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

Draft response to UAE TDRA's consultation "UAE Spectrum Outlook 2026 – 2031"				
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This document contains a proposed response to Telecommunications and Digital Government Regulatory Authority (TDRA)'s consultation "UAE Spectrum Outlook 2026 – 2031".

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Re: Consultation "UAE Spectrum Outlook 2026 – 2031"

Dear Respected Officer,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks Telecommunications and Digital Government Regulatory Authority (TDRA) for providing an opportunity to comment on the consultation "UAE Spectrum Outlook 2026 – 2031".

IEEE 802 LMSC is a leading consensus-based open standards development committee for networking standards that are used by industry globally. It produces standards for networking devices, including wired and wireless local area networks ("LANs" and "WLANs"), wireless specialty networks ("WSNs"), wireless metropolitan area networks ("Wireless MANs"), and wireless regional area networks ("WRANs"). Technologies produced by implementers of our standards are a critical element for all networked applications today.

IEEE 802 LMSC is a committee of the IEEE Standards Association and of Technical Activities, two of the Major Organizational Units of the IEEE. IEEE has over 460,000 members in more than 190 countries and its core purpose is to foster technological innovation and excellence for the benefit of humanity. IEEE is also a major accredited standards development organization whose standards are recognized worldwide. In submitting this document, IEEE 802 LMSC acknowledges and respects that other components of IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802 LMSC. Therefore, this submission should not be construed as representing the views of IEEE as a whole[1].

IEEE 802 LMSC follows the UAE's regulatory activities regarding license-exempt short-range devices closely and applauds TDRA for developing the latest version of the spectrum outlook. Please find below the responses of IEEE 802 LMSC to this consultation.

Question 11: How should the TDRA prioritize spectrum allocation and regulatory measures to support the growth of low-power wireless technologies (UWB, SRD) and Intelligent Transport Systems (ITS) in the UAE, given emerging trends like smart cities, autonomous vehicles, and sustainable transportation?

Wi-Fi

IEEE 802 LMSC commends TDRA's effort in enhancing the operation of Wi-Fi devices, based on IEEE 802.11 technologies, in the 5150 MHz to 5250 MHz and 5650 MHz to 5850 MHz. International spectrum harmonization will leverage economies of scale and produce a robust equipment market, benefiting the UAE's businesses and consumers.

In considering further spectrum allocation in the 6425 MHz to 7125 MHz frequency band (i.e., the upper 6 |GHz band), IEEE 802 LMSC respectfully asks TDRA to consider the following points.

[1] This document solely represents the views of IEEE 802 LMSC and does not necessarily represent a position of either the IEEE or the IEEE Standards Association or the IEEE Technical Activities.

A growing number of countries, including Argentina, Canada, Saudi Arabia, South Korea, and the USA have already allocated the entire 6 GHz band (i.e., 5925 MHz to 7125 MHz) for licence exempt operation.

In addition, UK Ofcom recently proposed[2] a phased approach that balances low power indoor Wi-Fi access to the upper 6 GHz band ("*We intend to do this as early as feasible, ideally before end 2025*") with future consideration of IMT operation in the upper 6 GHz band based on the conclusion of ongoing coexistence studies. The benefit of this approach is that it enables UK businesses and consumers to benefit immediately from the latest generation of IEEE 802.11-based Wi-Fi technologies, specifically Wi-Fi CERTIFIED 7™ based on the IEEE Std 802.11be-2024[3]. Once the European harmonisation of specific sharing mechanism between Wi-Fi and mobile in the same frequency band is available, then IMT operation using a proposed sharing mechanism will be proposed.

Ofcom is also proposing use of Standard Power operation in 5925 to 6425 MHz Wi-Fi (up to 36 dBm / 4W EIRP) both indoor and outdoor on a license exempt basis. Standard Power Operation requires use of and Automated Frequency Coordination System. Ofcom intends to harmonize the AFC System approach and requirements with the FCC and ISED to benefit from the existing ecosystem of AFC operators and to promote equipment compatibility.

IEEE 802.11be's global 6 GHz channelization is designed to accommodate multiple 160 MHz and 320 MHz channels throughout the 5925 MHz to 7125 MHz frequency band, where available. TDRA's current designation of 500 MHz of the 6 GHz band from 5925 MHz to 6425 MHz for Wi-Fi operation provides for only one contiguous 320 MHz channel, while the 5925 MHz to 7125 MHz frequency band would allow three such channels to support Gigabit connectivity in the UAE.

UWB

UWB devices, as specified in IEEE 802.15.4 standards, are being used worldwide for a wide range of applications in communication, measurement, location, imaging, surveillance, and medical systems[4], often in conjunction with other short range device technologies. UWB enhances the operation of such technologies and is an efficient means to share spectrum.

The next generation of UWB technology, being developed under IEEE P802.15.4ab[5], builds on IEEE Std 802.15.4-2024[6]. Future developments supported by this project include:

- Improved link budget and reduced air-time
- Enhanced sensing capabilities for presence detection and environment mapping

[2] See UK Ofcom consultation "Proposals for AFC in Lower 6 GHz and mobile / Wi-Fi sharing in Upper 6 GHz," February 2025.

[3] See IEEE Approved Draft Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment: Enhancements for Extremely High Throughput (EHT), https://standards.ieee.org/ieee/802.11be/7516 [accessed: 11 March 2025]. With introduction of 320 MHz channel bandwidth, Wi-Fi 7 doubles throughputs relative to Wi-Fi 6E and significantly improves latency for Extended Reality, bringing determinism through enablement of Multi-Link Operation over multiple bands in 2.4 GHz, 5 GHz, and 6 GHz bands. Wi-Fi 7 also provides higher efficiency, relative to Wi-Fi 6E, through offering of 4096 QAM. In addition, spectrum puncturing improves flexibility in utilizing spectrally efficient wide channel bandwidth, e.g., 160 MHz and 320 MHz, while protecting incumbent operation in the band. Of particular relevance is the multi-link operation feature which when used in the 6 GHz band, achieves and exceeds the performance expectations of Wi-Fi 7.

[4] See 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 [accessed: 11 March 2025]. The introduction of IEEE 802.15 UWB-enabled devices in smartphones and laptops puts forecasts at more than 1 billion devices shipped annually worldwide by 2025.

[5] See IEEE P802.15.4ab, https://www.ieee802.org/15/pub/TG4ab.html [accessed: 11 March 2025].

[6] "IEEE Standard for Low-Rate Wireless Networks," in *IEEE Std 802.15.4-2024 (Revision of IEEE Std 802.15.4-2020)* , vol., no., pp.1-967, 12 Dec. 2024, doi: 10.1109/IEEESTD.2024.10794632.

- Improved accuracy, precision, and reliability for high-integrity ranging
- The use of interference mitigation techniques to support greater device density and higher traffic use cases
- Improved coexistence with other services
- Reduced complexity and power consumption
- Enhanced support for ultra-low power, low latency streaming
- Support for emerging applications such as high-definition audio

IEEE 802 LMSC commends TDRA for recognizing the rapidly growing value of UWB. Use of extremely low power UWB devices in accordance with ECC Decision (06)04 and the ETSI EN 302 065 series of standards harmonizes with worldwide regions, creates further economies of scale, and supports a robust equipment market, benefiting UAE businesses, consumers, as well as providing significant societal benefits from the effective use of the radio spectrum.

SRD for IoT

In addition to the IEEE 802.11-based Wi-Fi technologies operating in 2.4 GHz, 5 GHz, and 6 GHz frequency bands, other IEEE 802 standards-based technologies, specifically IEEE 802.11ah-based Wi-Fi HaLow and IEEE 802.15.4-based Wi-SUN (Smart Utility Network), should be considered as short-range technologies for various IoT and M2M applications.

IEEE Std 802.11ah-2016[7], known as Wi-Fi HaLow in the marketplace[8] and now incorporated into the draft IEEE 802.11-2024 standard,[9] specifies mechanisms for the operation of Wi-Fi in the license exempt sub-1 GHz bands. IEEE 802.11ah was developed for long range, low power sensor and IoT networks and applications, which support many use cases of particular relevance to UAE. It excels in long range coverage of over 1 km (subject to the maximum allowed transmit power)[10] and has excellent penetration through walls and obstacles. The standard supports a wide range of data rates that allow support for sensors and new applications that may combine video applications with sensing operation. It also introduced many features to increase energy efficiency and optimize device power consumption. In the UAE, IEEE 802.11ah-based devices operate in the 863 to 870 MHz band, which limits transmit power to 25 mW. In the U.S., IEEE 802.11ah-based devices operates in the 902 MHz to 928 MHz band and has a much higher transmit power limit of 1 W. To support a much wider range of current and future IoT applications, that may combine sensors with video for example, TDRA could consider allowing IEEE 802.11ah-based devices to operate in a frequency band which allows higher transmit power and Listen Before Talk (LBT) coexistence mechanisms. An example is to allow wideband SRDs to operate in 915 MHz to 921 MHz, with higher power, wider operating channels, and using LBT to coexist with other wireless technologies such as RFID and LoRaWAN.

[7] IEEE Standard for Information technology—Telecommunications and information exchange between systems - Local and metropolitan area networks—Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 2: Sub 1 GHz License Exempt Operation, IEEE Std 802.11ah-2016 (Amendment to IEEE Std 802.11-2016, as amended by IEEE Std 802.11ai-2016), vol., no., pp.1-594, 5 May 2017, doi: 10.1109/IEEESTD.2017.7920364.

[8] Wi-Fi Alliance: Wi-Fi CERTIFIED HaLow, https://www.wi-fi.org/discover-wi-fi/wi-fi-certified-halow [accessed: 11 March 2025]

[9] See clauses 10.45 to 10.62, clause 23, and Annex L of "IEEE Draft Standard for Information Technology -- Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks -- Specific Requirements - Part 11: Wireless Local Area Network (LAN) Medium Access Control (MAC) and Physical Layer (PHY) Specifications," in IEEE P802.11-REVme/D7.0, August 2024 , vol., no., pp.1-6213, 30 July 2024.

[10] See Morse Micro: Pushing the limits: Wi-Fi HaLow Testing in Joshua Tree National Park, https://www.morsemicro.com/2024/09/09/pushing-the-limits-wi-fi-halow-testing-in-joshua-tree-national-park/ [accessed: 11 March 2025].

IEEE Std 802.15.4-based Wi-SUN[11] specifies physical layer radio and medium access control mechanisms for operation in sub-1 GHz license exempt frequency bands from 169 MHz to 928 MHz. The technology was initially developed for SUN and other large scale IoT networks[12], such as smart city networks. Devices using IEEE Std 802.15.4-2020 SUN are extensively deployed as Wi-SUN home area network (HAN) and Wi-SUN field area network (FAN) in a range of applications not only for smart utilities and smart cities[13] but also for smart agriculture and healthcare[14]. These technologies are widely used worldwide in applications that include door entry systems, environmental sensors, fire and security alarms, smart meters, smart-parking devices, smart signs, streetlights, and structural integrity sensors. As an example, there are estimated over 120 million smart electric meters[15] deployed across the North America, and approximately 1 million smart meters already deployed by Dubai Energy and Water Authority[16].

IEEE 802 LMSC respectfully requests TDRA to update the spectrum outlook to

- include the fact that Wi-Fi operates not only in 2.4 GHz, 5 GHz, and 6 GHz frequency band, but also in the sub-1 GHz band;
- introduce IEEE 802.15.4-based Wi-SUN as additional radio-based technologies that provide low-power and short-range communications for various smart sensors applications that are of particular relevance to UAE.

Terahertz spectrum for SRDs

IEEE 802 LMSC recommends TDRA to allow license exempt operations between 252 GHz and 450 GHz, which includes spectrum identified for the use of Terahertz communications by the World Radiocommunications Conference (WRC) 2019 per Radio Regulation (RR) No. 5.564A[17].

IEEE 802 LMSC has been leading the standards development of Terahertz communications since 2008. Of particular note is IEEE Std 802.15.3-2023[18], which defines physical layer (PHY) and medium access control (MAC) operation for high data rate wireless connectivity (typically over 200 Mb/s) with fixed, portable, and moving devices via 2.4 GHz, 60 GHz, and 300 GHz radio transmissions using low power and multiple modulation formats. Of note, the standard defines two PHY modes in the frequency range between 252 GHz and 450 GHz for switched point-to-point links, enabling data rates of up to 100 Gb/s using eight different bandwidths between 2.16 GHz and 69.12 GHz. Targeted applications supported by this standard include wireless backhaul/fronthaul links, wireless links in data centers as well as short range applications such as kiosk downloading, intra-device and close proximity communication.

[11] "IEEE Standard for Low-Rate Wireless Networks," IEEE Std 802.15.4-2020 (Revision of IEEE Std 802.15.4-2015), vol., no., pp.1-800, 23 July 2020, doi: 10.1109/IEEESTD.2020.9144691.

[12] See Wi-SUN Alliance: Wi-SUN Alliance marks a year of strong growth in membership and 91 million devices awarded globally, https://wi-sun.org/news/wi-sun-alliance-marks-a-year-of-strong-growth-in-membership-and-91-million-devices-awarded-globally-2/ [accessed 11 March 2025]. Wi-SUN Alliance has also seen its influence grow, with more than 91 million Wi-SUN capable devices (Navigant Research) awarded globally as service providers and city developers deploy new IoT applications and services for smart cities and utilities.

[13] National Institute of Information and Communications Technology: World's First Application of Wi-SUN Radio Sensor Network to Fishery Industry, MOZUKU Seaweed Aquaculture, 25 December 2015, https://www.nict.go.jp/en/press/2015/12/25-1.html [accessed: 11 March 2025]

[14] Japan Science: Successful multi-stage relay demonstration experiment performed at Kyoto University medical institution, 26 July 2021, https://sj.jst.go.jp/news/202107/n0726-03k.html [accessed: 11 March 2025]

[15] Information derived from Guidehouse Global AMI Tracker 4Q23 research data.

[16] Wi-SUN Alliance: DEWA Develops Integrated Smart Energy Grid Using Wi-SUN Technology, https://wi-sun.org/blog/dubai-smart-energy-grid/ [accessed: 11 March 2025]

[17] The frequency bands, which cover 137 GHz spectrum, are 275 GHz to 296 GHz, 306 GHz to 313 GHz, 318 GHz to 333 GHz, and 356 GHz to 450 GHz.

[18] "IEEE Standard for Wireless Multimedia Networks," in IEEE Std 802.15.3-2023 (Revision of IEEE Std 802.15.3-2016), vol., no., pp.1-684, 22 Feb. 2024, doi: 10.1109/IEEESTD.2024.10443750.

Conclusion

IEEE 802 LMSC thanks TDRA for the opportunity to provide this submission and respectfully asks TDRA to consider our input on Wi-Fi operating in the sub 1 GHz and 6 GHz bands, IEEE 802.15.4-based Wi-SUN devices for IoT applications, and spectrum allocation for license exempt operations between 252 GHz and 450 GHz.

Respectfully submitted,

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