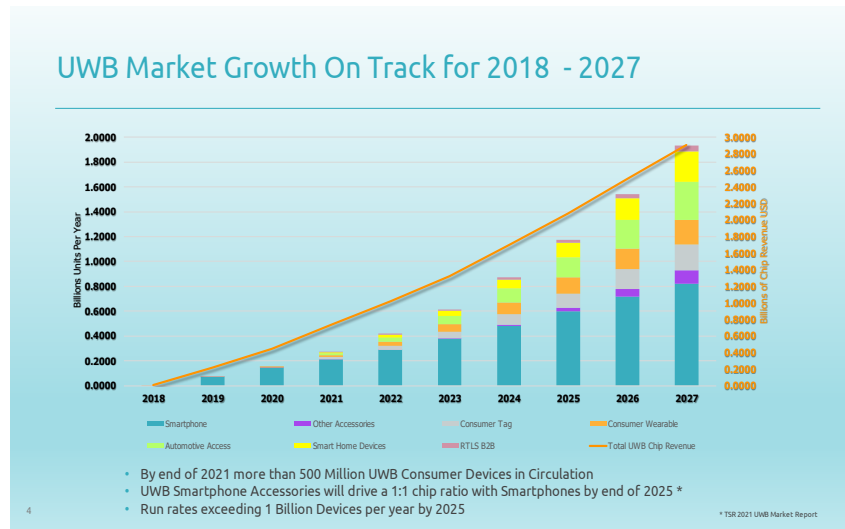


# THE ULTRA WIDE BAND (UWB) ECOSYSTEM

## A MATURING MARKET BUILT ON COEXISTENCE

### Amazing Growth in the Marketplace

Since 2018, the UWB market has experienced significant growth, increasing to more than a billion UWB consumer devices in circulation to date. At this time, virtually every significant smartphone product has embedded UWB capabilities, and there'll be more than 1 billion UWB devices sold per year by 2025.



UWB capability has been added to many other high-volume consumer devices, such as tablets, location tags, and wireless audio devices. A few examples include smartphones like the Apple iPhone, Samsung Galaxy, and Google Pixel, tracking devices such as the Apple AirTag and Samsung SmartTag+, and laptops such as the Microsoft Surface Duo 2 and Lenovo ThinkPad X1 Nano.

### A Variety of Use Cases

UWB is also widely deployed for new vehicle key fobs to allow secure wireless entry. Thieves can't easily hack and spoof signals to steal cars that have UWB key fobs like they do with conventional wireless fobs.

Additionally, it's used for a wide range of purposes that enhance public health and safety. UWB technology Enables firefighters to see behind walls and alert drivers about children left in cars. This Wall imaging capability is also used for many simple home applications such as stud finders. High dynamic range, low latency audio wireless microphone systems use UWB for stage productions allowing many high-fidelity audio transmissions to be broadcast simultaneously.

### UWB's Valuable Role To Play

UWB devices also fill an important role as part of the wireless device ecosystem that other wireless technologies are not as well-suited to perform. Wireless network data air interfaces, such as LTE and 5G, can provide wide area high-speed data communications and low precision wide area locating and tracking.

However, those systems are not ideal for extremely fast high-

### UWB Is In Many High-Volume Consumer Devices

	UWB	4G-LTE 5G	Wi-Fi	Bluetooth BLE	NFC	GPS
Apple iPhone 11, 12, 13, 14,15 Series	✓	✓	✓	✓	✓	✓
Samsung Galaxy Note20, Galaxy S21, Galaxy S22, Galaxy S23, Galaxy Z Fold 2, Galaxy Z Fold 3, Galaxy Z Fold 4	✓	✓	✓	✓	✓	✓
Lenovo ThinkPad X1 Nano/X1 Carbon, X1 Yoga	✓		✓	✓	✓	
Microsoft Surface Duo 2	✓	✓	✓	✓	✓	✓
Xiaomi Mix 4, Sound, My TV	✓	✓	✓	✓	✓	✓
Google Pixel 6, 7	✓	✓	✓	✓	✓	✓
Apple Watch 6, 7, 8, 9, Ultra 2	✓		✓	✓		
Apple HomePod Mini	✓		✓	✓		
Apple AirTag and Samsung SmartTag	✓			✓	✓	
Digital Key For BMW, MB, JLR, Hyundai, GM	✓			✓		

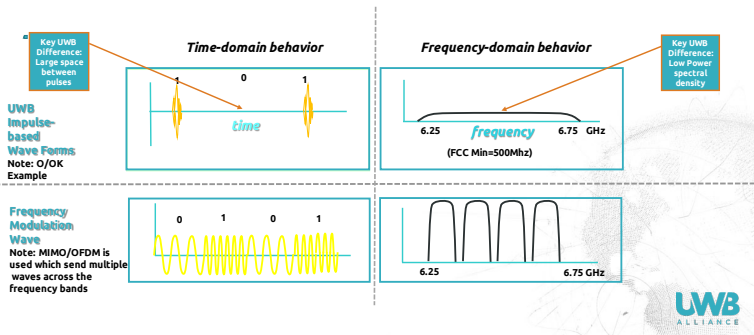
(See Appendix A)

bandwidth file transfers over short distances, (e.g., to send a 4K video file shot on a smartphone). Wi-Fi can

provide that capability but is made more secure, easier to use, and more efficient when it works in combination with UWB. The Apple iPhone Airdrop feature is a primary example of this technology combination. High precision, secure ranging and direction determination identifies the two users, then Wi-Fi makes the transfer after the link has been established by UWB. This remarkably accurate direction and distance resolution is not possible with other technologies.

### UWB Is Optimized for Spectrum Sharing

UWB uses impulse-based waveforms instead of continuous carrier waves.



### Designed To Coexist

UWB devices also don't interfere with other unlicensed technologies such as Wi-Fi 6E devices, due to the unique attributes of UWB technology. Specifically, UWB devices don't require an exclusive use of a band to transmit a continuous wave (CW). The signal is made up of tiny pulses that are only present sporadically. They do not experience the same linear signal aggregation as continuous wave (CW) technologies – an important key to coexistence.

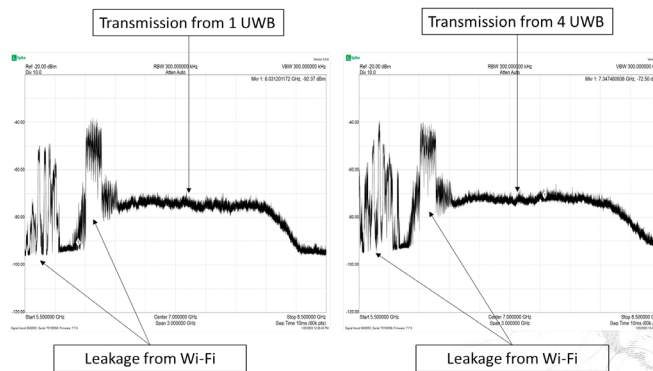
### Test Results: UWB Plays Well With Others

Recently, the UWBA participated in real-world testing that found no measurable impact from the introduction of UWB devices near Wi-Fi 6E operating in the same band. The tests examined whether the aggregation of signals would pose a threat to other high-sensitivity radio equipment. In an environment representative of a typical urban office setting, multiple non-coordinated RF sources operated in the 6 GHz band near UWB devices operating in the same band.

The baseline performance of Wi-Fi 6E was measured, and then UWB devices were introduced incrementally, beginning with a single device. Performance was measured after each UWB device was introduced, and no measurable impact on the performance of Wi-Fi 6E was observed. As such, the study demonstrated that no quantifiable aggregation occurs when UWB devices are operated simultaneously, and no harmful interference is detected even in the presence of many UWB devices.

Aggregation does not occur with UWB transmissions in the same way that it does with standard modulation methodologies. Results with a focused horn antenna pointed directly at the UWB transmitter indicate that there is essentially no risk of harmful interference to incumbent technologies from the deployment of many UWB devices even at slightly higher emission levels such as -31.3 dBm/MHz.

### No Significant Aggregation Detected In Joint Testing



For more information on how UWB continues to impact the economy without impacting the spectrum, please visit [www.UWBAlliance.org](http://www.UWBAlliance.org).