

**NIST Technical Note 2144**

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ProSe-based UE-to-Network Relays**

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## Evaluation of Timers Related to ProSe-based UE-to-Network Relays

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- shop on Computer Aided Modeling and Design of Communication Links and Networks (CAMAD)* (IEEE), , pp 1–7. <https://doi.org/10.1109/CAMAD.2019.8858441>
- [6] Zhang S, Xu X, Sun M, Tang X, Tao X (2017) Energy efficient uplink transmission for ue-to network relay in heterogeneous networks. *2017 IEEE 28th Annual International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC)* (IEEE), , pp 1–7. <https://doi.org/10.1109/PIMRC.2017.8292436>
- [7] Chaudhari A, Gandikota J, Sen A, Narayan S (2020) A Realistic Approach to Enhance the Battery Performance of Device-to-Device (D2D) Relay UEs. *2020 IEEE 17th Annual Consumer Communications & Networking Conference (CCNC)* (IEEE), , pp 1–2. <https://doi.org/10.1109/CCNC46108.2020.9045552>
- [8] Anamuro CV, Varsier N, Schwoerer J, Lagrange X (2021) Distance-aware relay selection in an energy-efficient discovery protocol for 5G D2D communication. *IEEE Transactions on Wireless Communications* <https://doi.org/10.1109/TWC.2021.3058636>
- [9] Koziół D, Moya FS, Yu L, Van Phan V, Xu S (2017) QoS and service continuity in 3GPP D2D for IoT and wearables. *2017 IEEE Conference on Standards for Communications and Networking (CSCN)*, , pp 233–239. <https://doi.org/10.1109/CSCN.2017.8088627>
- [10] Sun Y, Garey W, Rouil R, Varin P (2019) Access Time Analysis of MCPTT Off-Network Mode over LTE. *Wireless Communications and Mobile Computing* 2019. <https://doi.org/10.1155/2019/2729370>
- [11] 3GPP (2020) Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Third Generation Partnership Project (3GPP)), TS 36.213. Available at <http://www.3gpp.org/ftp/Specs/html-info/36213.htm>.
- [12] Griffith DW, Cintrón FJ, Rouil RA (2017) Physical sidelink control channel (PSCCH) in mode 2: Performance analysis. *2017 IEEE International Conference on Communications (ICC)* (IEEE), , pp 1–7. <https://doi.org/10.1109/ICC.2017.7997074>
- [13] Rouil R, Cintrón FJ, Ben Mosbah A, Gamboa S (2017) Implementation and Validation of an LTE D2D Model for ns-3. *Proceedings of the Workshop on ns-3 WNS3 '17*, , pp 55–62. <https://doi.org/10.1145/3067665.3067668>
- [14] NIST (2020) Public Safety Communication modeling tools based on ns-3. Available at <https://github.com/usnistgov/psc-ns3>.
- [15] 3GPP (2020) Vehicle-to-Everything (V2X) services in 5G System (5GS); Stage 3 (Third Generation Partnership Project (3GPP)), TS 24.587. Available at <http://www.3gpp.org/ftp/Specs/html-info/24587.htm>.