm Product Identification*

The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with IBIA (https://www.ibia.org/cbeff/iso/product-codes). This indicates which of the vendor's algorithms was used in the calculation of the quality score.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 65535 (1-5 N)

4) *QPV* *Algorithm Product Version*

The fifth information item specifies the version of the product assigned by the vendor.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

5) *QCM* *Algorithm Comments*

The sixth information item contains any comments related to the values in the subfield in which it occurs.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6) *QCK* *Algorithm Model Checksum*

The seventh information item contains the SHA-256 checksum of the algorithm model used in the calculation of this quality measure.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	64 Hexadecimal characters (64 H)

6.24.10. 99.103 BFO / BDB Format Owner

This field shall be used to denote the vendor, standards body, working group, or industry consortium that has defined the format of the biometric data (in the BDB). In a CBEFF structure the BDB Format Owner and Format Type, when used in combination, uniquely identify the specific format of the BDB content. The format and content of the BDB is "owned" by the CBEFF Client (see Section 6.1 of the CBEFF standard). This BDB format definition may be published (public) or unpublished (non-public).

A CBEFF requirement is that format owners register with IBIA for an assigned identifier of the format owner. The number is guaranteed to be unique. Refer to the CBEFF standard, Section 6, "CBEFF Patrons and Clients," for registration information.

The four hex digits assigned by IBIA shall be represented by a string of four characters, available at http://www.ibia.org/cbeff

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

6.24.11. 99.104 BFT / Biometric Format Type

This mandatory field shall be used to identify the value assigned by the format owner to represent the specific BDB Format as specified by the format owner. This may be a non-standard, unpublished data format or a data format that has been standardized by an industry group, consortium, or standards body. The registration of the Format Type value is recommended but not required. Refer to the CBEFF standard, Section 6, "CBEFF Patrons and Clients," for registration information. The four hex digits assigned by the format owner shall be represented by a string of four characters, available at http://www.ibia.org/cbeff

Condition:	Mandatory
Occurrence:	1
Value Constraints:	0000 ≤ hexadecimal ≤ FFFF. (4 H)

6.24.12. 99.105 – 99.199 Reserved for Future Use Only by ANSI/NIST-ITL
6.24.13. 99.200 – 99.900 UDF / User Defined Fields

These fields may be defined by the domain application profile owner to allow additional information necessary for their use cases. Data contained in these fields shall conform in format and content to the specifications of the domain name(s) as listed in Field 1.013: DOM / Domain Name found in the Type-1 record, if that field is in the transaction.

6.24.14. 99.901 Reserved for Future Use Only by ANSI/NIST-ITL
6.24.15. 99.902 ANN / Annotation Information

This field lists the operations performed on the original source in order to prepare it for inclusion in this record. It stores information associated with one or more processing algorithms, processes, or workstations.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 or more Subfields; Information Items as described below

Contains:

1) *GMT* ***Greenwich Mean Time / UTC***

The first information item provides a mechanism for expressing the date of the operation performed in terms of Universal Coordinated Time, UTC+0. This is sometimes referred to as “Zulu time” or “Zero time” and might not be the same as the local date.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	Must be a full datetime, relative to UTC+0 rather than the local date. For encoding-specific format, see Section 5.1.4 Zulu Datetime / UTC Datetime

2) *NAV* ***Processing Algorithm Name / Version***

The second information item shall contain text identifying the name and version of the processing algorithm, application, process, or workstation. This may also be a name of a physical process or procedure.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

3) *OWN* ***Algorithm Owner***

The third information item shall list the organization that developed or maintains the processing algorithm, application, or latent workstation. When there is no algorithm used (e.g., for a physical process or procedure) enter 'N/A'.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 to 64 characters from user-specified set as indicated in Field 1.015 DCS. (1-64 U)

4) *PRO* ***Process Description***

The fourth information item shall contain a text description of the process or procedure applied to the sample in this record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more characters from user-specified set as indicated in Field 1.015 DCS. (1+ U)

6.24.16. 99.903 DUI / Device Unique Identifier

This field uniquely identifies the biometric acquisition device, or source of the data. This field shall be one of:

- Host MAC address, identified by the first character 'M', or
- Host processor ID, identified by the first character 'P'

Condition:	Optional
Occurrence:	0-1
Value Constraints:	Must begin with 'M' or 'P' and shall contain only printable 7-bit ASCII characters, i.e., codes 32 – 126 inclusive. (13-16 ANS)

6.24.17. 99.904 MMS / Make, Model, Serial Number

This field contains descriptive metadata for the capture device used in this record. Optionally it can contain the underlying COTS device serial number, for example, in the case of a mobile phone running a capture app.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described below

Contains:

1) MAK ***Make***

This information item contains the make, or manufacturer, of the capture device. A value of '0' in this field indicates that the make is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

2) *MOD* *Model*

This information item contains the model of the capture device. A value of '0' in this field indicates that the model is not known.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

3) *SER* *Serial Number*

This information item contains the serial number of the capture device. If the solution uses a COTS device (such as a mobile phone), **DCT** should be 'Y', and the COTS device serial number should be included in **DSR** as well.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

4) *FSV* *Capture Device Firmware/Software Version*

This information item contains the firmware or software version number of the capture device. Firmware in this context can include the code embedded on the device which is used to capture the imagery from the device sensor. Software in this context can include the code which operates on the imagery captured from the device sensor and transforms that data into a standard representation.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

5) *CRT* *Capture Device Certification Code*

This information item contains the certification authority of the capture device. If a certification identifier is not available, NONE may be inserted into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 characters from user-specified set as indicated in Field 1.015 DCS. (1-255 U)

6) *DMO* *Device Mobility*

This information item describes the general stability of the capture device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**STA**' (Desktop/stationary location), '**MOB**' (Handheld mobile device portable), and '**TET**' (Desktop device in vehicle or portable rig). (3 A)

7) *DCT* *COTS Designation*

This information item indicates if a device was manufactured as a complete unit, or is an application installed on a COTS device.

Condition: Optional

Occurrence: 0-1

Value Constraints: Allowed values are '**Y**' (Solution is app on COTS device, i.e., tablet, laptop or some other device that provides a host device sensor), and '**N**' (Device manufactured as a unit). (1 A)

8) *DSR* *COTS Serial Number*

This information item contains the serial number of the underlying COTS device (such as a mobile phone) that makes up the end-to-end capture solution. If the serial number of the device is inaccessible due to security constraints, 'UNKNOWN' may be inserted into this field.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 50 characters from user-specified set as indicated in Field 1.015 DCS. (1-50 U)

6.24.18. 99.905 – 99.992 Reserved for Future Use Only by ANSI/NIST-ITL

6.24.19. 99.993 SAN / Source Agency Name

This field contains the name of the agency referenced in 99.004 SRC / Source Agency.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 125 characters from user-specified set as indicated in Field 1.015 DCS. (1-125 U)

6.24.20. 99.994 Reserved for Future Use Only by ANSI/NIST-ITL

6.24.21. 99.995 ASC / Associated Context

This field links instances of one or more Type-21 Records to this record. Record Type-21 stores images and/or recordings that are NOT used to derive the biometric data in Field 99.999 DATA but that may be relevant or provide context to the collection of the biometric data, such as general scenes of the area where a latent print was found. This field consists of repeating subfields, each of which represent a different Type-21 Associated Context Record. See Section 5.11.6.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 to 255 Subfields; Information Items as described below

Contains:

1) *ACN* ***Associated Context Number***

The first information item contains the index value from Field 21.021 ACN / Associated Context Number for the referenced Type-21 Record.

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 ≤ integer ≤ 255. (1-3 N)

2) *ASP* ***Associated Segment Position***

The second information item contains the index value from the referenced Type-21 Record's Field 21.016 SEG / Segments / *Associated Segment Position* in order to link a particular set of segmentation coordinates. There may be up to 99 segments listed in Field 21.016, but only the relevant segment is entered here.

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 ≤ integer ≤ 99. (1-2 N)

6.24.22. 99.996 HAS / Hash

This field contains the SHA-256 hash value of the data described in this record, whether contained in Field 99.999 DATA of this record. Use of the hash enables the receiver of the data to perform fast searches of large databases to determine if the data already exist in the database. It is not intended as an information assurance check. See the latest version of the *Federal Information Processing Standard 180, Secure Hash Standard* (https://www.nist.gov/publications/secure-hash-standard) for information on computing SHA-256 hashes.

Condition: Optional

Occurrence: 0-1

Value Constraints: 64 Hexadecimal characters (64 H)

6.24.23. 99.997 SOR / Source Representation

This field uses values from Field 20.021 SRN to link this record to a Type-20 Source Representation Record from which the biometric sample data in Field 99.999 DATA was derived. An example of the use of this field would be when data is extracted from a representation, such as a scanned paper friction ridge card or the raw data from a contactless friction ridge capture, which is stored in a Type-20 record. The data could be segmented or processed and placed in separate Type-99 records. See Section 5.11.5.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 to 255 repeating Subfields; Information Items as described below

Contains:

1) *SRN* ***Source Representation Number***

The first information item contains an index to a specific Type-20 record in the transaction from which this record was derived. This same index value appears in the relevant instance of Record Type-20 as Field 20.021 SRN / Source Representation Number.

Condition: Mandatory

Occurrence: 1

Value Constraints: 1 ≤ integer ≤ 255. (1-3 N)

2) *RSP* ***Reference Segment Position***

The second information contains the index to a particular set of segmentation coordinates of the source representation. This same segmentation index value appears in Record Type-20 as the reference segment position (RSP) in Field 20.016 SEG / Segments. There may be up to 99 segments listed in Field 20.016, but only the segment used to produce the biometric data contained in Field 99.999 DATA shall be identified in this information item.

Condition: Optional

Occurrence: 0-1

Value Constraints: 1 ≤ integer ≤ 99. (1-2 N)

6.24.24. 99.998 GEO / Geographic Sample Acquisition Location

This field specifies the coordinated universal time (UTC+0) and the location where the biometric sample was collected. There are multiple possible formats for specifying the geographic location in this field (longitude and latitude, geographic coordinate universal transverse Mercator, and alternate coordinate systems).

Condition:	Optional
Occurrence:	0-1
Value Constraints:	1 Subfield; Information Items as described in Section 5.9 Geographic Sample Acquisition Location Field

6.24.25. 99.999 DATA / Biometric Data Block

This field shall contain the CBEFF Biometric Data Block (BDB).

Condition:	Mandatory
Occurrence:	1
Value Constraints:	1 or more binary or Base64 digits. (1+ B)

Appendix A. Change Log

Corrections made in this update (upd1) do not alter existing or introduce substantive technical information, but rather are intended to remove ambiguity, correct errors, and improve interpretation of the work. All Update1 changes are marked accordingly below.

Section 3 Normative References	Updated broken links; Removed unneeded / outdated standards; Added new references
Section 4 Terms and Definitions	Eliminated contradictions, duplicative, and circular definitions for Friction Ridge terms; Added “Contactless Fingerprint Capture”, “COTS Software”, and “JavaScript Object Notation (JSON)”; Corrected entry for INT-I.
Section 5.1 Dates	Clarified text; Added language to note that local Date Time should not include time zone when converting to traditional encoding.
Section 5.2 Character Encoding	Clarified text; Corrected conflicting information by specifying 7-bit ASCII as default when no character set is explicitly chosen; Deprecated unneeded 2007 version’s character set switching functionality
Section 5.3 Transformation Between Encodings	Clarified text; Added guidance on leading zero fields
Section 5.5 Backward Compatibility	Clarified text; Listed new deprecations
Section 5.6 Implementation Domain and Application Profiles	Clarified text
Section 5.7 DATA Field	Clarified text
Section 5.8 External Data File References	Clarified text
Section 5.9 Geographic Sample Acquisition Location Field	Removed the Elevation and Geodetic Datum Code from the optional group with the latitude and longitude information items; Removed the upper limit on Elevation; Corrected the minimum value for Geographic Coordinate Universal Transverse Mercator Easting; Changed condition for Geographic Coordinate Other System Value to allow its use in additional cases, removing contradictions in the 2015 text
Section 5.10 Friction Ridge Positions	Clarified term “slaps”; Added new FGP code ‘55’; Corrected dimensions for FGP 74 and 75 – increased maximum height of right foot to be the same size as left foot.
Section 5.11.1 IDC	Clarified text throughout
Section 5.11.4 Simultaneous Capture	Clarified text throughout
Section 5.12 Black and White, Grayscale, and Color Image Data Requirements	Clarified text throughout
Section 5.14 Subject Acquisition Profiles	Clarified text throughout

Section 5.14.2 FAP / Subject Acquisition Profile for Fingerprint	Changed FAP 45 to minimum compression of WSQ 3.1; Corrected FAP 45 and 145 “simultaneous number of fingers” value to agree with other platens of the same size and removed the associated extraneous footnote about implementation use-case scenarios; Corrected Table 8 Header from “Maximum Compression” to the more accurate term “Target Compression”.
Section 5.14.4 PAP / Subject Acquisition Profile for Palm Print	Corrected Table 10 Header from “Maximum Compression” to the more accurate term “Target Compression”.
Section 5.14.5 TAP / Subject Acquisition Profile for Toe and Plantar Prints	Corrected Table 11 Header from “Maximum Compression” to the more accurate term “Target Compression”.
Section 6 Record Types Data Dictionary	Updated record types table to reflect that type 4 records are legacy; Updated all x.001 LEN fields for non-binary record types to have no upper bound; Added language regarding leading zeroes to all x.002 and IDC referencing fields (Full list in Section 5.3.2) Added to all MMS Make/Model/Serial Number fields conditions and additional information items required for contactless capture; Added new subfield to all EFR fields to require file format information and remove the upper size limit on the External File Location; Clarified text throughout
Field 1.001 LEN / Record Length	Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition
Field 1.013 DOM / Transaction Domain Name	Update1 – Corrected Mnemonic from DNM to DMN
Field 1.015 DCS / Character Encoding	Update1 - Encoding WG – Adapted field to eliminate potential data conflicts, changed Condition and Occurrence for information item CSI to apply to Traditional Encoding only.
Field 1.016 APS / Application Profile Specifications	Corrected the description of information item 2) APN Application Profile Name
Field 1.017 ANM / Agency names	Corrected typographical error in Occurrences for information item 2) OAN Originating Agency Name
Field 1.018 GNS / Geographic name set	Corrected typographical error in Occurrences to agree with the Condition = Optional
Field 2.001 LEN / Record Length	Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition
Section 6.4 Record Type-4	Marked Type-4 records *Legacy*
Field 7.001 LEN / Record Length	Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition
Field 8.001 LEN / Record Length	Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition
Field 8.006 HLL / Horizontal Line Length	Update1 – Corrected upper value constraint to be the maximum possible for 2 Bytes (65535)
Field 8.007 VLL / Vertical line length	Removed unnecessary discussion of field 8.001. Update1 – Corrected upper value constraint to be the maximum possible for 2 Bytes (65535)
Section 6.9 Friction Ridge Metadata	Revised name of record to be more accurate; Deprecated proprietary vendor blocks; Clarified text throughout.
Field 9.001 LEN / Record Length	Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition

Field 9.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Fields 9.013-9.030	Updated URL for legacy FBI IAFIS feature set.
Fields 9.031-9.125	Deprecated proprietary vendor blocks
Field 9.126 CBI / M1 CBEFF Information	Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition for Information item CFO Update1 - Corrected Occurrence from 1 to 0-1 to match the Condition for Information item CFT
Field 9.138 RCI / M1 Ridge Count Information	Corrected index numbers to begin with 0
Fields 9.151-9.175	Deprecated proprietary vendor blocks
Fields 9.176 – 9.225 Other Feature Sets – User Defined Fields	Revised wording to allow application profiles to define these rather than vendors.
Fields 9.226 – 9.299	Added notation that these fields are reserved for future ANSI/NIST-ITL use
Section 6.9.12.1 EFS Coordinate System	Disallowed decimal approximation when converting between pixels and 10 micrometer units.
Field 9.302 FPP / EFS Finger - Palm - Plantar Position	ITL-1 2015 Errata applied (restoring FGPs 60-79); Removed the requirement of indicating the segments included in the ROI, thereby allowing a complete Slap instead; Changed “shall be marked” to “should be marked”; Allow FGP 13 & 14
Field 9.304 UNT / EFS Measurement Units	New field added to optionally allow pixels as unit of measurement
Field 9.307 PAT / EFS Pattern Classification	Added AMP Code resolution to Pattern Classification Table, “Capture Issues” descriptions
Field 9.308 RQM / EFS Ridge Quality/Confidence Map	Error corrected: this character type was changed to ‘H’ in 2013, but the uncompressed format is decimal (N), while the compressed format is Hexadecimal (H).
Field 9.309 RQF / EFS Ridge Quality Map Format	Update1 - Corrected GSZ grid size recommendation from 2 ƛ to 20 ƛ
Field 9.314 TRV / EFS Tonal Reversal	Revised description of code value ‘U’ from “Unknown” to “Unable to Determine” Added New Code value ‘O” with description “Analysis process has not occurred”
Field 9.316 FQM / EFS Friction Ridge Quality Measure	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 9.321 DEL / EFS Deltas	Resolved contradiction in 2015 of item DTP being marked both “mandatory” and “optional.” DTP is mandatory, but the value may be NULL.
Field 9.323 CPR / EFS Center Point of Reference	Changed traditional maximum character count from 5 to 6 for information items PXC and PYC, to account for the possible inclusion of a ‘-’ sign in the character string.
Field 9.331 MIN / EFS Minutiae	Increased maxOccurs from 999 to 9999; Added seventh information item, MINX Minutia Index
Field 9.333 MRC / EFS Minutiae Ridge Counts	Resolved mandatory/optional contradiction in 2015
Field 9.342 CLD / EFS Creases and Discontinuities	Resolved mandatory/optional contradiction in 2015; Reformatted confusing language into a table; Added new information item FGP to indicate the segment position from Field 9.302 which this subfield describes

Field 9.350 MFD / EFS Method Of Feature Detection	Removed maxOccurs and added language to allow an entry for each change in Field 9.331 MIN; Added new index information item MNXR to link the subfields to their corresponding 9.331 MIN.
Field 9.352 LPM / EFS Latent Processing Method	Changed reporting from “substantive” methods to “all methods in most to least destructive order; Removed upper limit on maxOccurs to allow this; Corrected description for code value ‘BAR’ to “Basic red 28”; Reverted to 2015 code values, reassess the proposed codes for 2026a
Field 9.353 EAA / EFS Examiner Analysis Assessment	Aligned analysis complexity values with ANSI/ASB BPR 165
Field 9.355 LSB / EFS Latent Substrate	Reverted to 2015 code values, reassess the proposed codes for 2026a
Field 9.356 LMT / Latent Matrix	Update1 - Corrected TOM value constraint description (1N to 1-2N) to accurately describe the maximum length of the field
Field 9.357 LQI / EFS Local Quality Issues	Update1 - Corrected LQP Occurrence to match the Mandatory condition (0-1 to 1)
Field 9.362 ECD / EFS Examiner Comparison Determination	Added new codes based on ANSI/ASB BPR 166; increased the size of the codes to allow this
Field 9.901 ULA / Universal Latent Workstation Annotation Information	Changed character type to U and removed maxOccurs limit
Field 9.905 FCT / Friction Ridge Capture Technology	New field, required for contactless fingerprints Update1 - Corrected previously truncated Table 40 Friction ridge capture technology to show all values.
Section 6.10 Record Type-10: Face, SMT and Body Part Photographic Image Record	Added guidance for morphed images to introduction; Clarified text throughout.
Field 10.003 IMP / Image Type	Removed “mugshot” from description of face code. Update1 – Corrected mnemonic (IMP -> IMT) and corrected minimum characters from 4 to 3
Field 10.011 CGA / Compression Algorithm	Added new codes ‘PNM’ and ‘MEDIA’. Update1 – Corrected Value Constraints description of field characters from ‘A’ to ‘AN’
Field 10.012 CSP / Color Space	Update1 - “Value constraints” was updated to reference Table 4 and delete duplicate embedded table.
Field 10.013 SAP / Subject Acquisition Profile	“Value constraints” was updated to reference Table 6 and delete duplicate embedded table.
Field 10.023 PAS / Photo Acquisition Source	Update1 – Corrected Condition and Occurrence to reflect that field is optional when Condition is not met, rather than prohibited.
Field 10.024 SQS / Subject Quality Score	Added new information items to describe algorithms; Removed the upper limit of 9 subfields.
Field 10.026 SXS / Subject Facial Description	Corrected typographical error in Value Constraints to correctly reflect the character types and count allowed for Traditional Encoding (to agree with the listed code values).
Field 10.028 SHC / Subject Hair Color	Update1 – Corrected mnemonic (SEC -> SHC)
Field 10.029 FFP / 2D Facial Feature Points	Corrected feature point codes to minimum of 1 character.
Section 6.10.29.1 MPEG4 feature points	Clarified description of the major and minor value notation.

Section 6.10.29.3 Anthropometric landmarks with and without MPEG4 counterparts	Corrected MPEG4 Feature Point codes for Feature Point ID 'go' in *ISO definitions of the anthropometric landmarks* table.
Field 10.033 FEC / Feature Contours	Corrected minimum number of feature points to 2, as it is an open path.
Field 10.035 FSB / Face/SMT/Body Image Quality Components	New field
Field 10.036 TIF / T10 Image Format	New field to support Media type in CGA
Field 10.042 SMD / SMT Descriptors	Corrected SMI / SMT code indicator field length to 9 to accommodate the length of the actual codes. (3-9 A)
Field 10.048 PID / Suspected patterned injury detail	Deprecated field
Field 10.049 CID / Cheiloscopic image data	Deprecated field
Field 10.199 Biometric Record Identifier	New Field
Section 6.11. Record Type-11: Voice Data Record	Revised name of record to be less restrictive; Clarified text throughout
Field 11.009 RCD / Record Creation Date	Update1 – Corrected Value Constraint to a local Datetime to agree with the descriptive text and updated the reference to point to the correct definition in Section 5
Field 11.010 VCD / Voice Recording Creation Date	Update1 – Corrected Value Constraint to a local Datetime to agree with the descriptive text and updated the reference to point to the correct definition in Section 5
Field 11.013 CONT / Container	Revised Code 1 to encompass the Media type reference instead of the (empty) container list maintained at NIST.gov; Increased the length of the container reference code accordingly
Field 11.014 CDC / Codec	Revised Code 1 to encompass the Media type reference instead of the (empty) container list maintained at NIST.gov; Increased the length of the codec reference code accordingly; Added new code to numeric format list to allow signed integers
Field 11.023 VDD / Voice Data Discontinuities	The Mnemonic and name for this field were changed in this version of the standard to disambiguate it from Field 9.324: DIS.
Field 11.024 DSD / Voice Data Discontinuities Diary	The name for this field was changed in this version of the standard to disambiguate it from both Field 9.324: DIS and Field 9.342 CLD / Creases and Linear Discontinuities.
Field 11.033 SQV / Vocal Segment Quality Values	Fifth information item COM was removed in favor of new algorithm items; Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 11.036 VSCT / Vocal Segment Content Description	Update1 – Corrected Condition to 'TLT' instead of 'TRN'.
Field 11.037 SCC / Vocal Segment Speaker Characteristics	Corrected information item T2C value range to begin at '00' instead of '1'because '00' is a common Type 2 IDC value.
Field 11.999 DATA / Voice Data	Character type was changed to B
Section 6.12. Record Type-12: Forensic Dental and Oral Record	Clarified text

Field 12.006 DSI / Dental Subject Information	Clarified condition for use of the 3rd, 5th, and 10th information items, *DRLC, DRDB,* and *DRDE*
Field 12.008 TDES / Transmittal Dental Encoding System Information	Corrected guidance to use Field 12.902 to log steps taken in creating the record; Removed upper occurrence limit of 100 for 2nd information item TSVT for consistency with OSVT in 12.007
Field 12.010 TDD / Tooth Data Detail	Changed condition from "Dependent" to Optional; Clarified text throughout
Field 12.011 MDD / Mouth Data Detail	Update1 – Corrected MARC Value Constraint to refer to Section 10 of the *ANSI/ADA Standard No. 1058 instead of Section 9*
Field 12.999 DATA / Dental Chart	Character type was changed to B
Section 6.13 Record Type-13: Friction-Ridge Latent Image Record	Clarified text throughout
Field 13.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Field 13.011 CGA / Compression Algorithm	Added new code 'PNM', designated WSQ20 as Legacy use only Update1 – Corrected Value Constraints description of field characters from 'N' to 'AN'
Field 13.015 PPC / Print Position Coordinates	Update1 – Corrected RHC Value Constraints lower bound from '0' to 'LHC' Update1 – Corrected BVC Value Constraints lower bound from '0' to 'TVC'
Field 13.018 RSP / Ruler or Scale Presence	Update1 – Revised conditional wording for Information Item RSF to be unambiguous
Field 13.021 CSP / Color Space	New Field
Field 13.024 LQM / Latent Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 13.029 FQC / Friction Ridge Quality Components	New field
Field 13.199 BRI / Biometric Record Identifier	New field
Field 13.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints Update1 – Updated Value Constraints to refer to Table 40 Friction Ridge Capture Technology, which corrects the allowed codes
Section 6.14 Record Type-14: Fingerprint Image Record	Clarified text throughout
Field 14.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin, deprecated old contactless codes and added a new one
Field 14.008 SLC / Scale Units	Added code 0 for contactless prints
Field 14.011 CGA / Compression Algorithm	Added new codes 'WSQ', 'PNM', 'PNG', designated WSQ20 as Legacy use only Update1 – Corrected Value Constraints description of field characters from 'N' to 'AN'
Field 14.013 FGP / Friction Ridge Generalized Position	Added slap information to descriptions; Added new code 55

Field 14.015 PPC / Print Position Coordinates	Update1 – Corrected RHC Value Constraints lower bound from '0' to 'LHC' Update1 – Corrected BVC Value Constraints lower bound from '0' to 'TVC'
Field 14.018 AMP / Amputated or Bandaged	Added clarifying language on amputation codes and clarified legacy "placeholder" image behavior; Added new information item to provide the reason for the missing friction ridge detail
Field 14.019 CSP / Color Space	New field Update1 - updated description to reference Table 4
Field 14.022 NQM	Marked as Legacy use only
Field 14.023 SQM / Segmentation Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 45 subfields
Field 14.024 FQM / Fingerprint Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 45 subfields
Field 14.029 FQC / Friction Ridge Quality Components	New field
Field 14.199 BRI / Biometric Record Identifier	New field
Field 14.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints; Updated code description Update1 – Updated Value Constraints to refer to Table 40 Friction Ridge Capture Technology, which corrects the allowed codes
Section 6.15. Record Type-15: Palm Print Image Record	Clarified text throughout
Field 15.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one ('43')
Field 15.011 CGA / Compression Algorithm	Added new codes 'WSQ', 'PNM', 'PNG', marked WSQ20 as legacy use only Update1 – Corrected Value Constraints description of field characters from 'N' to 'AN'
Field 15.014	Added notation that this field is reserved for future ANSI/NIST-ITL use
Field 15.015 CSP / Color Space	New field Update1 - updated description to reference Table 4
Field 15.018 AMP / Amputated or Bandaged	Added clarifying language on amputation codes and clarified legacy "placeholder" image behavior; Added new information item to provide the reason for the missing friction ridge detail.
Field 15.024 PQM / Palm Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 15.029 FQC / Friction Ridge Quality Components	New field
Field 15.199 BRI / Biometric Record Identifier	New field
Field 15.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints Update1 – Updated Value Constraints to refer to Table 40 Friction Ridge Capture Technology, which corrects the allowed codes

Section 6.16. Record Type-16 User-Defined Testing Image Record	Clarified text throughout
Field 16.011 CGA / Compression Algorithm	Added new codes 'WSQ', 'PNM', 'MEDIA', marked WSQ20 legacy use only
Field 16.013 CSP / Color Space	Update1 - updated description to reference Table 4
Field 16.015 TFT / Test Image Format	New field in support of the CGA Media value
Field 16.024 UQS / User-Defined Image Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 16.029 BQC / Biometric Quality Components	New field
Field 16.199 BRI / Biometric Record Identifier	New field
Section 6.17. Record Type-17 Iris Image Record	Clarified text throughout
Field 17.008 SLC / Scale Units	Corrected typographical error – restored Code '0'
Field 17.011 CGA / Compression Algorithm	Added new code 'PNM' Update1 – Corrected Value Constraints description of field characters from 'N' to 'AN'
Field 17.013 CSP / Color Space	Update1 - updated description to reference Table 4
Field 7.014 RAE / Rotation of Eye Angle	Added clarifying descriptive text
Field 17.016 IPC / Image Property Code	Added new scan type codes, marked code '1' legacy
Field 17.024 IQS / Image Quality Score	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 17.029 IQC / Iris Quality Components	New field
Field 17.035 UEB / Upper Eyelid Boundary	Changed allowed code and number of vertices to reflect the fact that this field is an open path, not a polygon
Field 17.036 LEB / Lower Eyelid Boundary	Changed allowed code and number of vertices to reflect the fact that this field is an open path, not a polygon
Field 17.199 BRI / Biometric Record Identifier	New field
Section 6.18. Record Type-18 DNA Record	Record will be revised in 2026 addendum
Field 18.016 STR / Autosomal STR, X-STR and Y-STR	Updated kit and loci value lists to point to STRBase-maintained lists instead of unmaintained text files; Changed these lists from **normative** to **informative**
Section 6.19. Record Type-19 Plantar Print Image Record	Clarified text throughout

Field 19.003 IMP / Impression Type	Updated descriptions of Impression Codes so that they explicitly include all friction ridge skin; Deprecated old contactless codes and added a new one
Field 19.011 CGA / Compression Algorithm	Added new codes 'WSQ', 'PNM', 'PNG'.; Marked code 'WSQ20' as legacy use only Update1 – Corrected Value Constraints description of field characters from 'N' to 'AN'
Field 19.015 CSP / Color Space	New field Update1 - updated description to reference Table 4
Field 19.018 AMP / Amputated or Bandaged	Added clarifying language on amputation codes and legacy "placeholder" image behavior; Added new information item to provide the reason for the missing friction ridge detail
Field19.021 SEG / Plantar Segment Position	Removed ambiguity in condition by explicitly stating it is mandatory when an entire foot is represented (FGPs 60-62).
Field 19.024 FQM / Friction Ridge – Plantar Print Quality Metric	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 19.029 FQC / Friction Ridge Quality Components	New field
Field 19.199 BRI / Biometric Record Identifier	New field
Field 19.901 FCT / Friction Ridge Capture Technology	New mandatory condition, required for contactless fingerprints Update1 – Updated Value Constraints to refer to Table 40 Friction Ridge Capture Technology, which corrects the allowed codes
Section 6.20. Record Type-20 Source Representation Record	Added language to allow videos without a Type-10 2D image for some facial identification scenarios; Added language to support contactless capture raw data and metadata; Clarified text throughout
20.003 CAR / SRN Cardinality	Update1 – Updated description to disambiguate the meaning of the code values. Update1 - Added new Code Value 'N' to indicate that the record has not been used to create another biometric record.
Field 20.011 CGA / Compression Algorithm	Added new codes 'WSQ', 'PNM', 'PNG', 'MEDIA'; Marked code 'WSQ20' as legacy use only
Field 20.013 CSP / Color Space	Clarified code descriptions
Field 20.015 SFT / Source Representation Format	Added IANA mediatypes as the preferred source of format information and alternate format scenarios and increased information item size accordingly
Field 20.022 ICDR / Imagery Capture Date Range Estimate	Clarified Condition for occurrence of this field
Field 20.099 BRI / Biometric Record Identifier	New field
Field 20.997 SOR / Source Representation	Update1 - New Field added to facilitate the (previously allowed) use case of developing a Type-20 record from another Type-20 record.
Section 6.21 Record Type-21 Associated Context Record	Added direction to use only this record for known or suspected synthetic or "morphed" facial data. Clarified text throughout
Field 21.015 AFT / Associated Context Format	Added IANA mediatypes as the preferred source of format information and alternate format scenarios and increased information item size accordingly

Field 21.022 ICDR / Imagery Capture Date Range Estimate	Clarified Condition for occurrence of this field
Field 21.994 EFR / External File Reference	Added new subfield to require file format information and remove the upper size limit on the External File Location; Removed restriction on using this field for 2D images, which should instead be addressed in an application profile
Section 6.22 Record Type-22 Non-photographic Imagery Data Record	Clarified text throughout
Field 22.006 BIC / Body Image Code	Corrected Occurrences from '1' to '0-1' (i.e., optional) Update1 – Corrected minimum characters from 4 to 3
Field 22.102 IFMT / Non-Photographic Imagery Data Format Code	Added IANA mediatypes as preferred code source
Field 22.999 DATA / Non-Photographic Imagery Data	Character type changed to B
Section 6.23. Record Type-98: Information Assurance Record	Clarified text throughout
Field 98.900 ALF / Audit Log	Corrected character type for information items IID and OLD to 'U' in order to accommodate logging changes to such data
Section 6.24. Record Type-99: CBEFF Biometric Data Record	Clarified text throughout
Field 99.100 HDV / CBEFF Header Version	Added code for INCITS 398-2008 (R2023)
Field 99.101 BTY / Biometric Type	Removed code for Voice records, as the list should only include modalities not represented in this standard.
Field 99.102 BDQ / Biometric Data Quality	Added new information items to describe algorithms; Removed the upper limit of 9 subfields
Field 99.999 DATA / Biometric Data Block	Character type changed to B
Appendix A	This change log
Appendix B	Removed Record Description sections with no information beyond "There are no special requirements for this record type."
B.5.8 Switching between character encoding sets	Removed section on "alternative encoding switching"
B.5.9 Handling of lists	Removed deprecated Field 10.049, and added the previously omitted Field 11.022 from the list of Fields using this method.
B.5.10 Paths B.5.10.1 Type-9 Extended Feature Set (EFS) Paths B.5.10.2 All Other Fields Specifying Paths	Relocated this information from Section 7.7.12 in 2015
B.6.2 Type-2 Record	Added previously omitted information about Type-2 format
Appendix C. NIEM-conformant encoding rules - Normative	Removed references to older version of NIEM; Updated URLs; Clarified text throughout;

	Expanded language to be inclusive of JSON encoding.
Appendix D. NCIC code table - Normative	Updated reference links; Clarified text throughout
Appendix E. Facial Capture – SAPs 30 and above - Normative	Updated web references throughout
E.3.3. Background and lighting	Removed outdated brand paint references
E.3.4. Exposure calibration	Corrected value from “0.5” to “0.05”
E.3.5. Exposure	Corrected value from “0.5” to “0.05”
E.6.2. Compression ratio	Corrected description to “target” compression ration rather than “maximum”.
Appendix F. Extended Feature Set Detailed Instructions – Normative	Clarified text throughout; Updated references to new document numbering

Appendix B. Traditional Encoding - Normative

The format and rules for this encoding of the ANSI/NIST-ITL 1-2025 version are consistent with ANSI/NIST-ITL 1-2011: Update 2015. The types of logical records together with the identifier and type of data for each record type are listed in Section 6 Record Types Data Dictionary (Normative).

Table 89 Logical record types

Record Identifier	Logical Record Contents	Type of Data
1	Transaction information	ASCII
2	User-defined descriptive text	ASCII
3	Low-resolution grayscale fingerprint image	Deprecated
4	High-resolution grayscale fingerprint image	Legacy
5	Low-resolution binary fingerprint image	Deprecated
6	High-resolution binary fingerprint image	Deprecated
7	User-defined image	Binary
8	Signature image	Binary
9	Friction ridge metadata	ASCII
10	Photographic body part imagery (including face and SMT)	ASCII/Binary
11	Voice data	ASCII/Binary
12	Forensic dental and oral data	ASCII/Binary
13	Variable-resolution latent friction ridge image	ASCII/Binary
14	Variable-resolution fingerprint image	ASCII/Binary
15	Variable-resolution palm print image	ASCII/Binary
16	User-defined variable-resolution testing image	ASCII/Binary
17	Iris image	ASCII/Binary
18	DNA data	ASCII/Binary
19	Variable-resolution plantar image	ASCII/Binary
20	Source representation	ASCII/Binary
21	Associated context data	ASCII/Binary
22	Non-photographic imagery data	ASCII/Binary
23-97	Reserved for future use	ASCII/Binary
98	Information assurance	ASCII/Binary
99	CBEFF biometric data record	ASCII/Binary

The first field in all records shall contain the length in bytes of the record. For all ASCII or ASCII/Binary records the first field shall also be labelled as field '1:'. The length has no upper bound. The mnemonic associated with each of these fields (x.001) is LEN. It is a positive integer value. The mnemonic LEN is used in Field 98.900: ALF / Audit Log as the value of IID / Information Identifier in order to record changes to the value in this field.

With the exception of the Type-1 record (See Section 6.1), the second field shall be labeled as field '2' and contain the IDC / Information Designation Character.

The data, field numbers, and information separators in the Type-1 record shall always be recorded in variable length fields using the 7-bit American Standard Code for Information Interchange (ASCII) as described in ISO/IEC 646. For purposes of compatibility, the eighth (leftmost) bit shall contain a value of zero.

Textual fields in Record Types 2 and 9-99 may occur in any order after the first two fields and contain the information as described for that particular numbered field, except for field 999, which shall be the concluding field, when it is included in a record. The allowed character encoding sets are included in Table 4.

In the Type-1, Type-2, Type-9 through Type-99 records, information is delimited by the four ASCII information separators. The delimited information may be items within a field or subfield, fields within a logical record, or multiple occurrences of subfields. These information separators are defined in the referenced standard ISO/IEC 646.

These characters are used to separate and qualify information in a logical sense. Viewed in a hierarchical relationship, the File Separator '$^{F}_{S}$' character is the most inclusive followed by the Group Separator '$^{G}_{S}$', the Record Separator '$^{R}_{S}$', and finally the Unit Separator '$^{U}_{S}$' character. The four characters are only meaningful when used as separators of data items in the ASCII fields of records. There is no specific meaning attached to these characters occurring in binary sample records and binary fields – they are just part of the exchanged data. Information separators should be functionally viewed as an indication of the type of data that follows.

The following is a detailed description of the separator characters and related data structures used to contain data throughout the standard:

Transaction (T) contains all biometric data to be submitted. A transaction is comprised of records.

Record (R) contains data related to one biometric modality or a set of related biometric modalities. A record is comprised of fields.

Field (IF) is used to transmit a particular datum or group of closely related data. A field contains one or more subfields.

Subfield (SF) separates logical groups of data within a field. A subfield contains one or more information items.

Information Item (II) is the smallest representation of data within a transaction which may not be separated into further components.

FN is the number of a field (including record type) within a record, other than Types 4, 7 or 8.

^{FS} File separator character – separates logical records within a transaction (Decimal value 28).

^{GS} Group separator character – separates fields within a record. (Decimal value 29).

^{RS} Record separator character – separates repeated subfields within a field. (Decimal value 30).

^{US} Unit separator character – separates information items within a subfield (Decimal value 31).

B.1. How separators are used

The separators defined above are used to separate multiple instances of data structures including records, fields, subfields, and information items. The number of separators present is always equal to one less than the number of structures present. For example, if two fields are present in a record, then only one ^{GS} separator is present between the two fields being separated. As a special case, when only one structure is present there are no separators. Thus, there is no difference in encoding when no structures are present and when one structure is present, because in both cases there are no separators. As a result of this observation, and to ensure consistency across all fields, a field contains a minimum of one subfield which contains a minimum of one information item. This case is listed as “Field containing a single value” in the definitions below.

B.2. General structure of a transaction

$T = R_1$ ^{FS}**$\ldots\ R_n$** where n is the number of records in the transaction.

The ^{FS} separator is used to separate records, R, contained in the transaction.

Note: The following descriptions apply only to non-binary record types (Types other than 4, 7, or 8). Binary records are comprised of pure binary data, and all structures are processed according to defined byte offsets.

B.3. General structure of a record

$R = FN_1{:}IF_1$ ^{GS} **$\ldots FN_n{:}IF_n$** where n is the number of fields in the record.

The ^{GS} separator is used to separate the fields contained in a record. Fields include a field number, FN, and a colon before the field contents: **FN:IF**

B.4. General structure of a field

Fields are formatted differently depending upon the type of data being transmitted. Every field contains a minimum of one subfield (one grouping of data), which contains at least one information item (the value of the field).

B.4.1. Field containing a single value

IF = II These fields appear in the record layout tables as a single row containing only one value. Example: Field 1.002: VER / Version Number.

This case represents the simplest field type, which contains only one value represented by a single information item. Note that the single subfield that contains the **II** is not visible because there are no subfield separator characters.

B.4.2. Field containing multiple values that do not repeat

IF = II_1 ^{US}… II_n where n is the number of information items present.

These fields appear in the record layout tables as a field with a set of information items. Example: 1.013: DOM / Domain name

The ^{US} separator is used to separate information items, **II**. Note that the single subfield that contains the set of II's is not visible because there are no subfield separator characters.

B.4.3. Field containing values with different formats that repeat as a set

IF = SF_1 ^{RS}…SF_n and **SF = II_1 ^{US}…II_k** where n is the number of subfields present, and k is the number of information items present for the given subfield.

These fields appear most commonly as "Subfields: Repeating sets of information items" but sometimes appear as "Subfields: Repeating pairs of information items" or "Subfield: Single set of information items".

Examples: Field 1.003: CNT / Transaction Content and Field 1.016: APS / Application Profile Specifications.

The ^{RS} separator is used to separate subfields, **SF**, in the field. The ^{US} separator is used to separate information items, **II**, in the subfields.

B.4.4. Field containing a value that may have multiple entries

IF = SF_1 ^{RS}… SF_n and SF = II where n is the number of subfields present. These fields appear as "Subfields: Repeating values". Example: Field 10.019.

The ^{RS} separator is used to separate subfields, **SF**, in the field, which each contain a single information item, **II**.

Normally, there should be no empty fields or information items and therefore only one separator character should appear between any two data items. The exception to this rule occurs for those instances where the data in information items in a transaction are unavailable, missing, or optional, and the processing of the transaction is not dependent upon the presence of that particular data. In those instances, multiple and adjacent separator characters shall appear together rather than requiring the insertion of dummy data between separator characters. In general, if one or more mandatory or optional information items are unavailable

for a field or subfield, then there shall be one fewer separator character present than the number of information items specified. For example, consider the definition of a field that consists of three information items. If the information for the second information item is missing, then two adjacent $^{U}_{S}$ information separator characters would occur between the first and third information items. If the second and third information items were both missing, then three separator characters should be used – two $^{U}_{S}$ characters in addition to the terminating field or subfield separator character.

B.5. Transmitted data conventions

B.5.1. Byte and bit ordering

Each information item, subfield, field, and logical record shall contain one or more bytes of data. Within a file, the order for transmission of both the ASCII and the binary representations of bytes shall be most significant byte first and least significant byte last otherwise referred to as Big-Endian format. Within a byte, the order of transmission shall be the most significant bit first and the least significant bit last. Figure 18 Byte and bit ordering illustrates the order of transmission of the bytes and bits within a file.

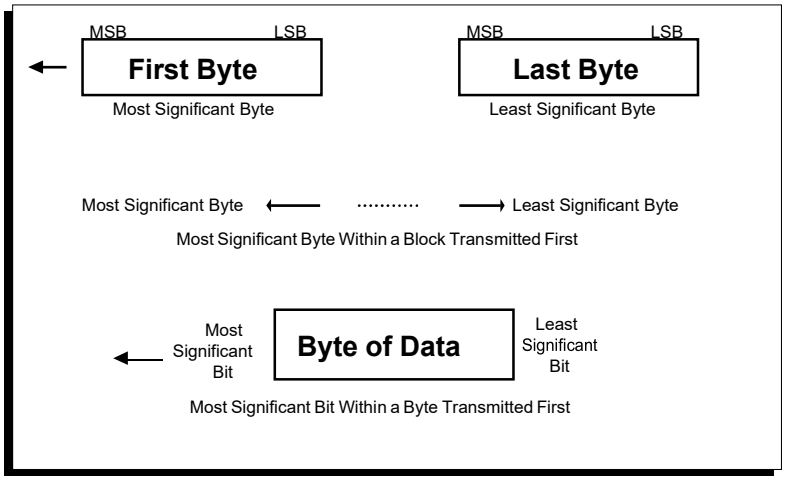


Figure 18 Byte and bit ordering

B.5.2. Date format

Dates shall appear as eight digits in the format “YYYYMMDD”. The “YYYY” characters shall represent the year of the transaction; the “MM” characters shall be the representation of the month; and the “DD” characters shall be the day in the month. For example, ‘20070103’ represents January 3, 2007. See Section 5.1 Dates.

B.5.3. Agency Codes

The 2007 version of the standard included only agency identifier fields. The 2008 version added the option of entering an organization name. This capability of the 2008 version is retained in this version of the standard by adding new fields (Field 1.017: ANM / Agency Names and Fields x.993 SAN / Source Agency Name).

B.5.4. Date/Time format

GMT/UTC shall be represented as "YYYYMMDDhhmmss**Z**"**,** a 15-character string that is the concatenation of the date with the time and concludes with the time zone character 'Z'. The 'YYYY' characters shall represent the year of the transaction. The 'MM' characters shall be the representation of the month. The 'DD' characters shall be the day of the month. The 'hh' characters represent the hour; the 'mm' the minute; and the 'ss' represents the second. See Section 5.1.4 Zulu Datetime / UTC Datetime.

Local Datetime uses the same format minus the 'Z'. Local date is of the format "YYYYMMDD". For Local Date Estimate it is possible to specify the date to the level known and fill the rest of the date with zeros.

B.5.5. Date offset

For Traditional encoding, the format **Y**yy**M**mm**D**dd is used for date offsets. Only one value need be present, but the code and an associated number shall be present. Leading zeroes before the offsets are optional. For example, '**Y**01' (or '**Y**1') is valid.

B.5.6. Date and time offset

For Traditional encoding, the format **Y**yy**M**mm**D**dd**h**hh**m**mm is used for date and time offsets. Only one value need be present, but the code and an associated number shall be present. For example, 'h01' is valid. Leading zeroes for the offsets are optional.

B.5.7. Record layout

For the Type-1, Type-2, Type-9 through Type-99 records, each information field that is used shall be numbered in accordance with this standard. The format for each field shall consist of the logical record type number followed by a period '.', a field number followed by a colon ':', followed by the information appropriate to that field. The field number may be any one to nine-digit number occurring between the period '.' and the colon ':'. It shall be interpreted as an unsigned integer field number.

This implies that a field number of '2.123:' is equivalent to and shall be interpreted in the same manner as a field number of '2.000000123:'.

For purposes of illustration throughout this appendix, a three-digit number shall be used for enumerating the fields contained in each of the Record Types, other than 4, 7 and 8. Field

numbers will have the form of “TT.xxx:” where the ‘TT’ represents the one- or two-character record type followed by a period. The next three characters comprise the appropriate field number followed by a colon. Descriptive ASCII information or the sample data follows the colon.

Logical Type-1, Type-2, and Type-9 records contain only ASCII textual data fields (See Appendix B: Traditional Encoding). The entire length of the record (including field numbers, colons, and information separators) shall be recorded as the first ASCII field within each of these record types. The ASCII File Separator ‘^{FS}’ control character (signifying the end of the logical record or transaction) shall follow the last byte of ASCII information and shall be included in the length of the record.

The Record Type-4: Grayscale fingerprint image, the Record Type-7: User-defined image record and the Record Type-8: Signature image record contain only binary data recorded as ordered fixed-length binary fields. The entire length of the record shall be recorded in the first four-byte binary field of each record. For these binary records, neither the record number with its period, nor the field identifier number with its following colon, shall be recorded.

Furthermore, as all the field lengths of these three records are either fixed or specified, none of the four separator characters (‘^{US}’, ‘^{RS}’, ‘^{GS}’, or ‘^{FS}’) shall be interpreted as anything other than binary data. For these binary records, the ‘^{FS}’ character shall not be used as a record separator or transaction terminating character.

Each ASCII field contains a numeric field identifier and its descriptive data.

When **Field 999** is present in a record, it shall appear as the last entry in the record and shall contain the data placed immediately following the colon (‘:’) of the field identifier. The record length field shall contain the length of the record. The ASCII File Separator ‘^{FS}’ control character shall follow the last byte of the compressed or uncompressed sample data. The ‘^{FS}’ character shall signify the end of the logical record or transaction and shall be included as part of the record length.

The Base-64 encoding scheme (see Section 5.2.3) shall be used for converting non-ASCII text into ASCII form. The field number including the period and colon (for example ‘2.001:’) and the ‘^{US}’, ‘^{RS}’, ‘^{GS}’, and ‘^{FS}’ information separators shall appear in the transaction as 7-bit ASCII characters without conversion to Base-64 encoding.

B.5.8. Switching between character encoding sets

All of the fields in the Type-1 record shall be recorded using the 7-bit ASCII code, which is the default character encoding set code within a transaction. In order to effect data and transaction interchanges between non-English speaking or foreign-based agencies, a technique is available to encode information using character encoding sets other than 7- bit ASCII. Fields from the Type-1 logical record and ASCII Field x.001 and Field x.002 text fields shall still be encoded using 7-bit ASCII, but all other designated text fields may be encoded using an alternate character encoding set, if they are shown with the character type of ‘U’ or “user-defined” in the record

layout tables at the beginning of each Record Type Section of this standard. One alternate character encoding set may be chosen per transaction.

To switch character encoding sets within a transaction, the Type-1 record shall contain Field 1.015: DCS / Character Encoding. The DCS consists of 3 information items containing an identifying code, the name of an international character encoding set, and its version.

B.5.9. Handling of lists

In record Types 11 and 12, some information items are defined as lists of values. Lists require special handling for Traditional encoding. A list is treated as a single data element. Each item in the list of values is entered as a single string, with individual values delimited by '|' (vertical bar). In XML/JSON encoding, these information items are represented by a group of elements, each with an individual value in the list.

The fields containing information items defined as lists are:

Field 11.012: PMO / Physical Media Object

Field 11.022: RDD / Redaction Diary

Field 11.024: DCD / Discontinuities Diary

Field 11.026: VCD / Vocal Content Diary

Field 11.028: OCD / Other Content Diary

Field 11.032: SGEO / Vocal Segment Geographical Information

Field 11.033: SQV / Vocal Segment Quality Values

Field 11.035: PPY / Vocal Segment Processing Priority

Field 11.036: VSCD / Vocal Segment Content Description

Field 11.037: SCC / Vocal Segment Speaker Characteristics

Field 11.038: SCH / Vocal Segment Channel

Field 12.010: TDD / Tooth Data Detail

Field 12.011: MDD / Mouth Data Detail

B.5.10. Paths

A path is a field containing a set of coordinates. Paths can be defined as a circle, ellipse, closed path (polygon), or open path.

- A circle only requires 2 points to define it
- An ellipse requires 3 points to define it.

Open paths (also called contours or polylines) and closed paths (polygons) on an image are comprised of a set of vertices. For each, the order of the vertices shall be in their consecutive

order along the length of the path, either clockwise or counterclockwise. (A straight line of only two points may start at either end). A path may not have any sides crossing. No two vertices shall occupy the same position. There may be up to 99 vertices.

• An open path is a series of connected line segments that do not close or overlap. An open path shall have at least 2 vertices.

• A closed path (polygon) completes a circuit. The closed path side defined by the last vertex and the first vertex shall complete the polygon. A polygon shall have at least 3 vertices.

There are two different approaches to the paths in this standard.

• The 2007/2008 version of the standard used paths for Field 14.025: ASEG / Alternate Finger Segment Position(s). That approach used repeating pairs of information items to indicate each (x,y) coordinate, so that the number of information items varies with the number of vertices. That approach has been retained in this version for all paths except in the Type-9 extended feature set (EFS) paths.

• The EFS adopted an approach expressing the path in a single information item, which is similar to the representation of lists.

Note that bounding boxes, such as in Field 14.021: SEG /Finger Segment Position are not considered paths in this terminology.

B.5.10.1. Type-9 Extended Feature Set (EFS) Paths

The vertices for paths in the EFS Type-9 records are defined in a single information item for each of the following fields in traditional encoding. If multiple paths are present, they are stored within separate subfields. Each vertex is expressed as an (x,y) pair of non-negative integers in units of either pixels or 10 micrometers (ƛ). One ƛ is equivalent to 1/100 mm (0.01 mm), 1/1000 cm, or 1/2540 in. A comma separates the x and y coordinates for a given vertex, and a dash separates consecutive vertices. For example: x1,y1-x2,y2-x3,y3.

The Extended Feature Set used in the Record Type-9: Friction ridge metadata record was developed as a separate encoding structure that has been incorporated into this standard. In order to avoid conflicts with systems that had already programmed using the EFS method of specifying paths, that structure is retained in this standard.

EFS fields using closed paths, and requiring at least 3 vertices, are:

• Field 9.300: ROI / EFS Region of Interest

• Field 9.302: FPP / EFS Finger - Palm - Plantar Position

• Field 9.324: DIS / EFS Distinctive Features

• Field 9.357: LQI / EFS Local Quality Issues

• Field 9.360: AOC / EFS Area of Correspondence

An open path is a series of connected points in which there is not an implicit connection between the last and first vertices. Within EFS, open paths are used in Field 9.373: RPS / EFS Ridge Path Segments.

B.5.10.2. All Other Fields Specifying Paths

For each of these fields, the first one or two information items are dependent upon the Record type and Field. The next information item specifies the number of vertices. The remaining information items are pairs of x and y coordinates of vertices.

• In Field 10.033: FEC / Feature Contours which is an open path, the first information item is the FCC / Feature Contour Code, selected from the “Code” column of Table 46 Feature contour code descriptions.

• In Record Type-17 Fields 17.033 through 17.036, and in Field 10.015: FPFI / Face Image Path Coordinates in Full Image the first information item is the BYC / Boundary Code, with an alphabetic value selected from the “Code” column of Table 78 Boundary definition codes .

• For Field 10.045: OCC / Occlusions and Field 17.037: NEO / Non-Eyelid Occlusions, the first information item is the OCY / Occlusion Opacity, selected from the “Code” column of Table 79 Occlusion opacity.

• In Field 14.025: ASEG / Alternate Finger Segment Position(S) and Field 19.019: FSP / Friction Ridge - Toe Segment Position(S) the first information item contains a FGP / Friction Ridge Generalized Position, an integer from Table 3 Friction ridge generalized position codes.

• In Field 20.016: SEG / Segments the first information item is the RSP / Reference Segment Position. This provides a unique index to a segmentation. (See Section 5.11.5 for its use in Field x.997 in other record types.)

• In Field 21.016: SEG / Segments the first information item is the ASP / Associated Segment Position. This provides a unique index to a segmentation. (See Section 5.11.6 for its use in Field x.995 in other record types.)

For Field 10.045, Field 17.037, Field 20.016, and Field 21.016, the second information item is described below.

• For Field 10.045: OCC / Occlusions and Field 17.037: NEO / Non-Eyelid Occlusions, the second information item is the OCT / Occlusion Type. It is one character containing a code from Table 80 Occlusion type.

• For Fields 20.016 and 21.016 only, the second information item is the IPT / Internal File Reference Pointer. It is set to ‘0’ if the source representation is a single file. If the external file referenced in Field 20.994: EFR / External File Reference or Field 21.994: EFR / External File Reference is a PDF, video, or presentation file, or has multiple locations where a sample may be located, this information item is the reference to the particular instance, such as page, video frame, or slide number used to derive the image transmitted in other record types. If a particular frame is chosen and there is no further image segmentation needed, NOP and the repeating pairs of information items (HPO and VPO) shall not be present. In this case, an

information item separator shall be present for NOP in Traditional encoding, but no information item separators are required for HPO and VPO pairs. This entry is free text with any special characters allowed, except for the reserved characters and the control characters described in this appendix.

The second (or third in the case of Field 10.045, Field 17.037, Field 20.016, or Field 21.016) information item (NOP / Number Of Points) shall specify the number of vertices.

The next information items are pairs of x and y coordinates of vertices. The horizontal offsets (x) are the pixel counts to the right, and the vertical offsets (y) are the pixel counts down from the origin. The first information item in this pairing is the HPO / Horizontal Point Offset. The second information item in this pairing is the VPO / Vertical Point Offset. Pairings are inserted for each vertex, up to the NOP.

B.6. Encoding for specific record types

The following sections provide specific detail for certain fields within the record types to provide clarity to programmers.

B.6.1. Type-1 Record

Field 1.001 LEN / Record Length shall begin with '1.001:' followed by the length of the record including every character of every field contained in the record and the information separators. The '$^{G}_{S}$' separator character shall separate the length code of Field 1.001 from the next field. The year, month, and day values in Field 1.005: DAT / Date are concatenated "YYYYMMDD".

In Field 1.013 DOM / Transaction Domain Name, the default value is '1.013:NORAM$^{U}_{S}$$^{G}_{S}$'

End of Type-1 Record

Immediately following the last information item in the Type-1 record (See Section 6.1), an '$^{F}_{S}$' separator character shall be used to separate it from the next logical record. This '$^{F}_{S}$' character shall replace the '$^{G}_{S}$' character that is normally used between information fields. This is the case with all Record Types.

B.6.2. Type-2 Record

With the exception of the first two fields, fields of the Record Type-2 shall be in accordance with definitions set according to the implementation domain or application profile (See Section 5.6 Implementation Domain and Application Profiles and Section 6.2 Record Type-2: User-Defined Descriptive Text Record).

B.6.3. Type-7 Record

With the exception of the first two fields, the order of the remaining fields of the Type-7 record (See Section 6.7) is user-defined. All fields and data in Type-7 records shall be recorded as

binary information. The first two fields are fixed length and total five bytes. These fields shall precede one or more user-defined fields, including the image data, contained in the remainder of the record.

LEN / Logical Record Length

This mandatory four-byte binary field (Field 7.001 LEN / Record Length) shall occupy bytes one through four. It shall contain the length of the logical record specifying the total number of bytes, including every byte of all the fields contained in the record.

IDC / Information Designation Character

This mandatory one-byte binary field (Field 7.002 IDC / Information Designation Character) shall occupy the fifth byte of a Type-7 record. It shall be used to identify the image data contained in this record. The IDC contained in this field shall be a binary representation of the IDC found in Field 1.003: CNT / Transaction Content .

User-defined fields for Type-7 records

The remaining fields (Section 6.7) of the Type-7 logical record shall be user-defined. Individual fields required for a given transaction, such as field description, size, and content shall conform to the specifications set forth by the agency to whom the transmission is being sent.

End of Type-7 Record

Since the Type-7 logical record is a defined and specified series of binary data fields, no additional bytes shall be transmitted to signify the end of this logical record type.

B.6.4. Type-8 Record

Table 90 Type-8 record layout shows the fields for the Type-8 logical record (See Section 6.8). The order of fields for Type-8 records is fixed. All fields and data in Type-8 records shall be recorded as binary information.

Table 90 Type-8 record layout

Field Number	Tag	Field Description	Byte Count	Byte Position
1	LEN	LOGICAL RECORD LENGTH	4	1-4
2	IDC	INFORMATION DESIGNATION CHARACTER	1	5
3	SIG	SIGNATURE TYPE	1	6
4	SRT	SIGNATURE REPRESENTATION TYPE	1	7
5	ISR	IMAGE SCANNING RESOLUTION	1	8
6	HLL	HORIZONTAL LINE LENGTH	2	9-10
7	VLL	VERTICAL LINE LENGTH	2	11-12

8	DATA	SIGNATURE IMAGE DATA	<LEN> – 12	13 through <LEN>

If the SRT field contains the binary value of ‘0’ then DATA shall contain the uncompressed scanned binary image data for the signature. In uncompressed mode, the data shall be packed at eight pixels per byte.

If the SRT field contains the binary value of ‘1’ then this field shall contain the scanned binary image data for the signature in compressed form using the ANSI/EIA-538-1988 facsimile compression algorithm.

If the SRT field contains the binary equivalent of ‘2’, then DATA shall contain a set of vectors describing the pen position and pen pressure of line segments within the signature. Each vector shall consist of five bytes.

The first two bytes of each vector shall contain the unsigned binary x coordinate of the pen position with the high order byte containing the most significant bits. The next two bytes shall contain the unsigned y coordinate using the same convention to denote the most significant bits. Both the x and y coordinates shall be expressed in units of 0.0254 mm (0.001 inches) referenced from the bottom leftmost corner of the signature. Positive values of x shall increase from left-to-right and positive values of y shall increase from bottom-to-top.

An unsigned binary number between ‘0’ and ‘255’ contained in the fifth byte shall represent the pen pressure. This shall be a constant pressure until the next vector becomes active. Binary value of ‘1’ shall represent the least recordable pressure for a particular device, while the binary equivalent of ‘254’ shall represent the maximum recordable pressure for that device. To denote the end of the vector list, the binary equivalent of ‘255’ shall be inserted in this entry.

B.6.5. Type-9 Record

Fields 9.005 through 9.012 are to be used for legacy data only. See ANSI/NIST-ITL 1-2007 for instructions on use of these fields.

Paths in EFS require a special data construct for Traditional encoding. See Section 6.9.12.3 EFS Paths. A comma separates the x and y coordinates for a given vertex, and a dash separates consecutive vertices. For example: x1,y1-x2,y2-x3,y3

Polygons are used in the following EFS fields:

Field 9.302: FPP / EFS Finger - Palm - Plantar Position

Field 9.300: ROI / EFS Region of Interest

Field 9.324: DIS / EFS Distinctive Features

Field 9.357: LQI / EFS Local Quality Issues

Field 9.360: AOC / EFS Area of Correspondence.

Open paths are used in the following EFS field:

Field 9.373: RPS / EFS Ridge Path Segments.

B.6.6. Type-11 Record

The Type-11 record contains information items that are lists. In Traditional encoding, the values in the list are separated by the special character '|'. See Section 6.11.

B.6.7. Type-12 Record

The Type-12 record contains information items that are lists. In Traditional encoding, the values in the list are separated by the special character '|'. See Section 6.12.

B.6.8. Type-13 Record

For Field 13.014: SPD / Search Position Descriptors, multiple portions of the EJI may be listed and separated by the '$^{R}_{S}$' separator character. See Section 6.13.

B.6.9. Type-14 Record

For Field 14.013 FGP / Friction Ridge Generalized Position, the 2007 and 2008 versions of the standard had this field as a repeating subfield that could occur up to 6 times. Since only one image is sent per record, the maximum should have been 1. To maintain backward compatibility, the subfield structure has been retained, but with a maximum occurrence of one.

Appendix C. NIEM-conformant encoding rules - Normative

This appendix contains a set of requirements for encoding the ANSI/NIST-ITL 1-2025 standard using the NIEMOpen model. This appendix has been shortened from previous versions of the standard. Schemas for the NIEM XML and JSON encodings will be made available on the standard's website upon their publication: https://www.nist.gov/programs-projects/ansinist-itl-standard.

These are alternatives to the "traditional" encoding format. Implementers will find that, with very few exceptions, there is a "one-to-one" correspondence of XML and JSON elements to the elements of the base specification, and to the numerically tagged (or untagged binary) traditional elements described in the Appendix B: Traditional encoding. The repeating subfield and information items (separated by the '$^{R}_{S}$' and '$^{U}_{S}$' characters in the traditional representation) have been given named counterparts in XML and JSON.

These encoding rules and referenced materials conform to the OASIS NIEMOpen[14] information exchange model (NIEM), which facilitates interoperability for information sharing supporting many relevant information domains. The NIEM encodings include rules for how user-defined extensions may be included inside the standard ANSI/NIST-ITL package, but do not define how the package may be wrapped in other data structures.

There are "user-defined" elements that implementers may create to extend this specification so that it is useful in a particular application. These implementation-specific elements shall be created in a separate, user-declared namespace. The content of these elements shall follow NIEM rules.

Implementers may modify or add namespace declarations and import elements to reference user-defined namespaces and extension schemas. Implementers may create constraint schemas that add any of the schemas used in this standard. These constraint schemas must follow the rules for NIEM constraint schemas as they are defined in the NIEM Naming and Design Rules (NDR). They may only be used to add constraints and restrictions to components; they must not loosen the standard by allowing content that is not allowed by the schemas upon which they are based.

Implementers shall not introduce new elements except for the user-defined elements described above. They shall not change the order or structure of elements defined by the standard. The root element may be included as a payload in a larger package.

An exchange package shall consist of two or more logical records. See Section 5.4 Structure of a Transaction. For each logical record contained in the package, several information elements appropriate to that record type shall be present. Complex elements may contain one or more complex or simple elements according to the NIEM Naming and Design Rules. Taken together, these items are used to convey different aspects of the data contained in a data information object. To the extent possible, the objects used have been defined as a part of the NIEMOpen model. Some information objects may be repeated multiple times.

[14] https://niemopen.org/community/

The schema referenced for these encodings define the structure and order of the elements in the information exchange package. To the extent possible, the schema define data types and constraints that enforce the allowable content rules of the base standard. Nevertheless, these schema may not strictly enforce the allowable content. The base standard defines allowable content, and its requirements shall be met by implementers regardless of encoding method.

Schema from other standards may be incorporated. The Type-99 CBEFF record is explicitly designed to accommodate this behavior. Other record types, such as Type-22 may also utilize this feature.

Lists are modeled in NIEM as regular elements; unlike Traditional format there are no special considerations for list encoding.

Date and time formats have different element names in different versions of NIEM. Check the associated schemas available on the standard's website.

If the base specification and schema define an element as optional, it should be omitted altogether rather than transmitting the element tags without any data content. For mandatory elements, in all cases, the element tags shall appear in the instance package. When there is no information to be transmitted for a mandatory element, prior agreement shall be made with the recipient agency or organization before constructing and transmitting an instance package.

Value verification may be handled by using explicit data types in the NIEM schema. For example, EyePositionCode can only have one of three values (0, 1 or 2). This restriction is made explicit in the schema.

However, when the allowed values may frequently change, such as is the case with externally referenced lists like KID / Kit ID in the Type-18 DNA Record, values will be contained in an external list that is periodically updated (e.g., as new DNA kits come to market). Thus, these values are not contained in the schema and must be validated via other methods.

Certain portions of the exchange package, such as Record Type-2, shall be in accordance with definitions set according to the implementation domain or application profile (See Section 5.6 Implementation Domain and Application Profiles).

The latest version of all documents to be referenced, including the latest ANSI/NIST XML and JSON schemas are available at https://www.nist.gov/programs-projects/ansinist-itl-standard.

Appendix D. NCIC code table - Normative

In earlier versions of the standard, the NCIC Personal Descriptors code table was present in the normative text of this standard as an annex. These NCIC codes are frequently updated, however, and in order to ensure consistency with the current version of these codes, this version of the standard includes the latest version of the NCIC Personal Descriptors code table as a normative reference, which may be found by a simple internet search[15].

Note that any codes that were listed in the 2007 and 2008 versions of this standard that are not included in the current NCIC tables are still valid, which is an NCIC feature to maintain backward compatibility. An example is CRIP FOOT. The current version of the NCIC code table has CRIP L FT and CRIP R FT.

[15] At the time of printing, the latest version was available at https://wsp.wa.gov/wp-content/uploads/2025/07/NCIC-Code-Manual-June-2025.pdf.

Appendix E. Facial Capture – SAPs 30 and above - Normative

E.1. Introduction

This appendix is based upon work originating at a Mugshot and Facial Image Workshop held at NIST in 1995. The original recommendation document was incorporated in the 2007 / 2008 version of the ANSI/NIST-ITL standard, which extended the recommendations further. This appendix was subsequently updated to include new information in the 2011 version of this standard.

The appendix is not designed to render current and legacy mugshot collections unacceptable. Rather, it is intended as a means of establishing or improving interoperability between mugshot systems. The provisions of this appendix are keyed to the quality aspects associated with the unaltered captured mugshot image. For new mugshot images being captured, the specifications contained in this appendix are equally applicable to real-time electronic capture of mugshots as well as the electronic conversion of photographic images. For conversion of legacy files of photographs, the provisions of this appendix are applicable.

This appendix consists of a set of Sections describing the capture of facial images at SAP levels 30 and above. See Section 5.14.1 SAP / Subject Acquisition Profile for Face. These Sections can be categorized into six types of requirements: digital, photographic, subject and scene, number of photographs, data handling, and format (for SAP levels 40 and above).

E.2. Digital requirements

E.2.1. Pixel aspect ratio

Digital cameras and scanners used to capture facial images shall use square pixels with a pixel aspect ratio of 1:1.

E.2.2. Image aspect ratio

For SAPs 30 and 32, the aspect ratio shall be 4:5 (480 x 600 pixels). For SAP 40 and above, the aspect ratio shall be 3:4. SAP 40 specifies a minimum of 768 x 1024 pixels, which corresponds to this aspect ratio, allowing a COTS digital camera to be used for capture. Images from some types of cameras with a different aspect ratio shall need to be cropped.

E.2.3. No interlacing

Interlaced video frames shall not be used in the capture of a facial image.

E.2.4. No digital zoom

Digital zoom (interpolation) to achieve specified resolution associated with Subject Acquisition Profiles shall not be used in the capture of a facial image.

E.2.5. Minimum number of pixels

The minimum number of pixels in an electronic digital image shall be 480 pixels in the horizontal direction by 600 pixels in the vertical direction. It should be noted that the image quality of the captured mugshots and facial images may be improved as the number of pixels in both directions are increased. However, as images are captured with an increased number of pixels, the 4:5 (SAPs 30/32) and 3:4 (SAP 40 and above) (Width:Height) aspect ratio shall be maintained.

E.3. Photographic requirements

E.3.1. Depth of field

The subject's captured facial image shall always be in focus from the nose to the ears. Although this may result in the background behind the subject being out of focus, this is not a problem. It is recommended that auto-focus on the central part of face be used with digital camera photography. For optimum quality of the captured mugshot, the f-stop of the lens should be set at two f-stops below the maximum aperture opening when possible. An objective metric to ensure that the subject is in focus is to test that the optical efficiency is $\geq$ 90%. (See ISO 12233:2000 *Photography – Electronic still-picture cameras – resolution measurements.)*

E.3.2. Subject lighting

Lighting shall be equally distributed on the face. There shall be no significant direction of the light from the point of view of the photographer. For non-mobile SAPs (those other than 32, 42 and 52), the following conditions apply:

Subject illumination shall be accomplished using a minimum of three (3) point-balanced illumination sources. Although a minimum of three photo lights is required for illuminating the subject's face, two of these lights should be sufficient for some operational environments. Use of a third light as a backlight generally requires about two feet of additional floor space behind the subject, which may not be available in all environments.

Appropriate diffusion techniques shall be employed and lights positioned to minimize shadows, and to eliminate hot spots on the facial image. These hot spots usually appear on reflective areas such as cheeks and foreheads.

Proper lighting shall contribute to the uniformity of illumination of the background described in the exposure requirement.

The region of the face, from the crown to the base of the chin, and from ear-to-ear, shall be clearly visible and free of shadows. In particular, there shall be no dark shadows in the eye-sockets due to the brow, and the iris and pupil of the eyes shall be clearly visible.

E.3.3. Background and lighting

This section does not apply to mobile SAPs (32, 42, or 52).

The subject whose image is being captured shall be positioned in front of a background that is 18% gray with a plain smooth flat surface. A Kodak or other neutral gray card or densitometer shall be used to verify this 18% gray reflectance requirement. The boundary between the head and the background should be clearly identifiable about the entire subject (very large volume hair excepted). There should be no shadows visible on the background behind the face image. Proper lighting shall contribute to the uniformity of illumination of the background.

Ensure that the background completely fills the image frame behind the subject. If possible, avoid the presence of visible shadows and other objects in the background, such as a clock.

An objective measure is to have the ΔE_{1976} between all points on a uniform gray card to be < 5. ΔE_{1976} are calculated from the known CIELab[16] value of the card and the sRGB camera code values. ΔE_{1976} refers to the 1976 formula of the CIE[17] using the distance metric ΔE.

E.3.4. Exposure calibration

This section does not apply to mobile SAPs (32, 42 or 52). The exposure shall be keyed to the background. Several areas of the recorded 18% gray background shall be used to verify the proper exposure. The averages of the 8-bit Red, Green, and Blue (RGB) components within each area shall be calculated. Each of the RGB means shall fall between 105 and 125 with a standard deviation of ±10. Furthermore, for every area examined, the maximum difference between the means of any two of the RGB components shall not exceed 10.

A quantifiable test is to measure the RGB code values for a minimum of six gray patches ranging from 0.05 to 1.5 neutral density. Target values for these patches are calculated for the sRGB color space. Allowable values are within 10 code values of the target.

E.3.5. Exposure

When capturing images using digital cameras, the exposure should be such that the image is as bright as possible without introducing any clipping of the highlights. With most digital cameras, this can easily be checked by examining the histogram associated with the image. Most modern digital cameras have sophisticated metering systems that should ensure that a properly exposed image is always captured once the camera and lights have been correctly set up.

A quantifiable test is to measure the RGB code values for a minimum of six gray patches ranging from 0.05 to 1.5 neutral density. Target values for these patches are calculated for the sRGB color space. Allowable values are within 10 code values of the target. This action is done to ensure absolute brightness without clipping.

[16] CIELab is a color space (see CIE Colorimetry - Part 4: 1976 L*a*b* Colour Space, 2nd Edition).
[17] CIE is the International Commission on Illumination (https://cie.co.at/).

E.3.6. No saturation

For each patch of skin on the person's face, the gradations in textures shall be clearly visible. In this sense, there shall be no saturation (over or under exposure) on the face.

A quantifiable test is to use color targets to include red, green, blue, cyan, magenta, and yellow patches with known CIELab values. The ΔE_{1976} of each color for the sRGB color space is to be less than 10. (ΔE_{1976} refers to the 1976 formula of the CIE using the distance metric ΔE.)

E.3.7. No unnatural color or "red eye"

Unnaturally colored lighting (e.g., yellow, red) is not allowed. Care shall be taken to correct the "white balance" of image capture devices. The lighting shall produce a face image with natural looking skin tones when viewed in typical examination environments. "Red eye" is not acceptable.

E.3.8. No color or grayscale enhancement

A process that overexposes or underexposes a part or all of a color or grayscale image for purposes such as beauty enhancement or artistic pleasure is not allowed. The full spectrum shall be represented on the face image where appropriate. Teeth and whites of eyes shall be clearly light or white (when appropriate) and dark hair or features (when appropriate) shall be clearly dark.

E.3.9. Distortion and angle of view

Unnatural radial distortion of the camera lens, resulting in a diagonal angle of view of approximately 20 to 28 degrees, shall not be allowed. "Fisheye" effect, a type of distortion where central objects of the image erroneously appear closer than those at the edge, typically resulting in what appear to be unusually large noses in the image, is not allowed. While some distortion is usually present during portrait photography, that distortion should not be noticeable by human examination. For a typical photo capture system with a subject to 2.5 meters from the camera, the focal length of the camera lens should be that of a medium telephoto lens. For 35 mm photography, this means that the focal length should be between 90 mm and 130 mm. For other negative formats/sensors, the recommended focal length is 2 to 3 times the diagonal of the negative/sensor.

E.3.10. Allowed color space

Digital images shall be represented as 24-bit RGB pixels. For every pixel, eight (8) bits shall be used to represent each of the red, green, and blue components. The RGB color space is the basis for other color spaces including the Y, Cb, Cr and YUV. Additional color management techniques are available from the International Color Consortium. Information regarding these techniques can be downloaded from the following URL: http://www.color.org/. A full color image shall be captured. To ensure that color images exchanged between differing systems can

be correctly displayed or printed, images shall be converted to the device-independent color space, sRGB.

E.4. Subject and scene requirements

E.4.1. Pose

The full-face or frontal pose is the most commonly used pose in photo lineups and shall always be captured. This pose is in addition to profiles or intermediate angled poses captured to acquire perspective and other information.

E.4.2. Subject position

It is important that no shadows are cast onto the background from the subject's head. One way to achieve this is by positioning the subject 1-2 feet away from the background, and/or using an additional light source to illuminate the background.

E.4.3. Centering

The full-frontal face pose shall be positioned to satisfy all of the following conditions. For non-frontal pose (SAP levels 40, 50 and 51), the subject shall satisfy these conditions when the head is rotated about an axis through the head and torso from the current pose back to center (zero angles) pose.

E.4.3.1. The "Head and Shoulders" photo composition

The composition consists of a subject's head, partial shoulders, and plain background. For a frontal-facing pose, the width of the subject's head shall occupy approximately 50% of the width of the captured image. This width shall be the horizontal distance between the mid-points of two imaginary vertical lines.

Each imaginary line shall be drawn between the upper and lower lobes of each ear and shall be positioned where the external ear connects to the head. See Figure 20 A facial template and example of "Head and Shoulders" scene constraints.

The approximate horizontal mid-points of the mouth and of the bridge of the nose shall lie on an imaginary vertical straight line positioned at the horizontal center of the image.

An imaginary horizontal line through the center of the subject's eyes shall be located at approximately the 55% point of the vertical distance up from the bottom edge of the captured image.

The width of the subject's head shall occupy approximately 50% of the width of the captured image. This width shall be the horizontal distance between the mid-points of two imaginary vertical lines. Each imaginary line shall be drawn between the upper and

lower lobes of each ear and shall be positioned where the external ear connects to the head.

E.4.3.2. The "Head Only" photo composition

The composition consists of a subject's head, and a plain background. For a frontal-facing pose, the width of the subject's head shall occupy approximately 70% of the width of the captured image. This width shall be the horizontal distance between the midpoints of two imaginary vertical lines. Each imaginary line shall be drawn between the upper and lower lobes of each ear and shall be positioned where the external ear connects to the head. A template and an example are shown in Figure 21. This composition is applied to SAP 51.

For other than frontal image capture, the composition shall be rotated about an imaginary axis extending from the top of the head through the base of the neck.

E.4.4. Head Coverings

Head coverings, including hats and scarves, shall not be worn. The full face and ears shall be displayed.

E.4.5. Hair

When capturing frontal, profile and angled images, the subject's hair shall be moved to reveal the full face and ears. If hair covers the ears, then when possible, two photographs should be captured – one with hair in its normal state, and one with hair pulled back behind the ears. For SAP levels 40 and above, if hair covers the ears, then when possible, two photographs shall be captured. One should be with hair in its normal state, and a second should be with hair pulled back behind the ears.

E.4.6. Glasses and eye patches

Since the 1990s, the best practice for face image capture was that subjects who normally wear eyeglasses should wear those eyeglasses when a face image is captured.

The American Association of Motor Vehicle Administrators (AAMVA) states that for drivers' licenses, Motor Vehicle Administrations should "Avoid eyeglasses – Glare affects enrollment – Heavy glasses affect comparison[18]." In addition, recent studies in Australia and the United States[19] have quantified the negative impact that wearing glasses has upon automated face recognition.

Previous versions of this standard stated, "For subjects who normally wear eyeglasses, every effort should be made to capture the mugshots with the glasses on." This guidance is now changed. Every effort should be made to capture the face image for enrollment without glasses.

[18] AAMVA, "Facial Recognition Program – Best Practices.", p.28, August 2015. http://www.aamva.org/Best-Practices/
[19] US National Body Contribution to ISO/IEC JTC 1 / SC37, "The Impact of Eye Glasses on Face Recognition," ISO/IEC JCT1 / SC37 N 6097, 12/22/2014 AND Australian experts presentation, "Impact of Glasses on Face Recognition," ISO/IEC JTC 1 / SC37/ WG4 N 29, 12/22/2014

When possible, images taken for comparison to a database (probes) should also be taken without glasses. Note that this recommendation does not prohibit the wearing of glasses in facial images. Whether to allow any subjects to wear glasses is a policy decision dependent upon local needs, conditions, and legal restrictions. For some organizations, legacy data, and unconstrained systems, it may not be possible to require facial images without glasses.

Specification of eyeglasses in Field 10.026 SXS / Subject Facial Description is required. The wearing of eye patches is allowed only for medical reasons. In these cases, the specification of the patch, in the Field 10.026 SXS / Subject Facial Description is required.

E.4.6.3. Rationale for the recommendation: "no glasses, if possible"

Both the Australian and US studies found:

Eyeglasses are detrimental to automated[20] face recognition.

When a subject wears glasses in one image, but not in another image, there is an elevated Type I error rate (that the subject will not be identified)

When a subject wears glasses and the images in the database contain people with glasses, the rate of false matches to others is elevated. This is a Type II error.

Presence of glasses increases similarity scores in imposter comparisons.

Images with glasses dominate candidate lists when probes are wearing glasses.

Imposter retrievals from the databases exhibit higher levels of facial similarities when subjects are not wearing glasses.

Glasses can occlude facial features and interfere with eye localization.

Glasses can be detected automatically with reasonable accuracy.

E.4.7. Expression

The expression should be neutral (non-smiling) with both eyes open normally (i.e., not wide-open), and mouth closed. Every effort should be made to have supplied images conform with this specification. A smile with closed jaw is not recommended.

E.4.8. Mouth

Mouth shall be closed (unless medical condition precludes it).

[20] The Australian study also found that there was a negative effect of wearing glasses on human-operated face recognition.

E.4.9. Subject facial expression

The Subject facial description field shall be present in the transaction when one or more of the facial attributes given by the type codes of Field 10.026 SXS / Subject Facial Description is present in the image.

E.4.10. Subject hair color

The Subject hair color Field 10.028 SEC / Subject Hair Color shall be present in the transaction.

E.4.11. Subject eye color

The Subject eye color Field 10.027 SEC / Subject Eye Color shall be present in the transaction (may be 'UNSPECIFIED').

E.4.12. Shoulder position

Shoulder position shall be square to the camera and forward facing for frontal images. Shoulder position shall be perpendicular to the camera for profile images.

E.4.13. Make-up and cleanliness

The subject's face should not be presented with heavy make-up, dirt, blood, etc. In an operational environment where this may not be possible, best practice is to take a second set of photographs once the subject has been cleaned up.

E.4.14. Face count

Only one face per image is allowed.

E.4.15. Medical conditions

If bruising, injuries, bandages, or medical conditions exist, these shall be captured as is. In an operational environment, and where business processes and legislation permit, best practice should be to take a second picture once any bandages have been removed and any injuries to the face have healed.

E.5. Number of photographs

Figure 19 Five poses for SAP 50 and 51

Levels 50 and 51 records mandate multiple images. However, if the subject has accessories that occlude facial features, e.g., such as eyebrow studs, ear plugs, or rings through the nose, at least one frontal image should be captured with them and one image without. Levels 50 and 51 shall

include at least five photographs of the subject: (frontal, left full profile, right full profile, left half profile and right half profile).



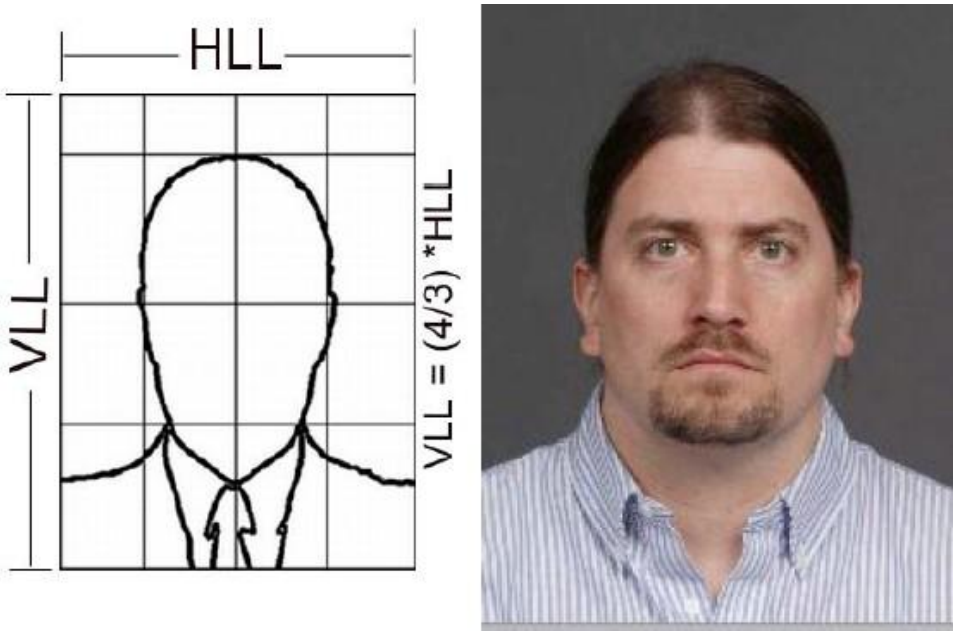


Figure 20 A facial template and example of "Head and Shoulders" scene constraints

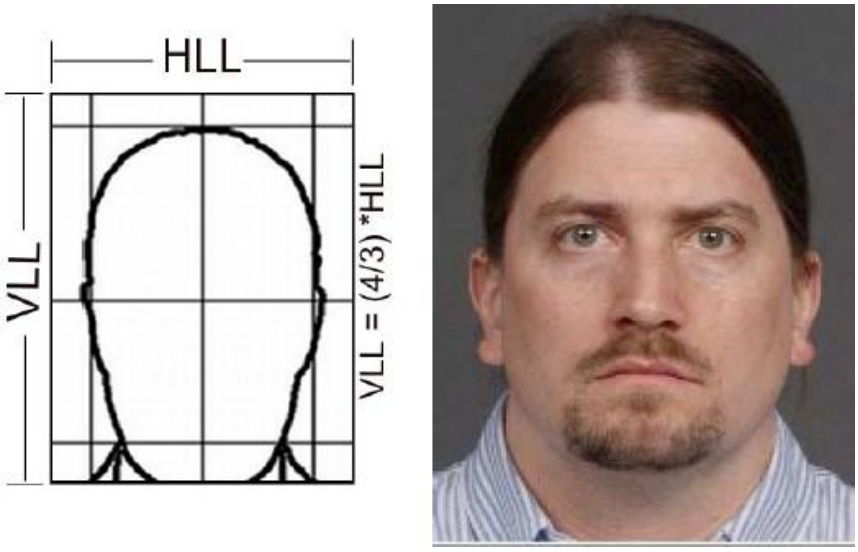


Figure 21 Facial image template and example of "Head Only" scene constraints

E.6. Data handling requirements

E.6.1. Compression algorithm

E.6.1.4. SAP Levels 30 and 32 only

The algorithm used to compress mugshot and facial images shall conform to the JPEG Sequential Baseline mode of operation as described in ISO/IEC 10918. The target size for a JPEG compressed color mugshot image file shall be 25,000 to 45,000 bytes.

E.6.1.5. SAP Levels 40 and above

Non-frontal facial images shall be compressed using JPEG 2000, as specified in ISO/IEC 15444. (JPEG is not allowed). There shall be one frontal facial image compressed using lossless JPEG 2000. If multiple frontal images are in the transaction, then one image must be compressed via lossless compression and the others can be compressed either using lossless JPEG 2000 or lossy JPEG 2000 that meets the maximum compression limits specified below. The best practice is to apply the lossless compression to the frontal image with ears visible.

E.6.2. Compression ratio

The target compression ratio for both JPEG and JPEG 2000 of a rectangular region containing any exposed skin of the face, from crown to chin and ear to ear, shall be at most 15:1. This requirement is derived from studies of face algorithm matching at high and low resolutions. The

non-facial portion of the mugshot, as well as other Type-10 records, can be compressed up to a target ratio of 120:1.

Custom JPEG source code can be created to implement compression with both ROI and fixed compression ratios. For JPEG 2000, these capabilities are built into the implementation.

For both JPEG and JPEG 2000, care must be taken to account for automatic compression by camera hardware. Multiple compression stages can damage the quality of photographic data. When possible, minimum compression (highest resolutions) should be applied at the camera level when external software performs the final (15:1 or less) compression stage.

Table 91 Example file sizes after compression

Level	Minimum W x H	Uncompressed Size (RGB888)	Size @ 2:1 Lossless Compression	Size @ 15:1 compression for the entire image	Size @ 15:1 compression for the face and 120:1 for the background
30/32	480 x 600	844 KB		58 KB	19.34 KB
40/42	768 x 1024	2.3 MB		156 KB	52.8 KB
50	3300 x 4400	42.5MB	14.2 MB		
51/52	2400 x 3200	22.5 MB	7.5 MB		

Table 95 Example file sizes after compression provides the typical size of a single facial photograph using the compression recommendations contained in this section. This table is based upon the image being formatted as RGB888 (8 bits per color channel per pixel) for levels 30, 32, 40 and 42. Since the face width is 50% of the image width, then the area taken by the face is estimated to be 25% of the total image area. SAP levels 50, 51, and 52 include the constraint of lossless compression for the frontal pose facial image as discussed above.

E.7. Format requirements (SAP levels 40, 42, 50, 51 and 52)

E.7.1. The definition and range of pose angles

The Yaw and Roll angles shall be measured from the full-face pose position and have a range of values from -180 degrees to +180 degrees. The Pitch angle shall have a range of values from -90 degrees to +90 degrees. The pose angle set is given by Tait-Bryan angles as shown in Figure 22.

The angles are defined relative to the frontal view of the subject, which has angles (0, 0, 0). Examples are shown in Figure 23.

Yaw angle*:* rotation about the vertical (y) axis. A positive Yaw angle is used to express the angular offset as the subject rotates from a full-face pose to their left (approaching a right profile). A negative Yaw angle is used to express the angular offset as the subject rotates from a full-face pose to their right (approaching a left profile).

Pitch angle*:* rotation about the horizontal side-to-side (x) axis.

Roll angle: rotation about the horizontal back to front (z) axis.

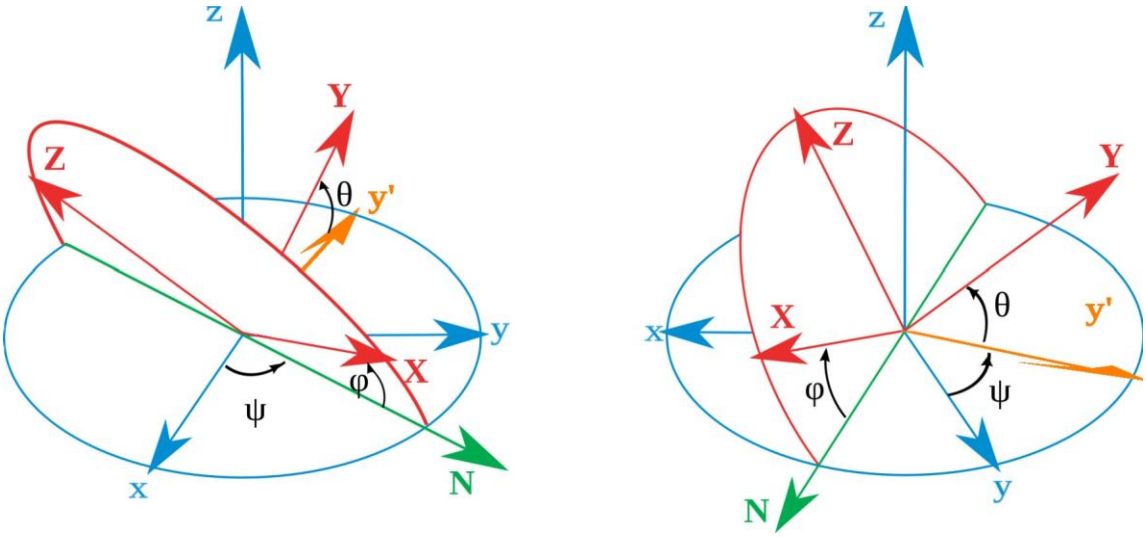


Figure 22 Tait-Bryan angles statically defined with the Z-X'-Y'' convention.
Source: http://en.wikipedia.org/wiki/Euler_angles

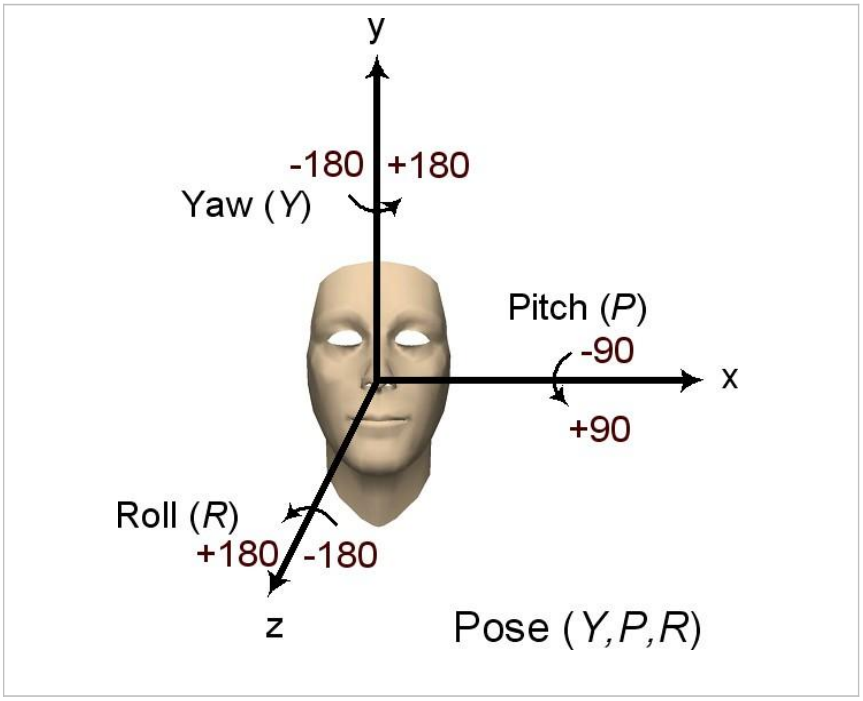


Figure 23 Pose angle set is with respect to the frontal view of the subject

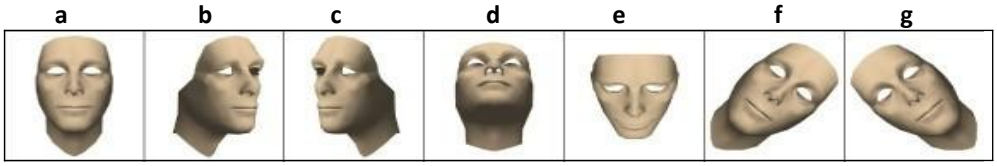


Figure 24 Examples of pose angles and their encodings.

The pose angles (Y, P, R) of (a) – (g) in Figure 24 are given by (0, 0, 0), (+45, 0, 0), (-45,0, 0), (0, -45, 0), (0, +45, 0), (0, 0, -45), and (0, 0, +45), respectively. (See also Appendix E.7.3 The order of rotation through pose angles.

The uncertainty in the pose angles is given by the range 0 to 90, inclusive. It shall denote approximately a maximum value of possible deviation in the measurement of the pose. This shall correspond to a two standard deviation confidence interval.

The encoding of angles is in ASCII format, with the minus sign '-' used to denote a negative value and the plus '+' sign optionally used to denote a positive value. Pose angle uncertainty angles always are positive.

E.7.2. Subject Pose (POS) and Subject Pose Angles (SPA)

One of either the POS or SPA fields shall be used to denote pose angles.

The code values in Field 10.025 SPA / Subject Pose Angles of 'F', 'R', and 'L' can be used for images in which the Pitch and Roll angles are 0 and the Yaw angle is 0, 90, and -90 respectively. (The sign of the Yaw angle in the previous sentence corresponds to the Field case where a right profile is when the subject is facing left).

Field 10.025 SPA / Subject Pose Angles can be used for the above poses and shall be used for all other angled poses. Field 10.020 POS / Subject Pose shall then be of type code 'D', for determined 3D pose, instructing the user to use Field 10.025 SPA / Subject Pose Angles as the reference for pose angles. (For example, a ¾ profile capture would require a POS field entry of 'D' with the angle specified for SPA.)

A frontal view consists of a face with Yaw, Pitch, and Roll angles of zero. Field 10.025 SPA / Subject Pose Angles values shall be recorded as (0, 0, 0).

A full profile view consists of a face with a Yaw pose angle of ±90 degrees, and with Pitch and Roll angles of zero. Field 10.025: Subject Pose Angles / SPA values shall be recorded as (90,0,0), subject facing left (right profile), and (-90, 0, 0), subject facing right (left profile). For full profile photographs, the ear facing the camera should be visible, pushing the hair back to the extent possible. For full profile images, the entire body shall be rotated with the head.

A half profile view consists of a face with a Yaw pose angle of ±45 degrees, and with Pitch and Roll angles of zero. Field 10.025 SPA / Subject Pose Angles values shall be recorded as (45, 0, 0), subject facing left, and (-45, 0, 0), subject facing right. For half profile, the orientation of the head is rotated 45 degrees to half profile; the rotation of the body is recommended but not required. Care should be taken to prevent the subject from keeping the head fixed while changing only the gaze. SAP 50/51 records may optionally include ¾ profile views, with a Yaw pose angle of ±67.5 degrees, and with Pitch and Roll angles of zero. Subject pose angle (SPA) values shall be recorded as (67.5, 0, 0), subject facing left, and (-67.5, 0, 0), subject facing right. In all cases, the uncertainty in the Yaw pose angle determination shall be less than 5 degrees of

the frontal photograph, and 10 degrees in the non-frontal photographs. Uncertainty in the Pitch and Roll angles shall be less than 5 degrees.

E.7.3. The order of rotation through pose angles

As order of the successive rotation around the different axes does matter, the encoded rotation angle shall correspond to an order of execution starting from the frontal view. This order shall be given by Roll (about the front axis), then Pitch (about the horizontal axis) and finally Yaw (about the vertical axis). The (first executed) Roll transformation shall therefore always be in the image (x, y) plane. Examples are shown in Figure 25. From the point of view of executing a transformation from the observed view to a frontal view, the transformation order shall therefore be Yaw, Pitch, and then Roll. The encoded angle is from the frontal view to the observed view. The pose angles have an origin of coordinate system at the nose tip. Figures (a)-(c) show three successive rotation steps to achieve the pose angles (Y, P, R) of (-45, -30, +45). Figures (d)-(f) show three successive rotation steps to achieve the pose angles (-30, +20, -30).



(Y, P, R)=(0, 0, +45)	(Y, P, R)=(0,-30, +45)	(Y, P, R)=(-45, -30, +45)
a	b	c



(Y, P, R)=(0, 0, -30)	(Y, P, R)=(0, +20, -30)	(Y, P, R)=(-30, +20, -30)
d	e	f

Figure 25 Examples of the order of rotation

Appendix F. Extended Feature Set Detailed Instructions – Normative

At the ANSI/NIST-ITL Standard Workshop I in April 2005, the Scientific Working Group on Friction Ridge Analysis, Study, and Technology (SWGFAST) was tasked to identify, define and provide guidance on additional fingerprint features beyond the traditional ending ridges and bifurcations currently defined in the ANSI/NIST-ITL-2000 standard. SWGFAST drafted a memo to NIST in response enumerating the features used by expert human latent examiners that are not currently addressed in fingerprint feature standards. In response to SWGFAST, a presentation was given at the ANSI/NIST-ITL Standard Workshop II in December 2005, entitled "Extended Fingerprint Feature Set", and it was proposed that a committee be convened to define an Extended Fingerprint Feature Set as an Annex to the next ANSI/NIST-ITL standard. The Committee to Define an Extended Fingerprint Feature Set (CDEFFS) was chartered for that purpose. The committee included representatives from various Federal Agencies, SWGFAST and the latent fingerprint community, and engineers from a variety of AFIS vendors.

This appendix to the standard and the fields associated with EFS included in Type-9 of this version of the standard are the result of agreements reached among the members of CDEFFS during workshops held in April, May, and July 2006, and extensive electronic interactions and document reviews from December 2005 through March 2011, as well as presentations and the agreement of participants in the workshops held in July 2010 and March 2011 at NIST to include EFS in the 2011 version of the standard.

This appendix defines a series of updated fields for the Type-9 record that include a broad, complete, and detailed set of friction skin features. These fields are collectively described as the "Extended Friction Ridge Feature Set" (EFS). Extended friction ridge features will generally correspond to a latent fingerprint or palm or plantar print image in a Type-13 record, a fingerprint image in a Type-14 record, a palm print image in a Type-15 record, or a plantar image in a Type-19 record.

F.1. Scope

This appendix defines the content, format, and units of measurement for the definition and/or exchange of friction ridge feature information that may be used in the identification of a subject based on fingerprint or palm or plantar print image information. This information is intended for an individual examiner to define the content of a single impression or comparison of two impressions, as well as for interchange between criminal justice administrations or organizations that use fingerprints or palm prints or plantar prints for identification purposes.

F.2. Purpose

The purpose of this appendix is to define a quantifiable, repeatable, and clear method of characterizing the information content or features of latent or exemplar images from fingerprints, palm prints, or other friction ridge skin.

Uses may include, but are not limited to:

Definition of the information content of a single friction ridge impression as discerned by an examiner during analysis, for archiving, interchanges with other examiners, validation and quality assurance processing, and quantitative analysis.

Definition of the information content and determination of a comparison of two friction ridge impressions as discerned by an examiner during comparison and evaluation, for archiving, interchanges with other examiners, validation and quality assurance processing, and quantitative analysis.

Interoperable interchange format for automated fingerprint or palm print systems, for human-initiated searches, fully automated searches, data interchange between automated systems, and feedback to examiners from automated processing.

Different uses may require different subsets of the features defined in this appendix. Field 9.303: FSP / EFS Feature Set Profile Defines the specific sets of EFS fields. Profiles can be incorporated by reference into the definition of transactions: this decoupling of feature sets from transactions enables different transactions to share a common feature set, aiding in interoperability.

Automated algorithms can use the extended features defined for a latent search without explicitly computing them for the exemplar image, and thus it must be emphasized that automated extraction of the extended features on the exemplar is not necessarily the only nor the best way to use this information.

F.3. No Features Present Fields

The following table shows the correspondence between related pairs of fields. For each row in the table, only one field shall be present in a record.

Table 92 Features and corresponding presence fields

Feature fields	Fields indicating lack of the feature
Field 9.320: COR / EFS Cores	Field 9.325: NCOR / EFS No Cores Present
Field 9.321: DEL / EFS Deltas	Field 9.326: NDEL/ EFS No Deltas Present
Field 9.324: DIS / EFS Distinctive Features	Field 9.327: NDIS/ EFS No Distinctive Features Present
Field 9.331: MIN / EFS Minutiae	Field 9.334: NMIN/ EFS No Minutiae Present
Field 9.340: DOT / EFS Dots	Field 9.346: NDOT / EFS No Dots Present
Field 9.341: INR / EFS Incipient Ridges	Field 9.347: NINR / EFS No Incipient Ridges Present
Field 9.342: CLD / EFS Creases and Linear Discontinuities	Field 9.348: NCLD / EFS No Creases or Linear Discontinuities Present
Field 9.343: REF / EFS Ridge Edge Features	Field 9.349: NREF / EFS No Ridge Edge Features Present

Field 9.345: POR / EFS Pores	Field 9.344: NPOR / EFS No Pores Present

For example, if there are no cores included in Field 9.320: COR / EFS Cores, then Field 9.325: NCOR / EFS No Cores Present would be set to “Y” if analysis determined that there were no cores discernible but would have been omitted if analysis had not been conducted for cores.

If a field shown in the second column of Table 96 is included, it will be populated with a “Y” indicating the analysis of the image has positively determined that there are no instances of that feature present in the image. If the analysis has not been performed for that particular feature, or if the analysis has determined there are a number of those features present in the image, the field in the second column of Table 96Table 96 Features and corresponding presence fields will be omitted from the transaction.

F.4. Definitions of feature confidence and local quality

Local friction ridge quality (Field 9.308: RQM / EFS Ridge Quality/Confidence Map) is an assessment of confidence in small local areas within an image. The local quality map is used to define the confidence in all other features and therefore is key information. In addition, when the quality map indicates a high-quality region in which features are not marked, that information can be used as “negative features” or definitive absence of features, which can be used for exclusion.

Accurate and consistent markup of local quality is essential, and the guidelines in Table 97 and Figure 26 should be followed as closely as possible. The names and color-coding indicated here are the result of extensive research and user feedback and are normative.

Table 93 Definitions for ridge quality map values

			Ridge flow	Minutiae	Dots	Incipients	Ridge edge feature	Pores	
Black	0	Background			✕				Black (0,0,0)
Red	1	Debatable ridge flow	?		✕				Red (255,0,0)
Yellow	2	Definitive ridge flow, debatable minutiae	✔	?	✕				Yellow (255,255,0)
Green	3	Definitive minutiae, debatable ridge edges	✔		?			✕	Green (0,255,0)
Blue	4	Definitive ridge edges, debatable pores			✔			?	Blue (0,0,255)
Aqua	5	All features definitive			✔				Aqua (0,240,240)

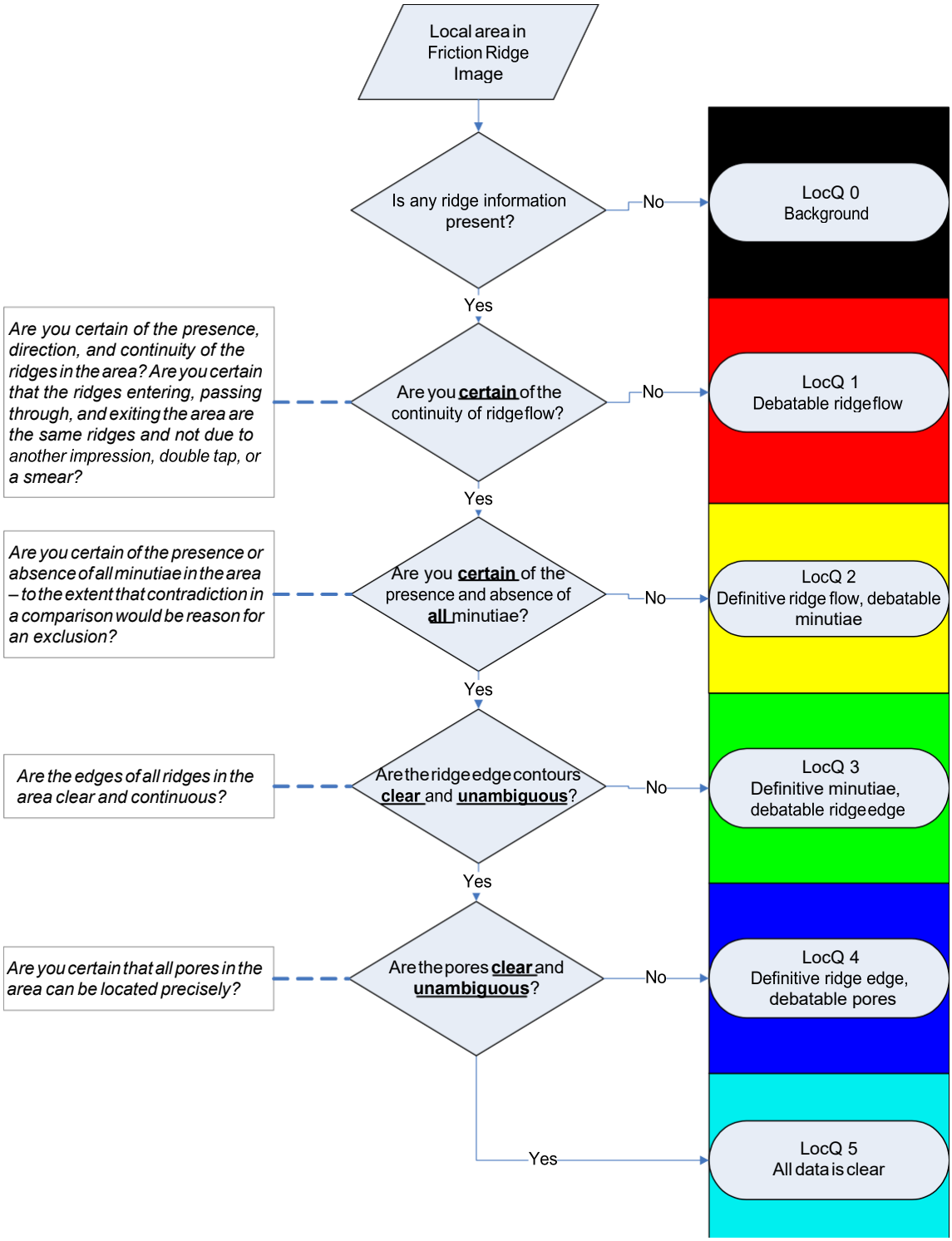


Figure 26 Decision process for local ridge quality

F.5. Extended friction ridge feature set fields – detailed instructions

The following sections provide additional definitions or examples for some of the EFS fields described in the main text. Further guidance in the markup of EFS features in included in NIST Special Publication 1151, Markup Instructions for Extended Friction Ridge Features.

F.5.1. Location and orientation fields

These fields define where the impression is located in the image, how it is oriented, and the type of impression(s) present. Fields are described in this section only if there are additional instructions and guidance beyond that covered in Section 6.9.11 Extended Feature Set. The fields in this grouping are:

Field 9.300: ROI / EFS Region of Interest. See Section 6.9.12.2 EFS Region of Interest for more information about the ROI. With the exception of Field 9.323: CPR / EFS Center Point of Reference, all other fields are in relation to the ROI defined in this field, and not the original image.

Field 9.301: ORT / EFS Orientation

Field 9.302: FPP / EFS Finger - Palm - Plantar Position

F.5.1.1. Field 9.301: ORT / EFS Orientation instructions

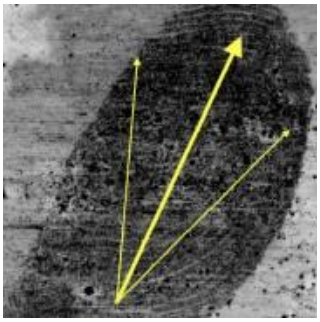


Figure 27 Example of orientation -25 ± 20 degrees

While arbitrary rotation of the image is not recommended due to image degradation concerns, rotation of the image in multiples of 90° can be performed without image degradation and is acceptable. See Section 6.9.12.6 for a description of the information items contained in this field.

F.5.1.2. Field 9.302: FPP / EFS Finger - Palm - Plantar Position instructions

If the image/region of interest contains multiple areas, this field allows the option to label and mark each of those areas within the region of interest. Each of the areas present should be indicated using the appropriate FGP / Friction Ridge Generalized Position, with a polygon

delineating each of the areas. Polygons may overlap if appropriate. See Figure 28, Figure 29, and Figure 30 for examples.

If the image is an exemplar entire joint image or full finger view (from a set of complete friction ridge exemplars), or a latent of equivalent area, it shall be marked with the information item FGP / Friction Ridge Generalized Position (0-10), and shall have the individual segments marked with the information item SGP / Segment Polygon (See Figure 28 for segment areas)



Figure 28 Use of polygons to mark multiple finger segments in a latent equivalent to a full finger view

If the image is of a palm (or foot), each of the palm areas present shall be marked with the relevant FGP / Friction Ridge Generalized Position and delineated with the information item SGP / Segment Polygon.

The information item OCF / Off-Center Fingerprint information item is optional but is only used for fingerprints. Figure 30 shows examples of off-center fingerprints.

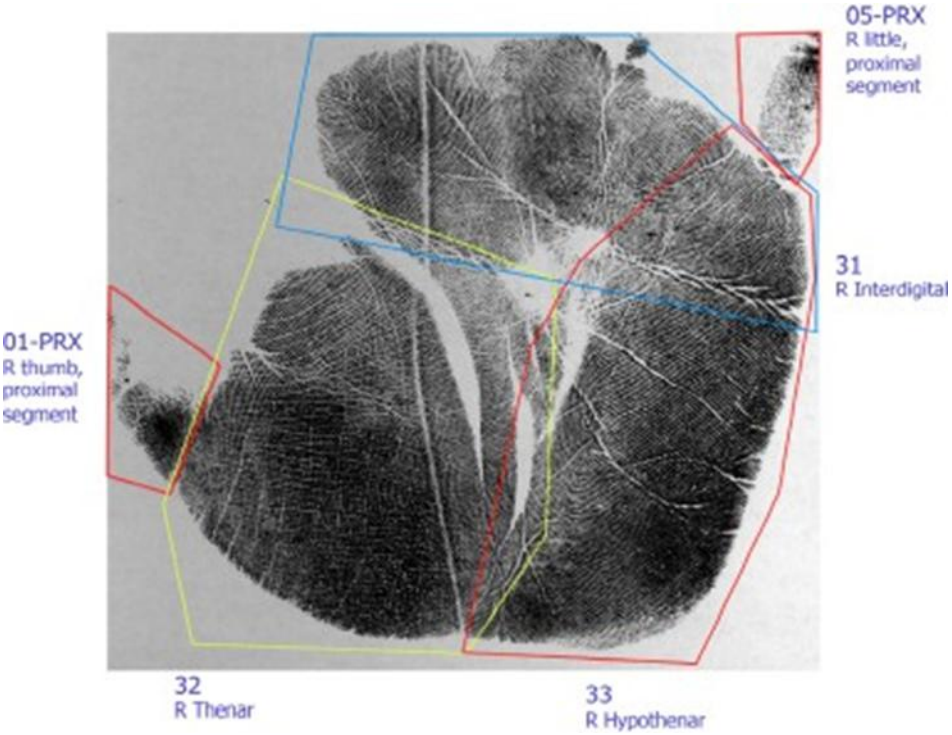


Figure 29 Use of polygons to mark multiple finger segments in a latent equivalent to a full finger view

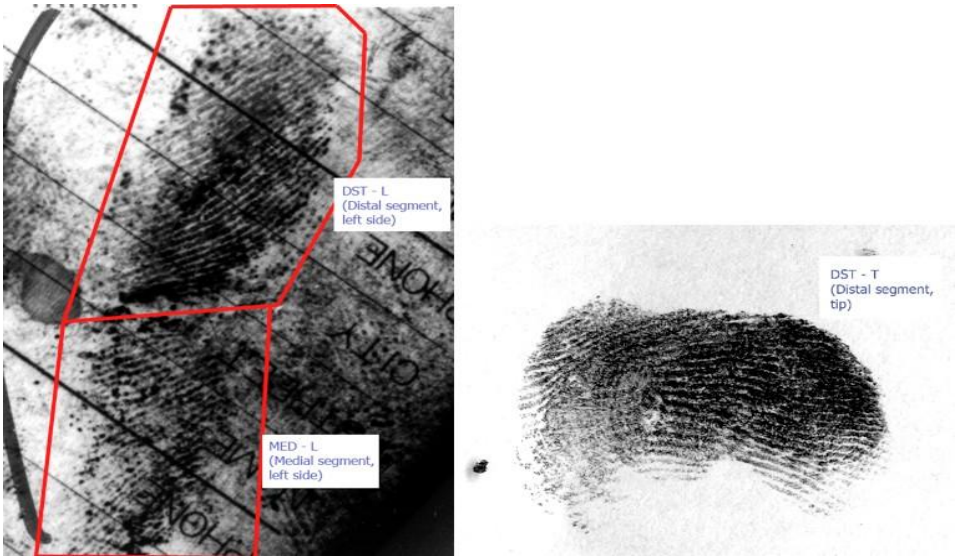


Figure 30 Examples of off-center fingerprint positions

F.5.2. Overall image characteristics

F.5.2.1. Field 9.304 UNT / EFS Measurement Units

This field indicates EFS units of measurement. All EFS fields will be interpreted using this field. When the field is omitted, the unit of measure shall be in units of ƛ (0.01 mm) to maintain backward compatibility. Domains and Application Profiles may restrict the allowable units.

F.5.2.2. Field 9.307: PAT / EFS Pattern Classification instructions

This field, described in Section 6.9.12.11, contains fingerprint classification information for the image. This field shall only be used for fingerprints and shall be omitted for other friction ridge impressions.

The first information item, GCF / General Class, is the general set of pattern classifications with a value selected from Table 22 Pattern Classification Codes, general class column.

The second information item, SUB / Subclass, is the subclass of arches and whorls selected from Table 22 Pattern Classification Codes, subclass column. This information item shall only be included if the sub-classification can be determined precisely.

The third information item, WDR / Whorl - Delta Relationship (also known as Whorl Tracing) may optionally be used by a human examiner or automated system to provide the relationship between the deltas in a whorl. This information item shall only be included for whorls if the subclass is known, and only if the whorl delta relationship can be determined precisely. This information item shall be set to ‘I’ (Inner), ‘O’ (Outer), or ‘M’ (Meeting), following the guidelines from The Science of Fingerprints, p. 60 (See Section 3 Normative References):

> When the deltas have been located, the ridge emanating from the extreme left delta is traced until the point nearest or opposite the extreme right delta is reached. The number of ridges intervening between the tracing ridge and the right delta are then counted. If the ridge traced passes inside of (above) the right delta, and three or more ridges intervene between the tracing ridge and the delta, the tracing is designated as an “inner” […] If the ridge traced passes outside of (below) the right delta, and three or more ridges intervene between the tracing ridge and the delta, the tracing is designated as an “outer” […] All other tracings are designated as “meeting.”

This field may include up to seven subfields, indicating all possible pattern classifications. Classification must be conservative: if the pattern is known precisely, only a single pattern shall be indicated; however, if there is any doubt as to the precise classification, all possible patterns shall be included. If the pattern cannot be classified, but a pattern type can be definitively excluded, then that shall be indicated by including all possible patterns. For example, a latent that contains a delta but no other pattern area information could possibly be a left loop, right

loop, whorl (of any type), or tented arch, so it would indicate four subfields with the following information items specified:

Subfield 1: GCF / General Class = LS

Subfield 2: GCF / General Class = RS

Subfield 3: GCF / General Class = WU

Subfield 4: GCF / General Class = AU and SUB / Subclass = TA

Complete Scar (SR) and Dissociated Ridges/Dysplasia (DR) should only be noted if the fingerprint cannot be classified. If the print can be classified and scar(s), dissociated ridges, and/or dysplasia are present, this field should note the classification(s) and the scar(s), dissociated ridges, and/or dysplasia should be noted in Field 9.324: DIS / EFS Distinctive Features. The use of Field 9.322: CDR / EFS core Delta Ridge Counts can be used to further subcategorize pattern classification.

F.5.3. Reference points

F.5.3.1. Field 9.321: DEL / EFS Deltas instructions

This field is described in Section 6.9.12.24. For fingerprints, one or more deltas are defined for all pattern classifications other than plain arches, as shown in Table 28 EFS Delta Codes. Note that tented arches should have deltas marked if such a structure is present. Accidentals may have any number of deltas. Most palm prints contain four interdigital deltas and one carpal delta. Other delta-like patterns may be defined using this field if such structures are present in friction ridge images.

This field consists of the following information items:

The first two information items are mandatory. (DXC / ‘X’ Coordinate and DYC / ‘Y’ Coordinate). They define the location of the delta.

The next three optional information items (DUP / Direction Up, DLF / Direction Left, and DRT / Direction Right) define the three directions of the delta, in degrees counterclockwise from the right. The three angles shall be reported in order by increasing angle, which for fingerprint deltas with known orientation will result in the order up, left, then right. These three information items may be omitted.

The sixth information item, DTP / Delta Type, is optional. It defines the type of delta, as defined in Table 28 EFS Delta Codes.

The seventh information item, RPU / Radius of Position Uncertainty, is optional. It defines the radius of a circle centered at the location (x,y) of the delta; the circle is sized to include the area of other possible locations of the delta, if the precise location cannot be determined (such as due to poor clarity). If the location is known precisely, the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty shall be expressed as integers in units of either pixels or 10 micrometers (ƛ) (0.01 mm) and may overlap the edge of the image.



Figure 31 Palm with carpal delta and interdigital deltas 7-10 marked

The eighth through tenth information items (DUU / Direction Uncertainty Up, DUL / Direction Uncertainty Left, and DUR / Direction Uncertainty Right) contain the uncertainty of the three delta angles, in non-negative integer degrees. Valid values range from ‘0’ to ‘180’: a value of ‘0’ (default) indicates a certain direction, while a value of ‘180’ indicates an unknown orientation. If one or more deltas are present and the features set is from a fingerprint, Field 9.307: PAT / EFS Pattern Classification should be defined. Note that this does not mean that the classification has to be known definitively but must at least be known to the extent of excluding plain arches.

F.5.3.2. Field 9.323: CPR / EFS Center Point of Reference instructions

This field, described in Section 6.9.12.26, contains the location of a center point of reference of a fingerprint, which can be used to define how centered a fingerprint is, as a feature, for registration or orientation, and for quality measurements. While the core may serve some of the same purposes, a center point of reference is defined for arches and provides a single center location for complex whorls, unlike cores. The location of a center point of reference can be determined using different algorithms, as stored in the Method information item, in which case different center points of reference may be stored in different subfields.

The center point of reference is defined for fingerprints or toeprints, not for other types of friction ridge images. This field consists of the following information items:

The first information item is the CPM / Method of determining the (x,y) location, selected from Table 29.

The second and third information items (PXC / X Coordinate and PYC / Y Coordinate) are the location of the center point of reference, as defined in CPM.

The fourth information item, CRU / Radius Position of Uncertainty, is optional. It is ‘0’ (default) if the location is known precisely; if the precise location cannot be determined (such as due to poor clarity), the position is marked at the best estimate of position, with a radius including the area of other possible locations, expressed as integers in units of either pixels or 10 micrometers (ƛ) (0.01 mm). The radius of uncertainty can overlap the edge of the image.

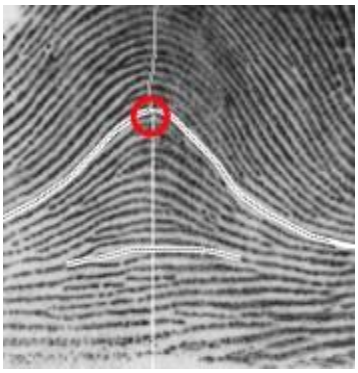


Figure 32 Lateral center example

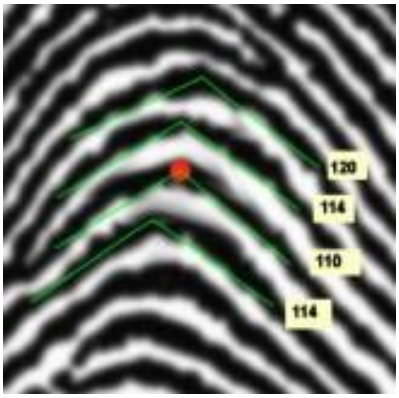


Figure 33 Uppermost point of the ridge with greatest curvature measurement angles (degrees)

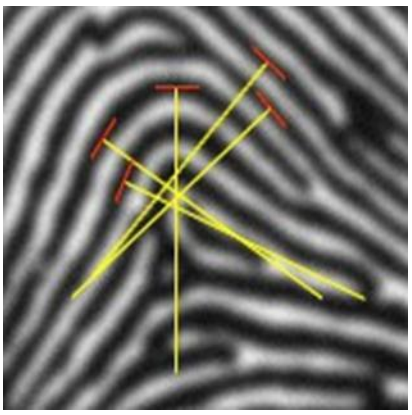


Figure 34 Overall fingerprint focal point

F.5.4. Minutiae

F.5.4.1. Field 9.331: MIN / EFS Minutiae instructions

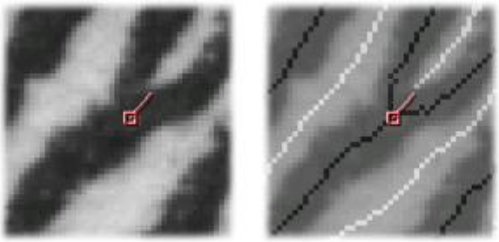


Figure 35 Minutia placement for a bifurcation

This field is used to define the characteristics of all minutiae in the region of interest. The information item MTY / EFS Minutia Type shall be marked if it is clearly identifiable as a ridge ending or bifurcation (as selected from Table 31 EFS Minutia Type); otherwise, it shall be marked as unknown type (code ‘X’). If the type is unknown, the information item MRU / Radius of Position Uncertainty shall be indicated. As seen in Figure 35 Minutia placement for a bifurcation the center of the bifurcation should be at the "Y" of the ridge. The theta angle should run down the valley.

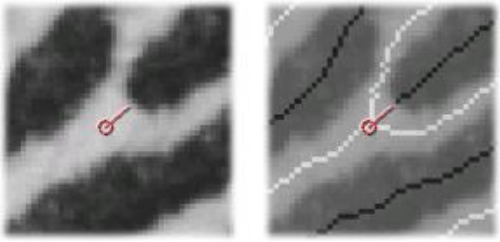


Figure 36 Minutia placement for a ridge ending

As seen in Figure 36 Minutia placement for a ridge ending, the center of the ridge ending should be at the "Y" of the valley. The theta angle should run up the ridge. Note that the ridge ending location corresponds with that used for the FBI's EBTS and INCITS 378 and differs from some vendor-specific approaches. If the precise location for a ridge ending cannot be ascertained, a radius of uncertainty shall be marked to include the area of possible locations.

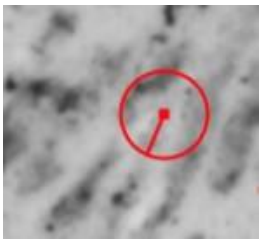


Figure 37 Minutia placement when type is unknown

In Figure 37 Minutia placement when type is unknown the minutia is placed as for a ridge ending, MTY / EFS Minutia Type is set to unknown, and the MRU / Radius of Position Uncertainty is defined to include possible points of intersection with neighboring ridges, as shown. The MTY / EFS Minutia Type shall be set if the examiner/encoding process is confident as to type: the "either" type (code 'X' from Table 31 EFS Minutia Type) shall be used for all minutiae that are not clearly identifiable as a ridge ending or a bifurcation. Because of the frequency with which minutiae appear to be ridge endings in one impression and bifurcation in another, even in clear images, it is recommended that the MTY / EFS Minutia Type be used as supporting evidence rather than as a basis for exclusion. All complex minutia types (crossovers/trifurcations, etc.) should be marked as combinations of bifurcation/endings. Unusually distinctive types/combinations of minutiae should be marked as unusual minutiae/groups of minutiae in Field 9.324: DIS / EFS Distinctive Features.

Ridge endings are located at the fork of the midpoint of the valley (see Figure 36 Minutia placement for a ridge ending), and bifurcations are at the fork of the midpoint of the ridge (Figure 35 Minutia placement for a bifurcation). Unknown types are marked as for ridge endings (Code 'E' in information item MTY / EFS Minutia Type), and with the information item MRU / Radius of Position Uncertainty also defined (Figure 37 Minutia placement when type is unknown).

The direction of the minutia, the information item MTD / Theta Degrees, is expressed in degrees. The angle of the minutia is determined by constructing three virtual rays originating at the minutia and extending 1.93 mm (0.064" – about three ridge widths) along each ridge (for a bifurcation) or valley (for a ridge ending). The smallest of the three angles formed by the rays is bisected to indicate the minutiae direction.

The information item MRU / Radius of Position Uncertainty is optional. It defines the radius of a circle centered at the location (x,y) of the minutia; the circle is sized to include the area of other possible locations of the minutia, if the precise location cannot be determined (such as due to poor clarity). If the location is known precisely, the radius of position uncertainty may be omitted or set to 0. The radius of uncertainty shall be expressed as integers in units of either pixels or 10 micrometers (ƛ) (0.01 mm) and may overlap the edge of the Region of Interest.

The information item MDU / Minutia Direction Uncertainty is optional. It contains an integer from '0' (default) to '180' indicating the precision in the direction (theta) of the minutia, measured in degrees. The resulting direction is Theta±Uncertainty°. Examples of cases in which confidence in direction may be low include cases when the ridge stops or bends close to the minutia so that a good angle measurement cannot be taken, or cases with three equally spaced legs.

Note the relationship between Field 9.308 RQM / EFS Ridge Quality/Confidence Map and minutiae. In areas of RQM that are green, blue or aqua, the presence and absence of minutiae is definitive and can be used in future comparison. Otherwise, the regions should be marked yellow.

F.5.5. Additional features

F.5.5.1. Field 9.343: REF / EFS Ridge Edge Features instructions

This field is described in Section 6.9.12.41. Ridge edge features include **Protrusions**, **Indentations**, and **Discontinuities**:

- A ***protrusion*** (or spur) is an abrupt increase in ridge width that is not long enough to be called a bifurcation. An event on a ridge longer than local ridge width shall be marked as a standard bifurcation with a ridge ending; a shorter event shall be marked as a protrusion. Protrusions are marked at the center of the protruding area.
- An ***indentation*** is an abrupt decrease in ridge width. Indentations are marked at the center of the gap in the ridge.
- A ***discontinuity*** is a point where the ridge stops briefly and restarts again without shifting. A wider gap in the ridge flow, or where the ridges do not line up across the divide, should be marked as two ridge endings, not a discontinuity. A series of discontinuities in a line (such as a cut or crack) should be marked as a linear discontinuity, using Field 9.342 CLD / EFS Creases and Linear Discontinuities. A discontinuity is marked at the center of the gap in the ridge.

This field consists of three information items. The first two (CLX / X Coordinate and CLY / Y Coordinate) are the coordinates of one endpoint. The third information item is CLT / Feature Type. Allowed types are '**P**' (Protrusion), '**I**' (Indentation), or '**D**' (Discontinuity), as described above.

F.5.6. Corresponding features

These fields are used to define the areas or points that correspond or do not correspond between two or more of the images contained in the current transaction: when images are compared as candidates for individualization (potential mates), the corresponding areas and points can be retained in these fields; similarly, the reasons for complex exclusions can be

indicated. Points of Correspondence may be marked using any type of feature and are explicitly not limited to minutiae.

Comparison features are especially appropriate in transactions in which one latent image is bundled with one or more candidate/potential match images in order to show which areas and points in the latent image correspond to areas and points in the candidate images. Such transactions may be useful for exchanges between examiners, or for communicating results back from AFIS searches. See Figure 9 EFS areas and points of correspondence in rolled exemplar, latent, and plain exemplar images. The latent illustrated has two different areas of correspondence, one for each of the exemplars.

F.5.6.1. Field 9.361: CPF / EFS Corresponding Points or Features instructions

This field, described in Section 6.9.12.58, is used to label points or features for comparison of the current feature set with other Type-9 feature sets in this transaction, as illustrated in Figure 7 EFS locations of major flexion creases. This field is to be used only when two or more images contained in a single transaction are compared, either as candidates for individualization (potential mates), or for annotating reasons for exclusion. For each of the images being compared, specific points or features are marked in each of the Type-9 records, with correspondence indicated by the use of the same label. Labels within a single Type-9 record shall be unique.

For example, if a transaction contains one latent and multiple candidate exemplars, a feature labeled “A” in the latent Type-9 feature set corresponds with the feature labeled “A” (if present) in all of the exemplar Type-9 feature sets.

Table 94 Informal explanation of types of corresponding points and features

Category	Type	Code	Description
Definite correspondence	Feature	F	The labeled feature *definitely corresponds* to the feature defined by the **CFN/Corresponding Field Number** and **FOC/Corresponding Field Occurrence** information items. (**CXC/Corresponding X Coordinate** and **CYC/Corresponding Y Coordinate** are unused) *Informally: It definitely exists & it corresponds to this specific minutia (or dot, pore, core, etc.*)
Definite correspondence	Point	P	The labeled feature *definitely corresponds* to the location with the coordinates defined in the **CXC/Corresponding X Coordinate** and **CYC/ Corresponding Y Coordinate** information items. (**CFN/Corresponding Field Number** and **FOC/Corresponding Field Occurrence** information items are unused) *Informally: It definitely exists & it corresponds to this specific point (allows quick definition of points, rather than having to define each feature*)

Possible or debatable correspondence	Debatable Feature	DF	The labeled feature may debatably correspond to the feature defined by the **CFN/Corresponding Field Number** and **FOC/Corresponding Field Occurrence** information items. (**CXC/Corresponding X Coordinate** and **CYC/Corresponding Y Coordinate** information items are unused). *Informally: It appears to correspond to this specific minutia (or dot, pore, core, etc.), but it isn't clear enough to be certain.*
Possible or debatable correspondence	Debatable Point	DP	The labeled feature may debatably correspond to the location with the coordinates defined in the **CXC/Corresponding X Coordinate** and **CYC/Corresponding Y Coordinate** information items. (**CFN/Corresponding Field Number** and **FOC/Corresponding Field Occurrence** information items are unused) *Informally: It appears to correspond to this specific point, but it isn't clear enough to be certain.*
Definite lack of correspondence	Does not exist	X	The labeled feature definitely does not exist in the impression, and the consistency of presentation of the potentially corresponding region is sufficient to make a definite determination. (**CXC/Corresponding X Coordinate, CYC/Corresponding Y Coordinate**, **CFN/Corresponding Field Number** and **FOC/Corresponding Field Occurrence** information items may optionally be used) *Informally: The feature isn't there, and the regions correspond enough that I would be able to see it if it were there – this is presumably a justification for an exclusion.*
Inconclusive	Out of region	R	The labeled feature is not visible in the impression because it lies outside of the area of correspondence for this image: the feature may or may not be present, but the impression does not include the relevant area (**CXC/Corresponding X Coordinate**, **CYC/Corresponding Y Coordinate**, **CFN/Corresponding Field Number** and **FOC/corresponding Field Occurrence** information items are unused) *Informally: It isn't in the area of overlap, so I can't say anything.*
Inconclusive	Unclear area	U	The labeled feature is not visible in the impression because the potentially corresponding region is not sufficiently clear: the feature may or may not be present, but local quality issues prevent a definite determination. (**CXC/Corresponding X Coordinate, CYC/Corresponding Y Coordinate**, **CFN/Corresponding Field Number** and **FOC/Corresponding Field Occurrence** information items are unused) *Informally: I can't tell if the feature is there because the area where it would be is smudged or otherwise unclear.*

Corresponding Points or Features may refer to arbitrary points or may refer to predefined features (as noted in Table 94 and Table 37 EFS Field Numbers Used for Corresponding Features). Note that the features include point features (such as minutiae, dots, or pores), but also may refer to areas (such as distinctive characteristics), lines (incipients or creases), or paths (ridge path segments).

Arbitrary points may be used to indicate characteristics that were not noted during analysis, or to indicate points in an exemplar that were not previously marked up. For example, referencing Table 95, assume that a latent and exemplar are both present in a transaction, and that the latent and exemplar columns in these tables are examples from Field 9.361: CPF / EFS corresponding points or features from different Type-9 records in a single transaction. The label 'M1' indicates that the latent minutia (stored in Field 9.331: MIN / EFS minutiae) #5 corresponds to location (1024, 765) within the exemplar's EFS region of interest (See Sections 6.9.12.2 and 6.9.12.5). The COL / Correspondence Label 'X1' indicates that the dot (Field 9.340: DOT / EFS dots) #1 does not exist within the exemplar image.

Field 9.361 CPF / EFS Corresponding Points or Features consists of the following information items:

The first information item, COL / Correspondence Label, 1–3-character alphanumeric label used to indicate correspondence between feature points in different Type-9 records within the same transaction. Labels within a single Type-9 record shall be unique. Note that the use of a given label in one Type-9 record means that point or feature corresponds with any or all other features with the same label in other Type-9 records in the transaction.

Table 95 Examples of corresponding points and features

Field 9.361 information Item	Latent	Exemplar	Latent	Exemplar
COL / Correspondence Label	M1	M1	X1	X1
TOC / Type of Correspondence (from Table 94 Informal explanation of types of corresponding points and features)	F	P	F	X
CFN / Corresponding Field Number	331		340	
FOC / Corresponding Field Occurrence	5		1	
CXC / Corresponding X Coordinate		1024		846
CYC / Corresponding Y Coordinate		765		992

The second information item, TOC / Type of Correspondence, is a 1–2-character information item and is set to the appropriate value from Table 94.

The third information item, CFN / Corresponding Field Number, is used only if TOC = F or DF. This information item indicates the field being compared as shown in Table 37 EFS Field Numbers Used for Corresponding Features. Note that these are simply the Type-9 field numbers of the fields that can be used for comparisons.

The fourth information item, FOC / Corresponding Field Occurrence, is used only if TOC = F or DF. This information item indicates which subfield (occurrence) of the specified field to which the label is applied. This is a 1-based index, not a 0-based index: occurrences are numbered (1…count), not (0…count-1).

The fifth and sixth information items (CXC / Corresponding X Coordinate and CYC / Corresponding Y Coordinate) are used only if TOC = P or DP. These two optional information items define the location of the CPF.

If the type of correspondence is ‘X’, the CXC and CYC information items may optionally be used to specify the location where the specified feature would have been expected. For the example used to illustrate code X in Table 94 Informal explanation of types of corresponding points and features, if the dot with the labeled ‘X1’ is present in the latent image, but is definitely not present in the exemplar, the labeled ‘X1’ is specified for the exemplar with the approximate location where the dot would have been expected. This is to allow the user interface to indicate the location of the missing feature.

The seventh information (COC / Corresponding Comments) is optional. It allows a free-text comment or description related to the CPF.

F.5.7. Ridge path: Skeletonized image and ridge path segments

Ridge path describes the course of a friction ridge. This specification provides for image or vector representations of ridge path information as a skeletonized image, or as a set of ridge path segments (open path vectors). Either representation is a simplified representation of the ridges in the image that provides a rich method of conveying information, including feature placement, interrelationships, ridge direction, and wavelength. Note that the ridge path representation is a means of annotating the image (rather than replacing the image); it is a clear way of defining and communicating the specific path of each ridge, both for a human examiner and an automated extractor.

F.5.7.2. Skeletonized image

The ridge path for the entire region of interest can be represented as a skeletonized image, also known as a ridge tracing, which reduces the friction ridge impression to an image with thinned representations of each ridge. The skeletonized image is a 2-tone image with a white background and a black single-pixel-wide thinned representation of each ridge and stored in Field 9.372 SIM / EFS Skeletonized Image.

F.5.7.3. Ridge Path Segments

The ridge path can be decomposed into multiple ridge path segments. Each ridge path segment (if completely visible) is the portion of a ridge that connects two minutiae, so each ridge path segment starts and stops either where the ridge intersects another ridge path segment (a bifurcation) or ends (a ridge ending). In the infrequent case in which a ridge segment forms a complete loop back on itself without intersecting another ridge segment (such as near the core of some plain whorls or central pocket loops), the ridge path starts and stops at a single arbitrary point on the ridge. Each ridge path segment is saved as an open path (ordered set of vertices) in Field 9.373 RPS / EFS Ridge Path Segments; see 6.9.12.3 EFS Paths for information on path formats. Incipient ridges, dots, ridge discontinuities, and protrusions are not included in the ridge path representation.

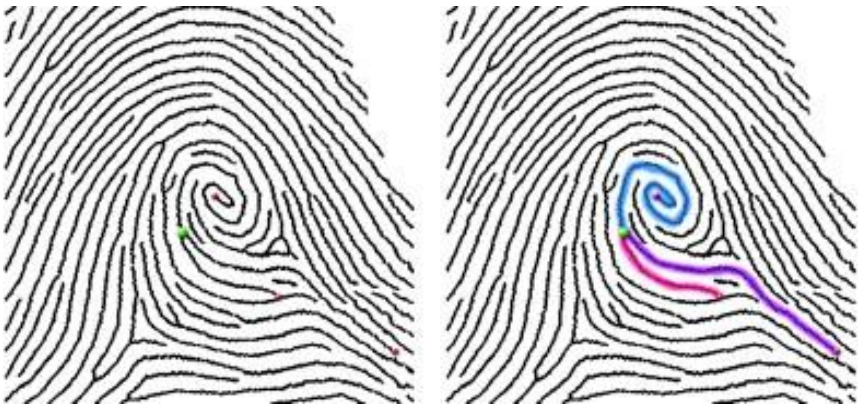


Figure 38 Example of interrelationships between minutiae, with connecting ridge path segments highlighted

Note that often ridge path segments are not visible over their entire length due to image clarity problems or due to being truncated by the edge of the impression, and therefore one or both ends of a ridge segment may not end at points defined as minutiae. Effective use of ridge path representations requires distinguishing between any areas in which the skeleton is debatable rather than definitive. Field 9.308 RQM / EFS Ridge Quality/Confidence Map is used for this purpose. Table 100 shows the relationship between the local quality values and the ridge path. Figure 39 Examples of fingerprint, skeletonized representation, and overlay of original / skeleton / quality map shows an example of a skeletonized image with a quality map: black and red areas (quality 0-1) have no skeleton; the yellow areas are poor (quality 2), and the skeleton information is not definitive; in other areas the skeleton is definitive.

Table 96 Local ridge quality and tracing

Ridge Path	Local Quality Code	Name	Display Color
Ridge path is definitive	5	Definitive pores	
	4	Definitive ridge edges, debatable pores	
	3	Definitive minutiae, debatable ridge edges	
Ridge path is debatable	2	Definitive ridge flow, debatable minutiae	
No ridge path	1	Debatable ridge flow	
	0	Background	



Figure 39 Examples of fingerprint, skeletonized representation, and overlay of original / skeleton / quality map

A ridge skeleton can represent sophisticated interrelationships between features. For example, Figure 38 Example of interrelationships between minutiae, with connecting ridge path segments highlighted shows that the bifurcation in green shares the same ridge with the three minutiae in red. The human latent fingerprint comparison process relies heavily on such feature interrelationships.

Note that this path format permits the treatment of each ridge segment as a distinct feature, indexed by its (1-based) subfield number. Each ridge segment can be associated with the minutiae at its ends and features such as pores and ridge edge features along its length. Dots and incipients can be associated with the ridge segments on either side. Each ridge ending is associated with one ridge segment; each bifurcation is associated with three ridge segments.

In the case that the type of minutia cannot be determined, or its precise location cannot be ascertained, a minutia can be tentatively associated with any ridge segments that cross the minutia's radius of uncertainty, as shown in Figure 40 Examples of minutiae of uncertain type and radii of uncertainty, without and with ridge segments.

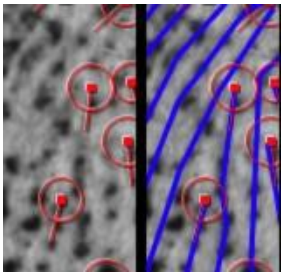


Figure 40 Examples of minutiae of uncertain type and radii of uncertainty, without and with ridge segments

F.5.7.4. Field 9.372: SIM / EFS Skeletonized Image instructions

The skeletonized image, also known as a ridge tracing, is stored as a 1-bit per pixel grayscale PNG[21] compressed image, bit-packed 6 bits per character using base-64 representation (See

[21] See ISO/IEC 15948:2004 in Section 3 Normative references.

Appendix B: Traditional Encoding). The entire PNG-formatted image file is included as a single subfield. Interlacing, alpha transparency, and color palettes shall not be used. The resolution of the skeletonized image must be the same as the original image.

Each black pixel can have 1, 2, or 3 neighboring black pixels; other values (0, 4-8) are errors. The skeletonized image's dimensions shall be identical to that specified in Field 9.300: ROI / EFS Region of Interest.

The values in Field 9.308: RQM / EFS Ridge Quality/Confidence Map are used to distinguish between the areas in which the skeleton is debatable and those in which it is definitive.

F.5.7.5. Field 9.373: RPS / EFS Ridge Path Segments instructions

Each skeletonized ridge segment is stored as a separate subfield, as an open path of consecutive vertices (see Section 6.9.12.3 EFS Paths). Each endpoint of a ridge segment is either shared by 3 ridge segments (at a bifurcation) or is unique to a single ridge segment (at a ridge ending).