**Comments of the**

# Ultra Wide Band (UWB) Alliance

**to the**

***European Commission Radio Spectrum Policy Group (RSPG)***

## *Questionnaire on long-term vision for the upper 6 GHz band*

***About the UWB Alliance***

*The Ultra Wide Band (UWB) Alliance is a global not-for-profit organization that works to collectively establish ultra-wideband (UWB) technology as an open-standards industry. A coalition made up of vendors that either design, manufacture, or sell products that use ultra-wideband technology, the UWB Alliance aims to promote and protect the current allocation of bandwidth as well as promote the continuing globalization of the technology. As part of our mission, we advocate UWB technology and use cases to promote verticals showing the value of UWB for IoT and Industry 4.0 and to build a global ecosystem across the complete UWB value chain, from the silicon to the service. In addition, the Alliance is promoting and assuring interoperability through its work with Standards Development Organizations such as the IEEE and ETSI and then working with members to define upper layers and testing to assure compliance. For more information, please visit us at www.UWBAlliance.org.*

# Introduction

The Ultra Wide Band (UWB) Alliance thanks the Radio Spectrum Policy Group (RSPG) for the opportunity to provide comments on the consultation "Questionnaire on long-term vision for the upper 6 GHz band"[1]. The UWB Alliance appreciates RSPG's recognition of UWB technology as a valuable incumbent service in the upper 6 GHz band.

The upper 6 GHz band is included in the European UWB regulations' preferred spectrum for UWB. The use of UWB is experiencing rapid growth in both economic value and positive social impact. We anticipate continued expansion of uses and users to continue to use the upper 6 GHz band before and beyond 2030.

UWB is inherently a low impact on other services sharing the band. UWB has proven to share effectively with other services using the upper 6 GHz band and causes no interference to other incumbents. Due to the extremely low power, and required sensitive receivers, there is concern that much higher power devices will have a disruptive impact. Preserving usability of the band by UWB is an important consideration when authorizing new uses.

# B. Questions directed to the stakeholders providing incumbent services in the upper 6 GHz

## I.1) What are your current and future spectrum needs (before and beyond 2030) in the upper 6GHz band?

UWB devices are currently being widely used worldwide in the 6 GHz to 8.5 GHz range for various applications, including communication, measurement, location, imaging, surveillance, and medical systems, providing significant value and utility. UWB-enabled smartphones and laptops puts forecasts at more than 1 billion devices shipped annually worldwide by 2025[2]. These applications often operate in conjunction with other short-range device technologies, enhancing their operation and efficiently sharing spectrum. The IEEE Std 802.15.4 standard UWB is widely used and is the foundation of application specifications developed by the Car Connectivity Consortium (CCC), FiRa, CSA, omlox/PROFIBUS, AES, UWBA and others. The standard includes

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[1] Questionnaire on Long-term vision for the upper 6 GHz band, 08 July 2024 - 20 August 2024, https://radio-spectrum-policy-group.ec.europa.eu/document/download/c87dc40a-3221-4842-98af-eb625d3557d2_en?filename=Questionnaire_U6GHz-2024.pdf

[2] FiRa Consortium: Unleashing the Potential of UWB: Regulatory considerations, August 2022, https://www.firaconsortium.org/sites/default/files/2022-08/Unleashing-the-Potential-of-UWB-Regulatory-Considerations.pdf

channelization for a wide range of frequencies including the upper 6 GHz band. There has been large scale adoption using the frequency range from 6 GHz to 8.5 GHz.

The next generation of UWB technology, being developed under IEEE P802.15.4ab[3], will continue to require access to the upper 6 GHz band. This project builds on IEEE Std 802.15.4z-2020[4] Future developments supported by this project include:

- Improved link budget and reduced air-time
- Enhanced sensing capabilities for presence detection and environment mapping
- Improved accuracy, precision, and reliability for high-integrity ranging
- The use of interference mitigation techniques for improved performance in the presence of significantly higher power RF devices, as well as to support greater UWB device density
- Reduced complexity and power consumption
- Enhanced support for ultra-low power, low latency streaming
- Emerging applications such as high-definition audio

As noted in the introduction, the use of UWB is experiencing rapid growth in both economic value and positive social impact. As UWB technology is still in the steep area of its growth curve, we anticipate continued expansion of spectrum needs in the upper 6 GHz band before and beyond 2030.

UWB technology efficiently uses spectrum in a non-disruptive manner, playing a key role in addressing the increasing scarcity of mid-band spectrum. Its inherent "low impact" nature promotes effective sharing of spectrum for multiple uses and users simultaneously, which is crucial for maximizing the value of available spectrum.

UWB does not need exclusive access to spectrum, so long as new incompatible uses are not introduced into the bands.

## I.2) What impact on your service do you expect from the introduction of MFCN and/or WAS/RLAN in the upper 6GHz band?

The introduction of high-powered MFCN in the upper 6 GHz band is expected to have significant negative impacts on UWB services. UWB devices operate at extremely low power levels, requiring highly sensitive receivers. This creates susceptible to interference from higher-power systems.

[3] See IEEE P802.15.4ab, https://www.ieee802.org/15/pub/TG4ab.html [accessed: 31 July 2024].

[4] "IEEE Standard for Low-Rate Wireless Networks--Amendment 1: Enhanced Ultra Wideband (UWB) Physical Layers (PHYs) and Associated Ranging Techniques," in IEEE Std 802.15.4z-2020 (Amendment to IEEE Std 802.15.4-2020).

UWB presents an extremely small interference footprint due to the extremely low transmit power used and non-continuous signal characteristics.  In most applications, UWB activity factor is also very low.

Impulse radio signals are comprised of pulse durations in the order of a nanosecond, typically transmitted in short bursts with gaps between pulses. UWB power limits are many orders of magnitude lower than more traditional wireless systems.  UWB power limits are extremely low, at the maximum mean e.i.r.p. spectral density of -41.3 dBm/MHz and maximum peak e.i.r.p. of 0 dBm[5].  Transmit power of RLAN devices are maximum e.i.r.p of 23 dBm with maximum mean e.i.r.p spectral density of 10 dBm/MHz[6].  Transmit power of MFCN limits may be between 61 dBm/(5 MHz) and 65 dBm/(5 MHz)[7].  Thus MFCN power spectral density may be approximately 50 dB higher than RLAN/WAS, and 100 dB higher than UWB.

Figure 1 and Figure 2 show the magnitude of power differences (approximately).  This view illustrates the potential for a high-power service like MFCN to render the band unusable for other uses. This shows that there is significant potential for RLAN/WAS to interfere with UWB due to the difference in transmit power and sensitivity of the UWB receiver.  This shows that the potential for MFCN to disrupt both UWB and RLAN/WAS is greater still.

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[5] ECC Decision (06)04 The harmonised use, exemption from individual licensing and free circulation of devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz,
https://docdb.cept.org/download/4215

[6] ECC Decision (20)01 On the harmonised use of the frequency band 5945-6425 MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN),
https://docdb.cept.org/download/1448

[7] ECC Report 298 Analysis of the suitability and update of the regulatory technical conditions for 5G MFCN and AAS operation in the 1920-1980 MHz and 2110-2170 MHz band,
https://docdb.cept.org/download/1388

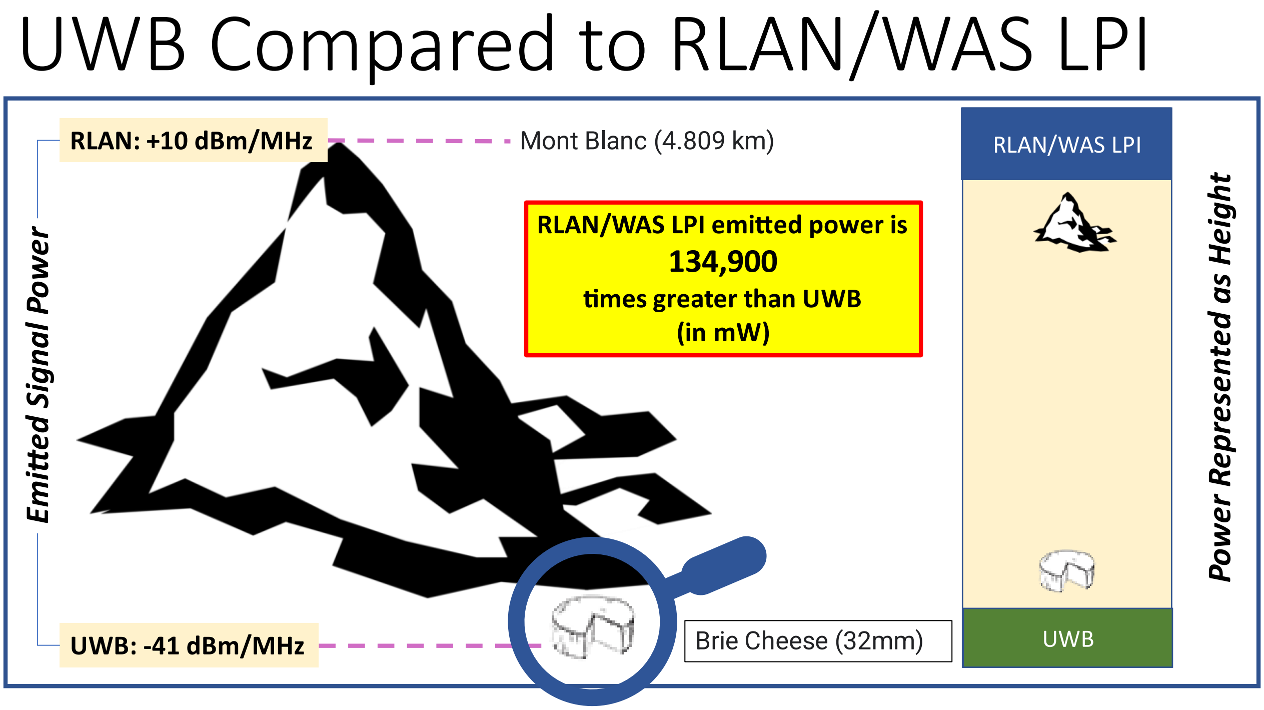


*Figure 1: Power Magnitude Comparison, UWB to RLAN/WAS*

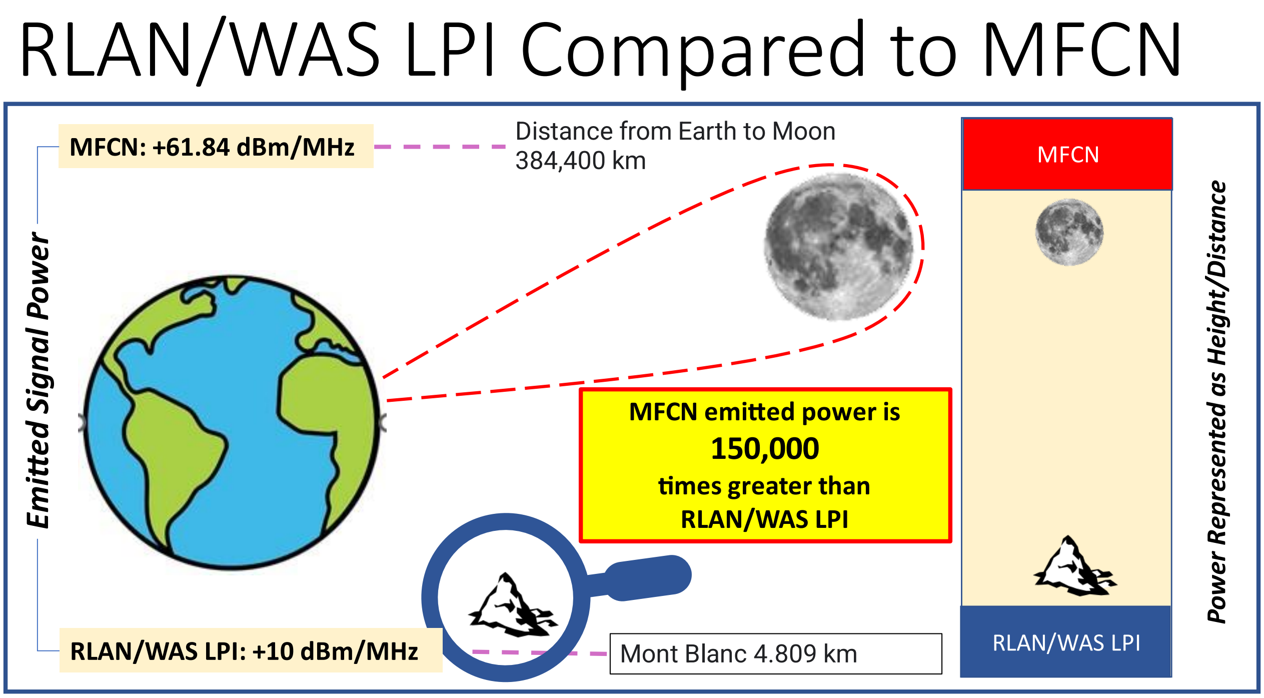


*Figure 2: Power Magnitude Comparison, RLAN/WAS to MFCN*

It has been demonstrated that UWB can coexist with 802.11 (Wi-Fi) RLANs effectively when transmit power is reasonable and sufficient separation in space is provided, there are gaps in the Wi-Fi transmissions, and mitigations are taken by the UWB device to detect the RLAN/WAS. While the impact of is significantly greater on UWB than the other way around, it has been shown that with reasonable mitigations sharing is possible[8],[9]. Reducing RLAN power to only that which is needed per link will reduce impact significantly. Before introducing even higher power services into the band, studies of MFCN impacts should be performed. These should include practical measurement-based studies.

Encouraging the use of appropriate technologies for specific objectives is another mitigation technique. A mobile handset has many radio capabilities including RLAN, Bluetooth, UWB and multiple mobile bands and protocol generations. For example, RLAN based on 802.11 (aka Wi-Fi) is widely available indoors, and on all mobile handsets. Use of Wi-Fi for data and calling an effective means to extend mobile coverage indoors. This can be less disruptive and more efficient use of spectrum than increasing mobile base station (or handset) power to overcome the outdoor-to-indoor losses. RLAN power levels indoors and activity factors can be made more compatible with UWB and other uses than increasing base station power to penetrate the building. Similarly, using the much lower impact UWB radio where it is adequate, or superior to other technologies, provides better performance with less negative impact.

We note that to some extent the constant need for more spectrum for MFCN and RLAN/WAS is due to the use of power levels that limit spatial spectral reuse and create a large interference footprint for similar as well as dissimilar services. We encourage RSPG to consider that the amount of spectrum presently available for these uses could be more efficiently used. Encouraging innovative ways to get more users per unit area can be a sustainable approach.

## I. 3) What measures could improve compatibility from your perspective?

To improve compatibility between Ultra-Wideband (UWB) services and potential new services in the upper 6 GHz band, we suggest the following measures:

1. Power Limitations: Use of moderately low power is a proven coexistence technique. Introduce new allocations and services with transmit power limits that are compatible with existing license-exempt uses such as UWB.

[8] Ultra-Wideband (UWB) Aggregation and Co-existence of Wi-Fi 6E Operating in the Presence of UWB https://uwballiance.org/wp-content/uploads/2023/05/UWBA-Interference-Testing-Report-April-2023-corrected-final.pdf

[9] SSBD enabled UWB radio coexistence with Wi-Fi 6e demo https://mentor.ieee.org/802.15/dcn/22/15-22-0642-02-04ab-ssbd-enabled-uwb-radio-coexistence-with-wi-fi-6e-demo.pptx

2. Encourage reducing transmit power: "using only what you need" through regulatory incentives. This can promote innovation that enables new users to share with existing users and improve overall efficiency of spectrum use. For example, adaptive transmit power control can be used to reduce interference footprint and impact on UWB as well as other services.
3. Time Domain Gaps: For high-powered transmissions, especially in wide-area systems like MFCN, implement duty cycle restrictions to provide silent periods during which UWB can slot its transmissions. This can mitigate the blinding effect of high-powered signals on UWB receivers.
4. Intelligent Spectrum Usage and Sharing (ISUS): Sensing the current spectrum usage and radio service activities in micro geo environments to adapt in ways that avoid causing harmful impacts to other spectrum users. For example, by reducing transmit power to the lowest level needed, or using a lower power link such as Wi-Fi when available.
5. Predictive Intelligent Spectrum Usage and Sharing (PISUS): Deploying AI based prediction of spectrum usage and radio service deployment depending on the daytime, the week day / calendar day (public holidays etc.) and geo location including the business and public surroundings. The PISUS method could be combined with the ISUS to update the required information base for feeding the AI learning with large data sets.

Some of these are immediately available strategies, while others are fields ready for innovations. For example, the concept of using collected spectrum information to manage access is an area ready for new innovations. Using the many radio capabilities of the mobile handset for spectrum characterization enables local device management to predict times when spectrum is less busy. Sharing information with other users multiplies the value by enabling other devices including infrastructure elements, e.g. MFCN base stations and RLAN/WAS APs, to predict in time and frequency optimal access and manage transmit power to avoid higher power than needed transmissions. While this does not directly benefit the UWB user, it can reduce the impact area of the higher power devices, as well as reduce traffic redundancy (e.g. retransmissions following packet failure).

By implementing measures such as these, it may be possible to introduce new services in the upper 6 GHz band while maintaining the valuable functionality and growth potential of UWB technology.

# Conclusion

We thank RSPG for considering the needs of UWB as an incumbent user of the band. We believe that to achieve the greatest value from the spectrum, sharing through coexistence is essential. UWB provides a good model for how to share and achieve diversity of uses, which is an important metric for spectral usage efficiency and value.   We encourage RSPG to consider measures to meet the need for new uses while ensuring the spectrum remains usable for UWB.