

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)	
)	
Unlicensed Use of the 6 GHz Band)	ET Docket No. 18-295
)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz)	GN Docket No. 17-183
)	

To: The Commission

**REPLY COMMENTS OF
THE BOEING COMPANY**

The Boeing Company (“Boeing”) herein replies to the comments that were filed in response to the Commission’s rulemaking proceeding on allowing additional unlicensed spectrum use in the 6 GHz band.

As Boeing indicated in its comments, Boeing’s role as a global leader in the manufacture of aircraft and aerospace systems makes it a heavy user of unlicensed spectrum resources, including for both relatively high power communications and monitoring systems (*i.e.*, “U-NII”) and low power ultra wide-band (“UWB”) devices. For example, Boeing uses relatively high power unlicensed systems in its factories to operate automated assembly equipment; for employee communications, logistics and safety; and for networking computers, while relatively low power UWB systems are used primarily for asset tracking and control. Boeing therefore requests the Commission to consider the spectrum requirements of both of these unlicensed services by authorizing new unlicensed operations in the 6 GHz band while adopting reasonable measures to facilitate the continued operation of UWB devices in this spectrum.

Boeing also supports allowing the use of the 6 GHz band for unlicensed operations inside aircraft. The significant attenuation of an aircraft fuselage ensures that such unlicensed operations will not cause harmful interference to incumbent licensed services in the 6 GHz band. Further, given the fact that UWB devices have never been permitted on aircraft, no spectrum sharing issues will exist between UWB and U-NII systems in flight.

I. THE RECORD SUPPORTS AUTHORIZING U-NII SYSTEMS ONBOARD AIRCRAFT

A number of parties expressed support for authorizing the use of U-NII devices onboard aircraft.¹ These parties recognize the results of extensive technical studies that have shown that an aircraft fuselage provides significant attenuation of radio signals, often rivaling standard residential and commercial construction materials. For example, the joint comments of a number of technology companies (the “RLAN Group”) included a summary of several technical studies that demonstrate the very high attenuation levels of an aircraft fuselage.² These studies supplement the technical studies that Boeing has participated in demonstrating comparable results.³

¹ See Comments of Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, Qualcomm Incorporated, and Ruckus Networks, ET Docket No. 18-295 *et al.*, at E-6 (Feb. 15, 2019) (“*RLAN Group Comments*”); Comments of Wi-Fi Alliance, ET Docket No. 18-295 *et al.*, at 35 (Feb. 15, 2019) (“*Wi-Fi Alliance Comments*”); Comments of Apple Inc., ET Docket No. 18-295 *et al.*, at 10-11 (Feb. 15, 2019); Comments of Hewlett Packard Enterprise Company, ET Docket No. 18-295 *et al.*, at 26 (Feb. 15, 2019).

² See *RLAN Group Comments* at E-6.

³ See, e.g., Aerospace Vehicle Spectrum Institute AFE 85 Project Report, *Analysis of Potential Interference from WiGig Radios on Aircraft to EESS Passive Sensors*, at 79-88 (Aug. 30, 2017) available at <https://ecfsapi.fcc.gov/file/10831759627379/AVSI%20WiGig%20Cover%20Letter%20and%20Report%20for%20FCC%20Filing.pdf>.

In contrast, those parties that expressed opposition to allowing 6 GHz U-NII operations inside aircraft provided no technical analysis to support their concerns.⁴ Instead, most of the opponents of permitting unlicensed use of the 6 GHz band inside aircraft also opposed more broadly other aspects of the Commission’s proposed rules for U-NII operations in the 6 GHz band.⁵ Their concerns should be considered in that context.

In fact, unlicensed use of the 6 GHz band inside aircraft will arguably result in substantially less interference to incumbent licensed services than other proposed uses given the fact that all radio systems inside aircraft are installed by professionals using very stringent procedures and will operate at relatively low power levels given the confined conditions of an aircraft cabin. Finally, aircraft are physically separate from other licensed transmitting systems, both on the ground at airports and during flight. Therefore, the Commission should not impose a prohibition on U-NII use in aircraft, but instead treat the cabin of an aircraft as an indoor location for purposes of its U-NII regulations. The Commission should also treat an aircraft that is parked at an airport terminal or on a tarmac as non-mobile for purposes of operations with U-NII-5 and U-NII-7 devices.

⁴ See Comments of APCO International, ET Docket No. 18-295 *et al.*, at 18 (Feb. 15, 2019) (“*APCO Comments*”); Comments of El Paso Electric Company, ET Docket No. 18-295 *et al.*, at 7 (Feb. 15, 2019) (“*El Paso Electric Comments*”); Comments of Intelsat License LLC and SES Americom, Inc., ET Docket No. 18-295 *et al.*, at 3 (Feb. 15, 2019); Comments of Southern Company Services, Inc., ET Docket No. 18-295 *et al.*, at 19 (Feb. 15, 2019).

⁵ See, e.g., *APCO Comments* at 3 (expressing opposition to “allowing the operation of low-power indoor access points that are not subject to a frequency coordination system in the 6 GHz band” including indoor use because “[r]estricting low-power access points to indoor use would be difficult, if not impossible” and “differences in building construction make it impractical to draw assumptions for signal attenuation”); *El Paso Electric Comments* at 3 (arguing that “[w]e do not believe the simplistic [Automated Frequency Control (AFC)] system concept will be able to automatically identify potential interference into licensed systems engineered and coordinated using proven standards and engineering practices” to protect incumbents in the U-NII-5 and U-NII-7 bands); *Southern Company Comments* at ii (arguing that “[i]ntroduction of unlicensed devices into a band with critical uses will require exceptional conditions to ensure there will be no possibility of interference to systems licensed on a primary basis”).

In contrast, Boeing continues to agree with those parties that oppose the use of unlicensed spectrum in the 6 GHz band for outdoor communications to and from mobile platforms, such as cars, aircraft or drones.⁶ Other frequency bands would be more suitable for use to control autonomous vehicles. For example, Boeing supports the petition of the Aerospace Industries Association (“AIA”) requesting the Commission to adopt technical and operational rules relating to the use of the 5030-5091 MHz band for unmanned aircraft systems.⁷ The Commission should move forward with the adoption of an NPRM on this proposal with alacrity.

II. THE COMMISSION SHOULD EXPLORE ADDITIONAL MEASURES TO ENABLE THE CONTINUED OPERATION OF UWB DEVICES AT 6 GHZ

Boeing is increasingly using UWB systems in its manufacturing operations. For example, Boeing uses UWB technology to operate an asset tracking system inside each of its aircraft manufacturing facilities to monitor the locations of more than ten thousand tools, carts and other equipment used in the aircraft assembly process. Each tracked device is equipped with an RF transmitter that emits a very low power UWB signal in the range of 6.35-6.75 GHz that penetrates walls and metallic surfaces and can be detected by UWB receivers placed within each manufacturing facility. The system ensures that Boeing is always able to locate the significant number of tools and equipment that are employed in its factories.

Given such uses, Boeing remains concerned regarding the relatively weak record in this proceeding with respect to the potential impact that may result if additional unlicensed spectrum uses are authorized in the same spectrum as low power UWB devices. The Ultra Wide Band

⁶ See NPRM, ¶ 84.

⁷ Petition to Adopt Service Rules for Unmanned Aircraft Systems (“UAS”) Command and Control in the 5030-5091 MHz Band, *Petition for Rulemaking*, RM-11798 (Feb. 8, 2018).

Alliance filed a technical analysis indicating that UWB devices are likely to suffer high levels of interference from co-frequency U-NII systems even when they are separated by significant distances.⁸ In contrast, no U-NII proponent provided any technical analysis on the potential conditions for spectrum sharing between U-NII and UWB.

Instead, the only substantive discussion on this issue was provided by the Wi-Fi Alliance, which suggested that “given the short range of both U-NII and UWB devices, as well as the nature of UWB operations, much of the interference potential between the two unlicensed applications will be confined to particular locations under the control of a single entity.”⁹ This may be true for large companies such as Boeing, which can segregate their incompatible uses of the 6 GHz band inside manufacturing facilities and other single-tenant buildings. As indicated by the technical analysis of the Ultra Wide Band Alliance, however, such segregation of incompatible uses may not be possible in multi-tenant office buildings or multi-family housing units.

In requesting the Commission to explore additional solutions to this issue, Boeing acknowledges that it does not endorse the proposal of the Ultra Wide Band Alliance to effectively partition the 6 GHz band (leaving only 175 MHz for U-NII use).¹⁰ In contrast, the Commission should explore whether imposing reasonable limits on U-NII power levels and/or duty cycles may facilitate co-frequency operations without inhibiting U-NII operations appreciably.¹¹ To this end, a study conducted by RKF Engineering Solutions, Inc. addressing sharing between U-NII and

⁸ See Comments of The Ultra Wide Band (UWB) Alliance, ET Docket No. 18-295 *et al.* (Feb. 15, 2019) (“*UWB Alliance Comments*”).

⁹ See *Wi-Fi Alliance Comments* at 39.

¹⁰ *UWB Alliance Comments* at unnumbered page 1 (Executive Summary).

¹¹ See *id.* at unnumbered pages 1-2.

incumbent licensed services in the 6 GHz band assumed that U-NII devices would operate using very low duty cycles (ranging from 0.00022% to 0.44%) based on the use case.¹² Such very low duty cycles may enable co-frequency UWB devices to continue to function.

The adoption of relatively modest spectrum sharing measures would be consistent with the Commission's efforts to facilitate the continued operation of unlicensed devices in other frequency bands. For example, in 1985, the Commission authorized unlicensed spread spectrum systems in the 902-928 MHz band.¹³ A decade later, the Commission introduced a new licensed primary service in the 902-928 MHz band, the Location and Monitoring Service ("LMS").¹⁴ In doing so, the Commission recognized the potential for interference to unlicensed devices and adopted technical and operational measures to ensure that licensed LMS systems and Part 15 devices "will be able to achieve their objectives without impeding each other's use of the spectrum."¹⁵ The Commission later explained that it had "sought to ensure that LMS systems are not operated in

¹² See *Frequency Sharing for Radio Local Area Networks in the 6 GHz Band*, RKF Engineering Solutions, LLC, Version 3 (January 2018), included as an attachment to Letter from Paul Margie, Counsel to Apple Inc., Broadcom Corporation, Facebook, Inc., Hewlett Packard Enterprise, and Microsoft Corporation, to Marlene Dortch, Secretary, Federal Communications Commission, GN Docket No 17-183 (Jan. 25, 2018).

¹³ See *Authorization of Spread Spectrum and Other Wideband Emissions Not Presently Provided for in the FCC Rules and Regulations*, Gen Docket No. 81-413, 101 FCC 2d 419 (1985); see also *Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License*, GEN. Docket No. 87-389, *First Report and Order*, 4 FCC Rcd 3493 (1989) (also authorizing non-spread spectrum Part 15 devices in the 902-928 MHz band).

¹⁴ See generally *Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicular Monitoring Systems*, *Report and Order*, 10 FCC Rcd 4695, ¶ 1 (1995).

¹⁵ *Id.*

such a manner as to degrade, obstruct, or interrupt Part 15 devices to such an extent that Part 15 operations will be negatively affected.”¹⁶

The Commission should exercise this same cautious approach with respect to ensuring that UWB technologies remain viable in the 6 GHz band despite the introduction of higher power U-NII systems. The Commission’s previous decision to permit the operation of UWB services was tremendously successful, facilitating the development and commercial use of countless innovative products and services that benefit manufacturers, businesses, and consumers. The Commission should now ensure that its introduction of additional unlicensed operations in the 6 GHz band does not dismantle the technological success that the Commission previously created.

III. CONCLUSION

The Commission should also authorize the use of U-NII devices onboard aircraft in the 6 GHz band by treating the inside of an aircraft fuselage as an indoor location and a parked aircraft as non-mobile for purposes of its U-NII rules. The technical evidence demonstrates that an aircraft fuselage provides high levels of attenuation of radio signals, thus ensuring the protection of incumbent licensed services. Boeing also continues to support the identification of spectrum resources in the 6 GHz band for use by other types of unlicensed systems and devices. At the same time, the Commission should make an effort to ensure that the introduction of U-NII systems at 6 GHz does not disrupt excessively the operation of UWB devices in this spectrum. Each of

¹⁶ Amendment of Part 90 of the Commission’s Rules to Adopt Regulations for Automatic Vehicular Monitoring Systems, *Order on Reconsideration*, 11 FCC Rcd 16905, 16911-12, ¶ 15 (1996).

these measures would promote the efficient and robust use of scarce spectrum resources for the benefit of consumers and industrial users.

Respectfully submitted,

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