**IEEE P802.19**

**Wireless Coexistence**

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| Project | IEEE P802.19 Wireless Coexistence WG |
| Title | **Contribution for Clause 6.2 6. Sub-1 GHz frequency band spectrum allocation for the United States.**  |
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| Re: | [TG3 draft development] |
| Abstract | [Summary of relevant FCC regulations for 802.11ah and 802.15.4 SUN FSK] |
| Purpose | [] |
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* 1. **6.2 United States**

There are a many frequency bands bellow 1 GHz in which radio frequency devices may operate as defined in the Code of Federal Regulations, Title 47, Part 15 [Bx] though at extremely low power levels. General rules given in §15.209 prescribe very low power levels of 200 microvolts/meter (equivalent to less than -49 dBm). Higher power levels are allowed for specific bands. For the purpose of this standards, the 902MHz to 928 MHz band is the only band that will support both 802.11 and 802.15.4 operations. Operation of communication systems in the 902-928 MHz band is addressed in §15.247 and §15.249.

The band used by systems covered in this standard is 902 MHz to 928 MHz, using the provisions of §15.247. Channel plans for this band are provided in both IEEE Std 802.11 and IEEE Std 802.15.4. Operation under this part requires either frequency hopping or a digital modulation.

Operation of 802.15.4 SUN FSK are considered frequency hopping systems to comply with this part. The requirements include a minimum channel spacing of 25 KHz and maximum allowed 20 dB bandwidth of the hopping channel of 500 kHz. The SUN FSK PHY includes modes to meet these requirements with channel spacing of 200 kHz and 400 kHz defined for the band. Per channel duty cycle is limited: for 200 kHz channel spacing, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; For the 400 kHz channel spacing, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. Hopping systems must use a pseudo-random sequence and the system designed so that all channels in a sequence must be used equally on average over time. Not all available channels must be included in a sequence, thus skipping over channels is allowed. The regulations prohibit coordination of transmitter sequences for the express purpose of avoiding simultaneous occupancy of a channel, i.e. coordination to achieve maximum band occupancy by a single system is not allowed.

Maximum transmit power (peak conducted output power) is 1 watt for systems employing at least 50 hopping channels. The channel plans for 200 kHz and 400 kHz channel spacing use 129 and 64 channels, respectively.

Systems using 802.11ah will be operated as digital modulation systems under this regulation. To be classified as using digital modulation techniques, the minimum 6 dB bandwidth shall be at least 500 kHz. The OFDM signal used by 802.11ah is considered a digital modulation, and uses a minimum channel spacing of 1 MHz. Digital modulation systems are not required to employ frequency diversity, although use of hybrid systems that use both digital modulation and hopping are allowed.

For systems using digital modulation, the maximum peak conducted output power is 1 watt. In addition, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Operation under §15.249 allows any modulation technique but is limited to fixed, point-to-point operation. Field strength of fundamental signal must be no greater than 50 millivolts/meter (measured at 3 meters). This is equivalent to transmit power of +18.75 dBm. This is not fit the majority of use cases for either 802.11 or 802.15.4; for these reasons most of the applications expected to apply this standard will be operated under the provisions of §15.247.

**Bibliography:**

[Bx] Code of Federal Regulations Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES <https://www.ecfr.gov/cgi-bin/text-idx?SID=b64d5226837cbb4f9100a672f34cfd7e&mc=true&tpl=/ecfrbrowse/Title47/47cfr15_main_02.tpl>