IEEE P802.18
Radio Regulatory Technical Advisory Group (RR-TAG)

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| Proposed Response to MIIT of China Consultation an “Ultra Wideband (UWB) Equipment Radio Management Regulations” |
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Abstract

This document drafts a response to MIIT of China consultation on new UWB regulations, especially new spectrum limits. Consultation is introduced in contribution IEEE 15-23-0023-02-04ab ([link](https://mentor.ieee.org/802.15/dcn/23/15-23-0023-02-04ab-china-miit-s-consultation-on-uwb.pptx)). Responses are due at MIIT by February 6th 2023.

## Introduction

The IEEE Standards Association (IEEE-SA) Organizational Unit oversees the development of technical standards, some of which specify the key global technologies using license-exempt spectrum globally. The IEEE-SA technical standards volunteer participants are major contributors to the published standards incorporating industry leading wireless technologies. Participation in the development of IEEE standards is open to any interested party without restriction. IEEE-SA supports the position that spectrum allocation and management is needed for both licensed and license-exempt technologies to meet the explosive growth in the demand for wireless communication and sensing.

## UWB

IEEE802.15 has developed UWB standards, most recently amendment 4z to IEEE802.15.4. The capability of the latter to support secure ranging has led to a renewed interest in UWB from both industry and regulators. The automotive industry was the driving force behind 4z and also the first to include UWB in consumer products. Mobile handset makers have followed closely. This is generating significant economic and social value, attracting further interest which is demonstrated by the popularity of the 4ab group that is developing future UWB standards.

The fact that UWB is now in consumer products has led many regulators to look at UWB again. Many countries that previously did not have UWB regulations are now introducing them, while other regulatory bodies such as CEPT have added capabilities in response to industry demand, e.g. by introducing fixed outdoor transmissions, which were forbidden in Europe, and 10 dB extra power indoors. Also in the US, FCC is willing to look at UWB regulations again.

It therefore makes sense for China to also review its UWB regulations. However, the changes China is introducing are going in opposite direction from rest of the world by reducing the amount of spectrum available to UWB. There have not been any reports of low power UWB systems causing interference to other systems anywhere in the world, so this restriction does not seem necessary to protect other spectrum users.

Throughout the world, license-exempt spectrum allocation between 6 and 7 GHz has provided significant value. Both UWB and RLAN based on 802 wireless standards are examples of such applications. Restricting UWB to frequencies above 7125 MHz will prohibit access to two very popular IEEE HRP UWB PHY channel, channel 5. IEEE would therefore like China to consider keeping the existing 6-9 GHz allocation.

## Detailed comments on proposed changes

We notice that the proposed changes [1] do not align well with the power spectral density mask in IEEE 802.15.4 UWB standard. The proposed band cut-off frequencies come close to those required for IEEE HRP UWB PHY channels 8, 9 and 10, but extra spectrum is required to take into account the roll-off for 500 MHz wide transmissions. Section 15.4.5 of 802.15.4-2020 specifies that

*The transmitted spectrum shall be less than –10 dB relative to the maximum spectral density of the signal for 0.65/Tp < |f – fc| < 0.8/Tp and –18 dB for |f – fc| > 0.8/Tp.*

For IEEE HRP UWB PHY channels 8, 9 and 10, Tp equals 1/499.2 MHz. The center frequencies are defined in the standard as Table 1

Table 1: IEEE802.15.4 subchapter 15 UWB power spectral density limits

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Channel | Lower ‑18 dB point[MHz] | Lower ‑10 dB point [MHz] | Center frequency [MHz] | Upper ‑10 dB point [MHz] | Upper ‑18 dB point [MHz] |
| 8 | 7088.64  | 7163.52  | 7448.0  | 7812.48 | 7887.36 |
| 9 | 7587.84 | 7662.72 | 7987.2 | 8311.68 | 8386.56 |
| 10 | 8087.04 | 8161.92 | 8486.4  | 8810.88  | 8885.76  |

Figure one below shows the power spectral density (PSD) masks for IEEE 802.15.4 UWB channels 8 and 10 vs the new proposed requirements. Channel 9 is between them with similar PSD mask, but it is left out to improve the clarity of the picture.



Figure 1; UWB PSD masks for channels 8 and 10 compared to the proposed requirements.

The figure illustrates two issues with the proposed limit for the IEEE standard UWB. First, the power spectrum density mask doesn’t fit inside the proposed limits. Secondly, the -10 dB minimum bandwidth is defined to be 500 MHz. The figure shows that meeting the minimum bandwidth requirement (staying above the dotted black line) and, at the same time, staying within the proposed emission limits (blue line) using the UWB channels defined by standard [2] is impossible with a practical implementation.

For comparison Figure 2 shows channel 5 PSD mask and European regulatory emission limits [3] at band edge. This could be used as a reference for possible limits. The European limit at 6 GHz is not very relaxed by any mean, but it does allow a feasible implementation. The 500 MHz minimum bandwidth limit is presented in the picture for reference, but it is not a requirement in Europe.

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Figure 2: UWB channel 5 (fc=6489.6 MHz) PSD and European band edge limits at 6 GHz

Channel 5 center frequency is 6489.6 MHz, so the European rules define 489.6 MHz separation from the center frequency to the band edge with -70 dBm limit. In order to enable use of channel 8 in China, corresponding separation for channel 8 (centered at 7488 MHz) would require the lower -70 dBm band edge not to be higher than 6998 MHz. Europe does not have a -51 dBm limit, but if it is considered necessary, it should not be more strict than the IEEE spectrum mask, which would set the -51 dBm limit at 7163 MHz or below.

Similar expansion of the available band would be needed for the upper UWB band limit to enable ch10 (centered at 8486.4 MHz), where -70 limit should be set to 8976 MHz or above, and the possible -51 dB limit at or above 8810 MHz.

Table 2 – Emission limits allowing use of ch8, ch9 and ch10

|  |  |
| --- | --- |
| Frequency range | EIRP limit |
| Below 6998 MHz | -70 dBm |
| 6998 – 7163 MHz | -51 dBm |
| 7163 – 8810 MHz | -41 dBm |
| 8810 – 8976 MHz | -51 dBm |
| Above 8976 MHz | -70 dBm |

Alignment with the spectral masks in the standard would give benefit in terms of availability of products, time to market, and international harmonization.

## References

[1] IEEE 15-23-0023-02-04ab, MIIT Consultation, https://mentor.ieee.org/802.15/dcn/23/15-23-0023-02-04ab-china-miit-s-consultation-on-uwb.pptx

[2] IEEE 802.15.4-2020, IEEE Standard for Low‐Rate Wireless Networks,

[3] Decision (EU) 2019/785, 14 May 2019