**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **Proposed Resolution for Comments #988** | |
| Date Submitted | August 29, 2024 | |
| Sources | Carlos Aldana (Meta) , Guoqing Li (Meta), Kumail Haider (Meta), Davide Magrin (Meta), Pooria Pakrooh (Qualcomm), Bin Tian (Qualcomm), Li-Hsiang Sun (Mediatek), Wenzheng Li (Calterah), Pelin Salem (Cisco) |  |
| Re: |  | |
| Abstract |  | |
| Purpose | To propose resolution to comment with CID #988 for “P802.15.4ab™/Draft 1.0 Standard for Low-Rate Wireless Networks” | |
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***Comment Index #988***

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| 988 | Technical | 71 | 10.38.7.3 | 13 | SSBD can be used to specify LBT behavior. Please add the following text: "Channel access using listen before talk shall be used for improved coexistence performance. When used for narrowband assist, SSBD shall use the following control attribute values: phyCcaDuration should be set as required by local regulations;  macSsbdMinBf and macSsbdMaxBf shall be set to 0; macSsbdMaxBackoffs shall be set to 0; macSsbdTxOnEnd shall be set to FALSE; macSsbdPersistence shall be set to FALSE; phyCcaMode shall be set to 1 (energy above threshold) phyCcaEdThreshold shall be set to -67 dBm/MHz - Ptx for channels 0 to 49 and to -74 dBm/MHz - Ptx for channels 50 to 249, where Ptx is the equipment’s instantaneous transmit power in dBm." |  |

**Discussion:** This proposal is based on the work [3] presented in the joint 802.11/802.15.4ab Coex SC meeting in July 2024.

Besides the ED threshold parameters, the other SSBD parameters are the same as those presented in [1] and consistent with the FBE section of [2], where a single CCA measurement of at least 9us is made before a transmission:

*Immediately before starting transmissions on a channel or group of adjacent or non-adjacent channels the initiating device shall perform a Clear Channel Assessment (CCA) check during a single observation slot. A channel is an occupied channel as long as transmissions in that channel are present at a power level greater than the ED Threshold (EDT) in clause 4.3.6.3.3.*

*A single observation slot as defined in clause 3.1 and as referenced by the procedure in clause 4.3.6.3.1.4 shall have a duration of not less than 9 μs.*

For example, if TXMAX\_capability=21 dBm, TXMAX\_power\_Regulatory=30 dBm, Pcca\_dBm\_MHz = -75 dBm, the 802.15.4ab transmitter can transmit up to 8 dBm in channels 0 to 49 (UNII-3). If the same level is measured in channels 50 to 249 (UNII-5), the 802.15.4ab transmitter can transmit up to 1 dBm. The table below shows a possible mapping of CCA levels to transmit power (in dBm) using the TXMAX\_capability=21 dBm, TXMAX\_power\_Regulatory=30 dBm assumptions.

|  |  |  |
| --- | --- | --- |
| CCA Power (dBm/MHz) | Max TX Power in channels 50 to 249 | Max TX Power in channels 0 to 49 |
| -67 | -7 | 0 |
| -68 | -6 | 1 |
| -69 | -5 | 2 |
| -70 | -4 | 3 |
| -71 | -3 | 4 |
| -72 | -2 | 5 |
| -73 | -1 | 6 |
| -74 | 0 | 7 |
| -75 | 1 | 8 |
| -76 | 2 | 9 |
| -77 | 3 | 10 |
| -78 | 4 | 11 |
| -79 | 5 | 12 |
| -80 | 6 | 13 |
| -81 | 7 | 14 |
| -82 | 8 | 15 |
| -83 | 9 | 16 |
| -84 | 10 | 17 |
| -85 | 11 | 18 |
| -86 | 12 | 19 |
| -87 | 13 | 20 |
| -88 | 14 | 21 |

Note that the noise floor of a 10 dB Noise Figure 802.15.4ab NB device at 290 Kelvin (62 degrees Fahrenheit, 16.85 degrees Celsius) is -174 dBm/Hz + 10\*log10(2.5e6) + 10 = -100 dBm. If 14 dBm is the intended transmit power in UNII-5 (which is the max value in Europe), the ED threshold of -88 dBm/MHz = -84 dBm is 16 dB above the noise floor. Therefore, the probability that a 9us measurement over a “noise only” window causes a channel to be busy is negligible. Even if the temperature increases to 311 Kelvin (100.13 degrees Fahrenheit, 37.85 degrees Celsius), the noise floor increases by 0.3 dB, since the noise floor is equal to kTB, where k is the Boltzmann constant, T is temperature in Kelvin, and B is bandwidth of the receiver.

**Proposed Resolution :** Revised

**NOTE TO EDITOR:** Replace the following text in Section 10.38.7.3

LBT shall be applied to channel numbers 50 to 249 according to regulatory constraints. LBT may be applied to all channels in the absence of regulatory constraints, for example, to improve coexistence with other spectrum users.

**with the following:**

Channel access using listen before talk shall be used for improved coexistence performance. When used for narrowband assist, SSBD, as described in Section 10.44, shall be used with the following control attribute values:

phyCcaDuration shall be set to the minimum value required by local regulations;  
macSsbdMinBf and macSsbdMaxBf shall be set to 0;  
macSsbdMaxBackoffs shall be set to 0;  
macSsbdTxOnEnd shall be set to FALSE;  
macSsbdPersistence shall be set to FALSE;  
phyCcaMode shall be set to 1 (energy above threshold)  
phyCcaEdThreshold shall be set to -67 dBm/MHz - Ptx in channels 0 to 49 and to

-74 dBm/MHz - Ptx in channels 50 to 249, where Ptx is the equipment’s instantaneous transmit power for the upcoming packet in dBm and Ptx<=Pmax = min(TXMAX\_capability, TXMAX\_power\_Regulatory). TXMAX\_power\_Regulatory is the max power allowed to be transmitted in the regulatory domain and TXMAX\_capability is the max power allowed to be transmitted by the device.

The transmitter has two options:

1. If Pcca\_dBm\_MHz <= phyCcaEdThreshold (i.e., channel is idle), then transmit up to Pmax
2. If Pcca\_dBm\_MHz > phyCcaEdThreshold (i.e., channel is busy), then either
   1. do not transmit OR
   2. stay in the same channel and transmit according to TX procedure below.

**TX Procedure**

Transmit up to Ptx2\_dBm using the formula below:

Ptx2\_dBm < = min(Pmax, -67-Pcca\_dBm\_MHz) in channels 0 to 49

Ptx2\_dBm <= min(Pmax, -74-Pcca\_dBm\_MHz) in channels 50 to 249

**References** :

[1]15-24-0226-03-04ab “DraftC comment resolution – NB channel access – CIDs 149, 161”

[2] ETSI EN 303 687 V1.1.1 (2023-06)

[3] IEEE 802.11-24/1182r0, “Transmit Power Control Based EDT for NB”