Comments of

The Ultra Wide Band (UWB) Alliance

Before

The National Telecommunications and Information Administration

Request for Comments on the Development of a National Spectrum Strategy

Docket No. 230308-0068
NTIA-2023-0003

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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.

Pillar #1—A Spectrum Pipeline To Ensure U.S. Leadership in Spectrum-Based Technologies

Question 1: Spectrum Requirements for UWB

While the usual pattern for both licensed and unlicensed users of spectrum is a growing need for more spectrum, some significant gains in use of spectrum can be achieved by preserving and improving upon the usability of the spectrum currently available. Key to maximizing spectrum value is recognizing that one key metric of value and efficiency is diversity of use.

Ultra Wideband (UWB) is an ultra-low power technology that provides optimum spectrum sharing and enables other technologies to be used more efficiently. Airdrop is an example of how UWB enhances other technologies: UWB is used to identify and authenticate the desired peer and enable Wi-Fi communications with a minimum amount of overhead.

In particular, systems operating under UWB rules (*See, FCC Rules at CFR 47 Part 15, Subpart F*) provide very efficient use of spectrum by achieving high spectral reuse. The use of UWB is expanding rapidly, supporting a robust ecosystem delivering products providing significant value. The UWB industry seeks to preserve and enhance the usability of the available spectrum. Examples include new standards efforts such as IEEE 802.15.4ab, which provides features to further improve coexistence, sharing, device density, ultra-low energy usage, and utility of standard based UWB. Potential enhancements to the rules can enable continued innovation in uses. UWB supports a diversity of uses such as precise (centimeter accurate) location services, secure entry, in-vehicle use for presence detection and multi-media communications, and many other uses. We anticipate continued expansion in the diversity of uses supported so long as the currently available spectrum remains usable. We strongly discourage allocation of spectrum currently being efficiently and effectively shared by UWB to services that require substantially more transmit power. Higher transmit power limits efficient use of spectrum as well as increases device carbon footprint. We ask NTIA to consider the value provided by both existing and emerging UWB and the significantly higher efficiency of use of spectrum that is provided by the high spectral reuse of UWB when considering spectrum policy.

The signal characteristics of the current generation of UWB present minimal to undetectable interference footprint due to the ultra-low power of transmissions. UWB's ability to successfully share spectrum with existing licensed services is proven by many years of operation without interference complaint. UWB transceivers can operate with very low energy consumption, and this is prompting application to uses such as high-definition audio where the UWB channel can offload traffic from other channels with lower energy consumption as well as reduced interference footprint. Already being demonstrated are implementations that use an order of magnitude less energy than other conventional radio technologies in such applications. UWB is being used with conventional technologies to improve performance and reduce energy used by those technologies, thus lowering the carbon footprint as well as achieving more efficient overall use of the spectrum.

Question 3: Considerations when repurposing spectrum

UWB is an inherently efficient means to utilize spectrum as it allows multiple uses. The unique capabilities provided by the current spectrum allocations provide for the bandwidth required to support very precise

ranging, location, and sensing applications at ultra-low transmit power levels. UWB does not require re-purposing of spectrum. UWB can augment other technologies to 'share the load' with traditional solutions focused on broadband access. This in turn can reduce the bandwidth required in some applications and provide more effective use of available spectrum.

While broadband services are essential, there are many other uses of spectrum that are of equal value that are not primarily intended for high-throughput broadband services. When considering allocation of spectrum, we urge NTIA to consider value propositions other than broadband access. In particular, the rapidly growing value provided by UWB should be considered when looking to repurpose spectrum so that the new purpose does not effectively exclude existing use of UWB not only as a primary wireless device, but also in the important role of making other wireless devices more efficient.

We recommend that policy decisions regarding repurposing of spectrum consider the increasing importance of energy consumption and carbon footprint of the technologies being used. Future policymaking should enable and encourage a shift from consumption-heavy legacy technologies and transition to more effective and efficient technologies which represent a much reduced carbon footprint. When billions of devices are used, the need for this reduction becomes significant. UWB has a significant advantage in energy consumption compared with other licensed and unlicensed wireless technology in many use cases. While, for example, localization via ranging and angle of arrival can be performed with conventional signals such as OFDM, current UWB delivers much higher precision, real time performance, and consumes orders of magnitude less energy. Optimal spectrum efficiency is achieved by using the right collection of technologies each for its best use. It is important to consider enabling and encouraging taking advantage of these relationships when considering where or how to repurpose spectrum. One approach may be to designate certain areas of spectrum in which ultra-low carbon footprint are a requirement for unlicensed operation. This will ensure not only efficient spectrum use and innovation, but our future environmental integrity.

Question 4: Diverse spectrum access

Diversity of spectrum access for a multitude of uses is critical to obtaining the maximum value from available spectrum. When considering reallocation of spectrum, we encourage NTIA to look beyond the traditional model of narrow-purpose allocations and consider that as an alternative to repurposing, NTIA consider the opportunity of gaining more uses without relocating existing services. Promoting non-disruptive sharing on an equal basis with traditional usage models will yield gains with lower cost than assuming existing services must be moved to allow other uses.

Question 6: Defining effective sharing

In addition to the characteristics NTIA identifies, sharing without the need for incumbents to vacate, compress or repack is possible. As noted, UWB is currently sharing with many other services as an underlay effectively. Further innovations are possible to provide greater coexistence among differing technologies in overlapping bands. The ultra-low power of UWB makes for 'quiet neighbors' but the corresponding need for sensitive receivers can make much higher-powered transmissions disruptive. In general, the higher the transmitted power the greater the impact on other spectrum users, in both intensity and physical area. Promoting very low to ultra-low power uses can greatly increase overall use without the overhead and potential problems with centralized coordination. Current work in coexistence among different unlicensed wireless technologies will yield improved

strategies for localized sharing. UWB is among the technologies currently seeing rapid growth and new innovations.

UWBA members are active in evaluating, developing, and promoting positive coexistence strategies. For example, our members' work in the development of sensing-based channel access has been demonstrated to improve mutual coexistence of UWB with unlicensed technologies operating under U-NII rules in 6 GHz. Their efforts also demonstrated SSBD enabled UWB radio coexistence with Wi-Fi 6e. The UWBA actively participates in standards development bodies including ETSI and IEEE-SA with a focus on coexistence. In addition, the UWBA also is participating in the development of specifications for Automatic Frequency Coordination as a member of WinnForum.

Question 9: International harmonization has great value

Global convergence and alignment of spectrum regulation has many benefits. The US has consistently led the way in flexible regulations that promote innovation. Recent updates to UWB regulations in Europe and other regions have provided clarity on use of UWB in and on vehicles, and enabled development of systems that include outdoor devices affixed to buildings and vehicles, to name a few examples. These changes have further stimulated innovative product development which is realizing even greater value from spectrum without creating any risk of disruption to other services. UWBA endorses efforts to further align US regulations with EU and parts of Asia to provide for these innovative products to provide value to US consumers and businesses.

Response to Pillar #2 – Long-Term Spectrum Planning

Question #1: Who are the stakeholders

Please include the UWB industry among the many stakeholders who have an interest in development of the National Spectrum Strategy and participating in the long-term planning process. Engagement directly with industry groups such as UWBA is a good step. Promoting and supporting collaborations between multiple groups is also important. Examples of collaborations that would be useful to inform effective policy would be empirical studies on coexistence, realistically characterizing performance, tradeoffs, and mitigation techniques. UWBA is actively engaged with multiple organizations in such efforts and would welcome collaboration with others, including NTIA. Additional cooperative testing with federal agencies should be encouraged. In fact, the UWB Alliance recently performed cooperative testing with members of two federal agencies to explore coexistence and security concerns which yielded data valuable for both the UWB industry and the federal agencies. We plan similar studies with European agencies as well.

Question #6: Consideration of overall spectrum usage

When considering repurposing, repackaging, and moving users into bands currently in use by unlicensed uses (e.g., UWB), we encourage NTIA to consider the existing uses and users. While trying to find more spectrum for

broadband services, consider also the other-than-broadband uses that have great value and enhance the value of broadband services.

Encouraging innovation requires encouraging investment in new technologies. Uncertainty around future availability of spectrum can discourage investment. Consideration of the current uses and trends can build confidence in investing in and deploying new technologies.

Response to Pillar #3 - Unprecedented Spectrum Access and Management Through Technology Development

Question 1: UWB is an innovative technology that is inherently sharing spectrum

UWB operates at ultra-low signal power and shares effectively. The ultra-low transmit power makes interference with higher power services highly unlikely. Years of empirical evidence confirms the non-interfering nature of UWB devices which co-exist naturally with incumbent services. There has not been a reported incidence of UWB operating under unlicensed rules interfering with any licensed service. The signal and use characteristics of UWB enable very high spectral reuse, enabling dense deployment of devices, which in turn makes UWB a valuable complement to other unlicensed technologies. UWB helps other unlicensed technologies work 'smarter.' As an example, innovative UWB assist technology helps other unlicensed devices locate and steer transmissions in order to help contain sphere of influence, determine the optimum transmission power needed, reduce overhead transmissions, and overall reduce the load on the high-bandwidth broadband channel. Such innovative synergy reduces RF transmission and processing energy consumption. There are other examples such as high-definition audio in AR/VR where UWB is being used to offload the higher data rate channel, thus improving overall efficiency in both spectrum use and carbon footprint.

Ongoing work is developing even more effective mutual coexistence strategies between UWB and other technologies such as traditional RLAN. Strategies for positive coexistence are being developed and tested. While UWBA understands unlicensed services receive no protection, optimal spectrum policy considers all uses. We ask that in developing policy, the high value provided by existing unlicensed systems such as UWB be considered. Measures taken to preserve the usability of spectrum for unlicensed operations including UWB will drive innovation and provide valuable services and growth well into the future. In particular, there is concern that repurposing bands for expanded high-power use to spectrum currently being used for unlicensed services on a shared (underlay) basis (e.g., 7-8.5 GHz) may effectively make the band unusable for any but the licensed use, limiting diversity of use, which diminishes efficient use of the spectrum resources.

Further innovation in ultra-low power is possible. For the traditional spectrum users, requests for more power and more bandwidth will continue as legacy technology is pushed to provide higher bandwidth and performance. This inefficient approach will result in spectrum scarcity and limits to device density and device diversity. UWB has demonstrated alternatives that can outperform legacy technologies in some use cases while providing the added benefits of lower carbon footprint and higher reuse, and thus greater diversity of use. UWB is driving innovation in existing legacy technologies. It is being used as a complement to traditional unlicensed technologies such as Wi-Fi and Bluetooth, enabling new services and more efficient use of the high throughput technology. Examples include applications such as the 'point-and-send' transfer in which the UWB technology in

the personal device (e.g., smartphone) is used to rapidly identify and authenticate the intended peer, reducing the overhead of connection setup for the Wi-Fi connection. Another example is in the AR/VR application space, where UWB is providing high resolution, low latency audio with very high energy efficiency, freeing up the bandwidth of the traditional RLAN link for other data such as video. This ability to compliment and off-load other radios helps increase the value of those radios and enhance the consumer experience.

Question #2: Spectrum policies to promote new and innovative use of spectrum

Spectrum policy can enable even greater use of the current UWB band. Recent changes in EU policy that enable greater adoption of UWB should be considered, such as the 2022 Revision of ECC Decision (06)04 2022. Extensive analysis and field testing have shown that UWB presents no risk of causing harmful interference with the modified restrictions reflected in recent EU changes.

Question #3:

Current and future expected work in key standards developments organizations as well as industry organizations should be considered by NTIA in developing policy. SDOs and industry alliances are a critical part of the ecosystem that enables full value from available spectrum.

As examples of relevant work ongoing in the UWB industry which should inform future policy, are projects working to improve upon the way spectrum is used to enable higher reuse, better coexistence, and greater energy efficiency. When used in conjunction with other unlicensed technologies, UWB forms synergies that deliver greater value to the consumer, enhance the value of other technologies, and benefit overall spectrum value . While the quest for higher throughput continues and will enhance consumer experiences, this is not the only value provided. UWB is enabling further technological innovation that will provide value to federal and non-federal users. Innovations include:

- centimeter precision ranging used to enhance localization and personal navigation, secure entry, secure payment, and 'point-and-link' sharing applications such as Airdrop;
- precise sensing for presence detection, heartbeat and respiration monitoring, baby monitors, senior citizen fall detection, and many other uses; and
- low latency streaming for high-definition audio with very high spectral reuse.

Traditional mobile broadband services that depend on high power and exclusive use of spectrum are not in all cases the most effective use of spectrum. In considering policy, 'more bits per second' is not the only measure of value. Diversity of spectrum use provides very high value compared to traditional models such as exclusive access. The ability to support many different kinds of usage coexisting positively should be a key goal for future spectrum policy. UWBA believes that a variety of approaches can be applied to maximize diversity of use. No single model of spectrum access is optimal. All have their use, but those that enable sharing and diversity are likely to provide more value than exclusive access models.

Question #5:

As noted, UWB is an example of enabling real-time dynamic spectrum sharing without reliance on databases or other infrastructure. The ultra-low transmit power used as well as the characteristics of the typical UWB signal (e.g., impulse radio) are two reasons UWB is non-disruptive. There are ways to apply the same concepts to other

technologies to reduce the interference footprint and enable greater sharing without coordination. For example, smart antennas with focused patterns enable reduced transmit power while maintaining link margin, reducing overall footprint without reducing performance. In many environments, the transmit power of traditional radio links has to increase to overcome the impact of other spectrum users, both intentional and unintentional. This creates a kind of escalation as each increase in power also increases impact on other users. Looking at alternatives to high power can stop this destructive cycle and yield more efficient use of spectrum.

New time-based (non-continuous signal) technologies should be further explored. Traditional continuous wave modulations that require exclusive use of an occupied channel are inherently harder to support sharing.

New methods to promote positive coexistence, and thus more effective sharing, are under development in SDOs and other areas. For example, innovative channel access schemes that characterize the spectrum usage over time (predictive channel access) are showing promise.

UWBA believes that there are many sharing mechanisms that are valid and have a place.

We believe that policy and regulations driven by goals rather than specific technology are most effective. Technology agnostic policy provides the greatest opportunity for future innovation. Incentives that reward positive coexistence (sharing), low carbon footprint, and diversity of uses will provide the best returns. Markets are constantly changing and technology moving forward. UWBA favors establishing policy, guidelines, and incentives that provide clear technical objectives, rather than technology driven solutions.

Conclusion

Shared spectrum is essential to the future of the United States. Although the spectrum is infinite, the usable bandwidth is not. For certain, there are many opportunities to ensure that bandwidth is allocated and used in the most efficient manner for all stakeholders, such as dialogues between SDOs and industry associations (such as the IEEE-SA and the UWB Alliance) and government, such as the NTIA and the FCC. We thank you for the opportunity to comment on this very important issue, and look forward to working with the NTIA as it develops the National Spectrum Strategy. If you have any questions, please do not hesitate to contact us.