Comments of the

Ultra Wide Band (UWB) Alliance

to the

European Commission Radio Spectrum Policy Group (RSPG)

6G Strategic vision Draft RSPG Report

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 Public Consultation on the Draft RSPG Report on 6G Strategic vision”[1]. The UWB Alliance appreciates RSPG’s prior recognition of UWB technology as a valuable incumbent service in the upper 6 GHz band[2] up to 8.5 GHz. We encourage continued consideration of valuable existing uses such as UWB in the bands under consideration for 6G. UWB presently operates in the 3.1 – 4.8 GHz and 6 - 10.6 GHz ranges under consideration for 6G.

UWB Overview

UWB is inherently a sharing technology, with low to no impact on other services.

The use of UWB is experiencing rapid growth in both economic value and positive social impact. 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[3].

UWB is expanding use of available spectrum without a need for repackaging or repurposing of spectrum. UWB is compatible with many other uses and users of spectrum. UWB is a complement to other technologies, increasing capability and capacity without increasing need for new spectrum allocations. The UWB industry has much to contribute to the future use of spectrum and so we feel is an important perspective to include in research and development of sustainable spectrum strategies, methods, and policy.

The UWB market is in the early stages of significant growth. The global UWB market is generally considered to be in the range of USD 1-2 billion as of 2024, with a CAGR (Compound Annual Growth Rate) of 17%, reaching up to USD 4 billion by 2029. Key market drivers for UWB include:

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[1] Public Consultation on the Draft RSPG Report on 6G Strategic vision, 15 November 2024 - 27 December 2024, https://radio-spectrum-policy-group.ec.europa.eu/document/download/73cd8110-0c48-41a5-96e6-ab7332ae0ec6_en?filename=RSPG24-030final-Draft_RSPG_Report_on_6G_strategic_vision.pdf

[2] Questionnaire on Long-term vission 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

[3] 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

- **Consumer Electronics.** Increasing adoption of UWB in smartphones is facilitating features like secure sharing, precision location tracking for AR/VR experiences, and improved connectivity between devices.
- **Automotive:** UWB is used by vehicle access control systems to provide keyless entry and enhanced security. Additionally, UWB is being used to detect when a child is left unattended in a vehicle to prevent accidental heat strokes.
- **Healthcare:** UWB is used for tracking life-saving equipment in hospitals such as infusion pumps, mobile X-ray machines, and defibrillators. UWB is also being used to monitor patient vitals, track the location of staff and patients, and monitor environmental factors in sensitive areas that require precise temperature, humidity, and air quality.
- **Manufacturing:** UWB is used for real-time location tracking of materials, tools, and finished products on factory floors. It is also used for streamlining operations and improving worker safety.
- **Retail:** UWB improves inventory management and customer experience through targeted advertisements and product information based on customer location relative to products.

UWB adoption is expected to accelerate as UWB technology awareness among consumers increases, as the cost of UWB chipsets decreases, and as universally standardized protocols for UWB continue to be developed.

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.

Spectrum Sharing

The UWB Alliance agrees with RSPG that sharing of spectrum is essential. We would like to stress that, in addition to coordinated sharing and geographic-based sharing, coexistence is a critical method of sharing spectrum as well. We encourage RSPG to further consider diversity of uses as an important metric for efficiency and value. When spectrum can be shared by multiple uses and many users simultaneously, overall capacity and value is greatest.

We note that to some extent the constant need for more spectrum 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. These factors limit overall capacity.

Sustainable networks and spectrum

RSPG notes that for past evolutions of mobile networks, new exclusive spectrum allocations have been made available. This is no longer efficient with respect to mid-band spectrum. There is no unused or underused mid-band spectrum.

For optimal use of the mid-band, avoiding new services that disrupt existing uses is recommended. Technologies that can coexist simultaneously should be encouraged. Incentives that promote sharing through coexistence is sustainable in the long term.

Continuously expanding exclusive use and non-coexisting use with very high transmit power and large interference footprints is not sustainable. Limiting transmission power has smaller spectrum impact, enables higher re-use and more co-use, and enables more energy efficient implementations.

We agree with RSPG that "New technologies with higher efficiency can easily be implemented with no need to make or wait for changes to the regulatory requirements." when new technologies do not require exclusive use and are not disruptive to existing uses.

Sharing through coexistence

RSPG recognizes the value of sharing spectrum. Many methods for sharing require coordination. These methods generally provide sharing by avoidance simultaneous use of the same frequency range in a given physical area. Such methods are valuable but not the only means of sharing spectrum.

Wireless coexistence can be defined as the capability of multiple wireless devices and services in the same geographical area to access the same RF spectrum band simultaneously without causing harmful interference to each other allowing all to operate with acceptable performance[4]. Coexistence is a critical model for sharing in mid-band spectrum. Within this definition there can be many ways to achieve positive coexistence. Some methods are intended to avoid simultaneous occupancy, either by coordination (e.g. time-based sharing) or by evaluation of the spectrum (e.g. LBT). Such techniques are valuable and essential. UWB provides another, complementary model for sharing via coexistence which supports simultaneous use by a large number of devices and compatibility with a diversity of other technologies.

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[4] Wireless coexistence, U.S. National Institute of Standards and Technology, https://www.nist.gov/programs-projects/wireless-coexistence#:~:text=Wireless%20coexistence%20is%20the%20capability,and%20maintain%20acceptable%20wireless%20performance%3F

Consideration of diversity of use and deeper sharing techniques requires new methods for evaluating coexistence performance. Collaborative measurement-based studies can be an effective method identifying potential areas of incompatibility. The approach should aggregate a mix of technologies and stakeholders with different spectrum usage needs.

Scaling the radio sphere of influence (interference footprint) to only that which is needed for a given link and application can greatly improve the reuse of spectrum. Other techniques in use or under development, such as directional energy containment (beam steering) and intelligent real time spectrum analysis can be applied to reduce impact and improve coexistence, enabling more simultaneous uses.

Sharing via coexistence can provide a very dynamic sharing solution. The ability to operate simultaneously without disruptions is ultimately dynamic. Combined with adaptive avoidance techniques for technologies that do not share inherently, sharing can be achieved with real-time reaction to changing use and environmental conditions.

Introduction of high-power services can render coexistence impossible.

Disruption vs Sharing

The introduction of high-powered 6G in the bands currently used by UWB is expected to have significant negative impacts on UWB services. UWB devices operate at extremely low power levels, requiring highly sensitive receivers.

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 RLAN is significantly greater on UWB than the other way around, it has been shown that with reasonable mitigations sharing is possible[5],[6].

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[7]. Transmit power of RLAN devices are maximum

[5] 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

[6] 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

[7] 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

e.i.r.p of 23 dBm with maximum mean e.i.r.p spectral density of 10 dBm/MHz[8]. Transmit power of 6G has been proposed as high as 61 dBm/(5 MHz) and 65 dBm/(5 MHz)[9]. Thus MFCN power spectral density may be approximately 50 dB higher than RLAN/WAS, and 100 dB higher than UWB.

Promoting Innovation

We agree with RSPG that sustainable spectrum use requires innovation in how spectrum is used. This requires rethinking what is assumed with traditional, evolutionary technologies. We encourage RSPG to continue to investigate many sharing techniques.

Experience in the UWB industry shows that it is possible to operate at much lower power than previously thought. Challenging the assumption that high power is required can lead to true innovation and break this unsustainable cycle.

Utilizing multiple technologies

We strongly endorse the idea of encouraging the use of appropriate technologies for specific objectives. A mobile handset has many radio capabilities including RLAN, Bluetooth, UWB and multiple mobile bands and protocol generations. In some of the use-cases for 6G given in the report, there are alternative technologies that are better suited and less disruptive.

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 is an established and effective means to extend mobile coverage indoors. This can be less disruptive and a 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.

As another example, integrated sensing and communication is a capability readily provided by UWB technology. Sensing is an area of expansive growth. Due to the extremely low transmit power used, the UWB radio has lower (to no) impact, especially when compared to the proposed 6G technologies. UWB can provide greater performance as well, in terms of accuracy and resolution. For example, UWB sensing is currently used to detect heart rate and respiration rate.

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[8] 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

[9] 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

Using the much lower impact UWB radio where it is adequate, or superior to other technologies, provides better performance with less negative impact.

The greatest efficiencies are achieved by taking advantage of the synergies of technologies, using the right tool for each part of the job.

Conclusion

We thank RSPG for considering the needs of UWB as an incumbent user of the band. The increasing need for spectrum sharing can only be satisfied by reducing interference footprint. UWB has proven to that communication and sensing are possible with much lower transmit power levels.

We agree with RSPG that meeting the needs of 6G sustainably requires innovation. Looking beyond the traditional means of expanding capacity via new, exclusive mid-band spectrum allocations is a key to a sustainable future. Rethinking the assumptions in how to provide ubiquitous services via high power, to include technologies that are more inherently sharing, is a key to this sustainable spectrum future.

Respectfully submitted,

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