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**AMERICAN NATIONAL
STANDARD**

ANSI/EIA-536-1988
APPROVED: MARCH 2, 1988

Handwritten:
NIST
#149
Pt. 2
1988

REFERENCE

NIST
PUBLICATIONS

EIA STANDARD

General Aspects of Group 4 Facsimile Equipment

EIA-536

ADOPTED FOR USE BY
THE FEDERAL GOVERNMENT

EIA-536

ITPS

PUB 149

SEE NOTICE ON INSIDE

AUGUST 1988

ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT



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#149
Pt. 2
1988

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Published by

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ELECTRONIC INDUSTRIES ASSOCIATION
Engineering Department
1722 Eye Street
Washington, D.C. 20006

PRICE: \$11.00

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GENERAL ASPECTS OF GROUP 4 FACSIMILE EQUIPMENT

(From EIA Standards Proposal No. 1466, formulated under the cognizance of the TR-29 Committee on Facsimile Systems and Equipment.)

1. General

1.1

Group 4 facsimile equipment is used mainly on public data networks (PDN) including circuit-switched, packet switched, and the integrated services digital network (ISDN). The equipment may be also used on the public switched telephone network (PSTN) where an appropriate modulation process will be utilized.

1.2

The procedures used with Group 4 facsimile equipment enable it to transmit and reproduce image encoded information essentially without transmission errors.

1.3

Group 4 facsimile equipment has the means for reducing the redundant information in facsimile signals prior to transmission.

1.4

The basic image type of the Group 4 facsimile equipment is black and white. Other image types, e.g. grey scale image or color image are for further study.

1.5

There are three classes of Group 4 facsimile terminals:

- Class I - Minimum requirement is a terminal able to send and receive documents containing facsimile encoded information (in accordance with EIA-538 and CCITT Recommendation T.73).
- Class II - Minimum requirement is a terminal able to transmit documents which are facsimile encoded (in accordance with EIA-538 and CCITT Recommendation T.73. In addition, the terminal must

be capable of receiving documents which are facsimile coded (in accordance with EIA-538 and CCITT Recommendation T.73), Teletex coded (in accordance with the basic coded character repertoire as defined in CCITT Recommendations T.60 and T.61) and also mixed-mode documents (in accordance with Recommendations T.72 and T.73).

- Class III - Minimum requirement is a terminal which is capable of generating, transmitting and receiving facsimile coded documents (in accordance with EIA-538 and Recommendation T.73), Teletex coded documents (in accordance with the basic coded character as defined in Recommendation (T.60 and T.61),) and mixed mode documents (in accordance with Recommendation T.72 and T.73). See Note.

Note - The above definitions are extracted from Study Group 1 where "terminal" is used instead of "equipment".

2. Scope of Standards concerning Group 4 facsimile equipment

2.1

This Standard defines the requirements for Group 4 facsimile equipment.

2.2

The Group 4 facsimile coding scheme and facsimile control functions are defined in EIA-538.

2.3

All Group 4 facsimile equipment has to communicate with unique procedures that are described as follows:

- a) the interface to the physical network is defined in this Recommendation; See Note 1;
- b) the transport end-to-end control procedure is defined in Recommendation T.70;
- c) Group 4 facsimile control procedures are defined in EIA-537. See Note 2;
- d) Group 4 facsimile document interchange protocol is defined in Recommendation T.73. See Note 3.

Note 1 - Recommendation T.71 may be applicable for PSTN operation.

Note 2 - EIA-537 and Recommendation T.70 are used in Group 4 facsimile, Teletex and terminal supporting mixed mode of operation.

Note 3 - Recommendation T.73 is used in Group 4 facsimile and terminal supporting mixed mode of operation.

2.4 When operating as mixed-mode terminals, Recommendation T.72 applies.

3. General characteristics of the equipment

3.1 Basic characteristics

3.1.1 The Group 4 facsimile equipment provides the means for direct document transmission from any subscriber to any other subscriber.

3.1.2 All equipment participating in the international Group 4 facsimile service has to be compatible with another at the basic level defined in this Recommendation. Additional operational functions may be invoked.

3.1.3 The range of data rates is described in § 6.

3.1.4 The page is the basis for facsimile message formatting and transmission in Class 1 and Class 2. Both A4 and North American paper formats are taken into account.

3.1.5 Facsimile coding schemes are applied in order to reduce the redundant information in in facsimile signals.

3.1.6 The equipment must have the ability to reproduce facsimile messages. The content, layout and format of facsimile messages must be identical at the transmitting and receiving equipment.

3.1.7 The reproducible area is defined within which facsimile messages are assured to be reproduced. (See § 3.2.6)

3.1.8 The Group 4 facsimile equipment must provide means for fully automatic operation.

3.1.9 All classes of Group 4 facsimile equipment shall incorporate the functions defined as basic for the Group 4 facsimile service in Section 3.2 below. In addition, optional functions can be incorporated. In this Standard, the optional functions are divided into EIA- standardized options and nationally and/or privately specified options.

3.2 Basic functions

3.2.1 Group 4 facsimile equipment shall be capable of handling:

- a) the basic end-to-end control procedures as defined in EIA-537.
- b) document interchange protocol as defined in Recommendation T.73;
- c) the basic facsimile coding scheme as defined in EIA-538.
- d) the control functions associated to the basic facsimile coding scheme defined in EIA-538.

3.2.2 All classes of Group 4 equipment shall have the following provisions for facsimile messages:

- a. provisions for scanning the documents to be transmitted (see paragraph 3.2.5)
- b. provisions for receiving and presenting hard or soft copies of the documents

3.2.2.1 In addition Group 4 Class II equipment shall have provision for receiving and displaying basic Teletex and mixed-mode documents.

3.2.2.2 In addition to the requirements for Group 4 Class II equipment, Class III equipment shall have provisions for generating and transmitting basic Teletex and mixed-mode documents.

3.2.3 Basic page formatting functions are as follows:

- a) vertical page orientation;
- b) paper size of ISO A4;
- c) reproducible area/printable area - to be defined taking into account A4 and North American paper formats and ISO 3535;

3.2.4 Terminal Identification Each Group 4 facsimile equipment should be equipped with a unique identification. Details of the identification are given in Recommendation F.161.

3.2.5 Scanning The message area should be scanned in the same direction in the transmitter and receiver. Viewing the message area in a vertical plane, the picture elements shall be processed as if the scanning direction were from left to right with subsequent scans adjacent to and below the previous scan.

3.2.6 Page sizes and reproducible area

3.2.6.1 Sometimes paper length may not be specified, because the paper end is detected by paper scanning.

3.2.6.2 The size of the guaranteed reproducible area for ISO A4 paper size is identical to Group 3 equipment described in Appendix I to Recommendation T.4.

3.2.7 Group 4 facsimile transmission pel density (resolution) requirements The Group 4 facsimile resolution requirements and their tolerances are given in Table I:

TABLE 1

Resolution (pels/25.4 mm)	Horizontal and vertical tolerance 0/0
200 x 200	+ 1
240 x 240	+ 1
300 x 300	+ 1
400 x 400	+ 1

Center line referencing will be used for paper positioning. Each page will be positioned on the scanner so that the center line is in registration with the value: (number of pels/line)/2. (For further study.)

Specific values for the number of pels per line, scan line length and nominal number of scan lines per page are given in Tables 2a and 2b for all the Group 4 resolutions for ISO A4, North American, B4, and A3 paper. Table 3 and Figure 1 specify the blanking procedure for ISO A4 and North American paper. An equal number of pels on the left and right side of the page are set to white to fit the paper format. The same procedure is used for the other paper formats.

The raster point in the upper left of an ISO page is used as a reference for portrait mode character printing. This raster point, termed the (1, 1) raster reference point, is used as a starting point for determining character margins and positions. This is also illustrated in Figure 1.

TABLE 2a

Number of pels and the scan line length for different paper sizes

		ISO A4	North American	ISO B4	ISO A3
Number of picture elements along a scan line	Resolution (pels/25.4 mm)				
	200	1728	1728	2048	2432
	240	2074	2074	2458	2918
	300	2592	2592	3072	3648
	400	3456	3456	4096	4864
Scan line length (mm) (P)		219.46	219.46	260.10	308.86
Paper width (mm) (Q)		210	215.9	250	297
P - Q		9.46	3.56	10.10	11.86

TABLE 2b

Nominal number of scan lines for various paper sizes

		ISO A4	North American	ISO B4	ISO A3
Nominal number of scan lines per page for each	Resolution (pels/25.4 mm)				
	200	2339	2200	2780	3307
	300	3508	3300	4169	4961
	400	4677	4400	5559	6614
Nominal paper length (mm)		297	279.4	353	420

TABLE 3

Blanking and address reference point for A4 and North American paper

Resolution (pels/24.4mm)	Pels per line	Pels per North American line	Pels per ISO A4 line	Blanking margin A (pels)	Blanking margin B (pels)	ISO A4 reference point	Total line length (mm)
200 x 200	1728	1700	1654	14	37	(38 , 1)	219.46
240 x 240	2074	2040	1984	17	45	(46 , 1)	219.46
300 x 300	2592	2550	2480	21	56	(57 , 1)	219.46
400 x 400	3456	3400	3308	28	74	(75 , 1)	219.46

Note - The pels as defined in the blanking margin sections A and B (see Fig. 1) are equivalent to the discarded pels in Recommendation T.73.

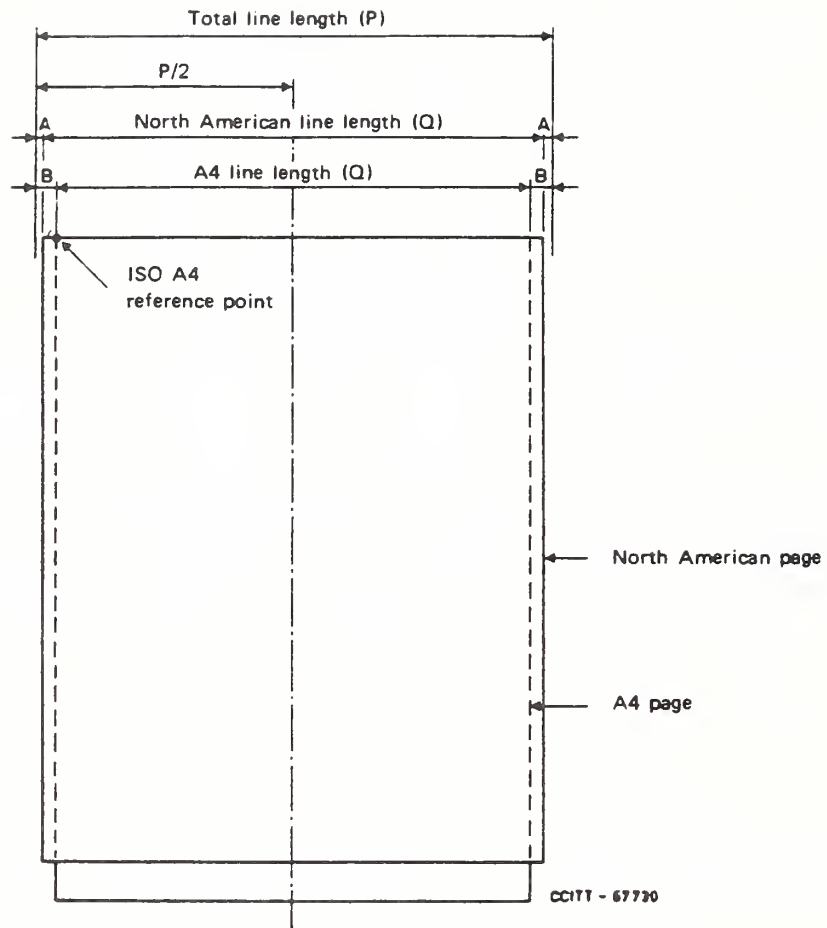


FIGURE 1

3.2.8 Group 4 facsimile class structure Table 4 shows the class structure of Group 4 facsimile equipment.

TABLE 4
Class structure

Class	I (See Note 1)	II (See Note 1)	III (See Note 1)
Standard pel transmission density (pels/25.4 mm)	200	200 and 300 (See Note 2)	200 and 300 (See Note 2)
Optional pel transmission density (pels/25.4 mm)	240 and/or 300 and/or 400	240 and/or 400 (See Note 3)	240 and/or 400 (See Note 3)
Pel conversion capability in standard	Not required	Yes	Yes
Teletex	Not required	option only	Yes
Mixed mode	Not required	option only	Yes
Page memory	Not required	Yes	Yes

Note 1 - Administrations may determine which class with options is to be used for their national service. Standardization work has to continue with the goal of achieving a uniform standard.

Note 2 - When operating as a mixed-mode terminal per Recommendation T.72, the pel receiving density of 240 pels per 25.4 mm is required.

Note 3 - To achieve a high service quality, the pel density of the scanner printer should be greater than or equal to the transmission pel density. This requirement is waived for a terminal which has a scanner or printer with a pel density of 240 x 240 pels per 25.4 mm and can communicate at 300 pels per 25.4 mm. In this case, the 240 x 240 pels per 25.4 mm terminal will exceptionally meet the standard Class II/III requirement.

Note 4 - For a period of four year, Group 4 Class I equipment may be

manufactured utilizing Group 3 scanner/printer components.

Note 5 - When a resolution conversion is necessary, the conversion is performed by the equipment which minimizes the transmission cost and time. An exception would be a 240 x 300 pels per 25.4 mm terminal transmitting to a 300 x 300 pels per 25.4 mm terminal which is operating at the standard transmission density.

Note 6 - Pel conversion algorithms should aim at low impairment of the quality and are for further study.

3.2.9 Facsimile coding schemes

3.2.9.1 In order to reduce the redundant information in facsimile signals, the basic facsimile coding scheme is defined in EIA-538. This coding scheme is used assuming that transmission errors are corrected by control procedures in lower levels.

3.2.9.2 On an optional basis an equipment can use other EIA standardized coding schemes defined in EIA-538.

3.3 EIA-standardized optional functions

3.3.1 The possibility of using optional functions can be negotiated during a handshaking procedure in the end-to-end control procedure (see EIA-537).

3.3.2 The optional functions are invoked by a document interchange protocol (see Recommendations T.73).

3.3.3 As the service develops, additions and changes to the EIA-standardized optional functions listed below may be needed.

- a) optional coding schemes defined in EIA-538.
- b) control functions associated with optional coding schemes:
- c) grey scale images:
- d) color images:
- e) resolution conversion algorithms.

3.3.4 Optional page formatting function are as follows:

- a) paper sizes of ISO B4 and ISO A3;
- b) other page formats are for further study.

3.4 Optional functions for national standardization or private use

The EIA standardization includes the necessary rules and means for indication of, of escape into, functions specified nationally or for private use (EIA-537 and T.73).

3.5 Default conditions

In the absence of specific indications, the receiving equipment shall assume the following conditions:

- a) communication (as specified in EIA-537).
 - one way (calling equipment transmitting the facsimile message);
 - normal document;
- b) coding scheme:
 - basic facsimile coding scheme;
- c) image type:
 - black and white two-level image;
- d) presentation:
 - paper size of ISO A4;
 - pel transmission density of 200 pels per 25.4 mm;
 - number of picture elements along scan line of 1728 pels per 219.46 mm;
 - vertical page orientation.

4. Mixed mode capabilities

For mixed mode of operation, requirements for Group 4 Class II and Class III terminals are specified in Recommendation T.72.

5. Communications

5.1 Storage

iving storage is not required for Group 4 Class I terminals. The minimum storage requirement for Group 4 Class II and Class III is 128 k octets. This value is based on a pel transmission density of 300 pels per 25.4 mm for an ISO A4 document. However, this does not cover the worst case situation for dense documents. Additional memory may be required and can be negotiated.

5.2 Call identification

The control procedures include the exchange of reference information prior to sending any document. Details of the call identification line are covered in Recommendation F.161. Printing the call identification line at the top of each page is an option.

5.3 Interworking

For further study.

6. Network-related requirements

6.1 Networks

The Group 4 facsimile transport service can be provided using a circuit-switched public data network (CSPDN), a packet-switched data network (PSPDN), a public switched telephone network (PSTN), or an integrated services digital network (ISDN). In all types of network the Group 4 facsimile equipment will provide automatic answering, transmission, reception and clearing.

6.2 Circuit-switched public data network (CSPDN)

- a) Functional and procedural aspect of the interface: Recommendation X.21.
- b) With external data circuit terminating equipment (DCE) - mechanical and electrical characteristics of the interface: Recommendation X.21.
- c) Bit rates: user classes of services 4 to 7 in Recommendation X.1.
- d) Link procedure: LAPB/Recommendation X.75.

6.3 Packet-switched public data network (PSPDN)

- a) Functional and procedural aspects of the interface: Recommendation X.25, levels 1,2,3.

- b) Duplex transmission.
- c) Bit rates: user classes of service 8 to 11 in Recommendation X.1.
- d) Number of logical channels at a time: one or more.

6.4 Public switched telephone network (PSTN)

- a) Modulation/demodulation schemes are for further study.
- b) Functional and procedural aspects of the interface: for further study.
- c) Link procedure: Recommendation T.71 may be applicable.
- d) Bit rate: for further study.
- e) Automatic answering: Recommendation V.25.

6.5 Integrated services digital network (ISDN)

The operation of Group 4 facsimile equipment on the ISDN can be achieved by the implementation of the relevant series I Recommendations.

7. Indicators

7.1 Indicators should inform users about situations in which negative effects on the grade of service can be expected.

7.2 The following indicators are required

- a) equipment unable to transmit (e.g., paper jam at transmitting end);
- b) equipment unable or soon unable to receive (e.g., paper jam or receiving memory nearly full);
- c) operator assistance required;
- d) message received in store.

8. Access to facsimile MHF

Users of Group 4 facsimile equipment may wish to have access to the services offered by message handling facilities. This requires the ability to generate control documents (see EIA-537).

This standard has been adopted for Federal Government use.

Details concerning its use within the Federal Government are contained in Federal Information Processing Standards Publication 149, General Aspects of Group 4 Facsimile Apparatus. For a complete list of publications available in the Federal Information Processing Standards Series, write to the Standards Processing Coordinator (ADP), National Institute of Standards and Technology, Gaithersburg, MD 20899.

