**IEEE P802.19**

**Wireless Coexistence**

|  |  |
| --- | --- |
| Project | IEEE P802.19 Wireless Coexistence WG |
| Title | **Contribution for Comment Resolution, ETSI TS 103 357** |
| Date Submitted | March 25, 2020 |
| Source | Joerg RobertFAU Erlangen-NuernbergAm Wolfsmantel 33 91058 Erlangen, Germany | Voice: +49 9131 85 25 373 E-mail: joerg.robert@fau.de |
| Re: |  |
| Abstract | Text and tables to support proposed resolutions to ballot comments.  |
| Purpose | [Resolve comments] |
| Notice | This document has been prepared to assist the IEEE P802.19. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. |
| Release | The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by IEEE P802.19. |

4.7 ETSI TS 103 357

The ETSI Technical Specification (TS) 103 357 [Add reference to ETSI TS 103 357] defines the radio interface for three different Low Throughput Networks (LTN): Chapter 5 defines the “Lfour family”, chapter 6 the “Telegram splitting ultra narrow band (TS-UNB) family”, and chapter 7 the “Dynamic Downlink Narrow Band (DD-UNB) family”. These three radio interfaces are three different systems that address different LPWAN scenarios.

4.7.1 Lfour family

The Lfour family only offers uplink communication and no downlink is defined. The uplink uses chirp modulated BSPK or BPSK and the occupied bandwidth ranges between 50 and 160 kHz. The maximum coupling loss, i.e. the maximum attenuation between transmitter and receiver, is between 150dB and 155dB. The reception network consists of base stations in a star or extended star topolgy. Lfour may use auxiliary time synchronization methods like GPSK for reduced base station complexity.

The forward error correction employs a state-of-the-art rate 1/4 Low Density Parity Check (LDPC) code, which is identical to the IEEE 802.15.4w LDPC code. Additionally, packets may be transmitted multiple times with the possibility to coherently add the multiple transmission in the receiver for enhanced robustness.

4.7.2 Telegram splitting ultra narrow band (TS-UNB) family

The TS-UNB family (brand name MIOTY) offers bi-directional and uni-directional communication. The modulation uses Minimum Shift Keying (MSK) with a symbol rate of 2.3kSyms/s. For improved robustness, TS-UNB uses frequency hopping, resulting in a typical effective bandwidth of 100kHz (standard mode) or 725kHz (wide mode). The MCL is between 153dB and 164dB on the uplink and 161dB on the downlink. TS-UNB support a star or extended star network topology.

The forward error correction is optimized for highly interfered channels and very similar to the encoding of IEEE 802.15.4w. It uses a rate 1/3 convolutional code and spreads the encoded data on several radio bursts, which are then transmitted on different frequencies. This offers the benefit that the data of multiple radio bursts may be lost without significantly degrading the decoding performance.

4.7.3 Dynamic Downlink Narrow Band (DD-UNB) family

The DD-UNB family only supports bi-directional communication, i.e. all endpoints have to support bidirectional communication. The modulation uses binary Frequency Shift Keying (FSK) with a symbol rate of 500 Syms/s with a BCH forward error correction. Frequency hopping is used to improve the robustness. The specification does not define the MCL, but according to the data rate it will be in the order of 150dB. The DD-UNB family supports a star or extended star topology. Furthermore, orphan endpoints can be connected using a relay link through another endpoint to improve coverage.