

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, DC 20554

In the Matter of	)	
	)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band	)	GN Docket No. 18-122
	)	
Petition for Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission’s Rules to Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3.7-4.2 GHz Band	)	RM-11791
	)	
Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Band Shared Between the Fixed Service and the Fixed Satellite Service	)	RM-11778
	)	

**COMMENTS OF  
THE BOEING COMPANY**

The Commission should adopt the proposal of the C-band Alliance because it is the only option that achieves each of the three critical goals of:

- Rapidly making mid-band spectrum available for terrestrial mobile services in order to advance the role of the United States in the global development of 5G technologies,
- Ensuring that sufficient C-band spectrum will remain available for users of satellite communications services that depend on the reliability and availability that can only be achieved in this spectrum, and
- Adequately protecting aeronautical safety services that operate in the immediately adjacent 4.2-4.4 GHz band.

No other proposal achieves these necessary objectives. In fact, nearly all of the proponents of other options fail to acknowledge some of these requirements, much less address in their comments how certain of these objectives would be achieved. Therefore, the Commission would

best serve the public interest by endorsing and implementing the comprehensive proposal put forth by the C-band Alliance.

**I. THE C-BAND ALLIANCE PROPOSAL WILL MAKE MID-BAND SPECTRUM QUICKLY AVAILABLE FOR WIRELESS SERVICES WHILE ENSURING THE CONTINUED AVAILABILITY OF CRITICAL C-BAND SATELLITE SERVICES**

The Commission was abundantly clear in expressing its primary objectives in this proceeding, explaining “we are pursuing the joint goals of making spectrum available for new wireless uses while balancing desired speed to the market, efficiency of use, and effectively accommodating incumbent Fixed Satellite Service (FSS) and Fixed Service (FS) operations in the band.”<sup>1</sup> Only the proposal put forth by the C-band Alliance addresses and achieves each of these requirements.

It is evident that the C-band Alliance carefully considered the complex technical considerations involved in partially clearing and repacking the satellite communications services that operate in the 3.7-4.2 GHz band so that nearly the same satellite throughput capacity can be achieved using only 300 MHz of the 500 MHz of available spectrum. Those that have argued that even more C-band spectrum should be cleared likely have not considered (or even understood) the intricate manner in which C-band satellites share the 3.7-4.2 GHz band for downlink transmissions.

Every C-band satellite is designed to use the entire 500 MHz of C-band spectrum. Further, most C-band satellites operate 24 overlapping “channels” (or transponders) within this spectrum. Each channel usually uses 36 MHz of spectrum that overlaps significantly with adjacent channels using opposite polarizations between channels to prevent intra-system interference. Thus, while

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<sup>1</sup> NPRM, ¶ 2.

one channel on a C-band satellite may be using the 3922-3958 MHz band, the next higher channel may be using the overlapping 3942-3978 MHz band, while the next lower channel may again be overlapping using the 3902-3938 MHz band. Given the complexity of this channelization scheme, overly simplistic proposals—such as dividing the band in half at 3950 MHz—would be inadequate to preserve the throughput capacity that is necessary to fulfill the critical needs of C-band satellite users. Such proposals also disregard the significant guard band that will be needed to avoid the interference that will result from the operation of relatively high-powered terrestrial wireless services within range of satellite earth stations receiving faint signals from geostationary satellites situated more than 22,000 miles away.

As Boeing and others explained in their comments, numerous important industries depend on C-band satellite services to provide uninterrupted and highly-reliable communications to less accessible locations, including for air traffic control and to distribute detailed weather information used to support the safe and efficient operation of the national airspace. The Commission therefore must ensure that the communications needs of these users are adequately protected. The satellite operators that formed the C-band Alliance have provided their assurance—both to the Commission and to their customers—that C-band satellite communications services will not be disrupted during the repacking of the 3.7-4.2 GHz band and will be protected adequately from the harmful interference that will result from the operation of terrestrial mobile services in the lower portion of the band. Therefore, the Commission should approve the proposal of the C-band Alliance and adopt the rules that have been proposed by the Alliance to enable the prompt clearing and repacking of the lower portion of this spectrum.

## II. ONLY THE C-BAND ALLIANCE PROPOSAL ENSURES THE PROTECTION OF AERONAUTICAL SAFETY SERVICES IN THE 4.2-4.4 GHZ BAND

Few of the comments that were filed in this proceeding appropriately acknowledged the critical importance of adequately protecting aeronautical safety services that operate in the spectrum immediately adjacent to the 3.7-4.2 GHz band. For example, the Aerospace Industries Association and the General Aviation Manufacturers Association filed comments explaining that any failure to adequately protect radio altimeters and wireless avionics intra-communications (“WAIC”) systems “could directly impact safe operation of flights putting the safety of the millions of daily passengers in the American skies at risk.”<sup>2</sup>

Because of the need to protect these aeronautical safety systems, international efforts were initiated in 2016 under the direction of the International Civil Aviation Organization (“ICAO”) to test the interference rejection capabilities of radio altimeters. The testing is being conducted through the Aerospace Vehicle System Institute (“AVSI”), a consortium of major aerospace and avionics manufacturers. Preliminary test results have raised significant concerns about the possible introduction of new spectrum uses in the upper portion (*i.e.*, 4.1-4.2 GHz) of the 3.7-4.2 GHz band. For example, Aviation Spectrum Resources, Inc., (“ASRI”), which is owned by U.S. airlines and other airspace users, explained that initial tests have shown that relatively high power signals using orthogonal frequency-division multiplexing (“OFDM”) can create an overload condition “that prevents an accurate or computable altitude from being reported to the aircraft systems and pilot.”<sup>3</sup> This is consistent with the preliminary analysis of Garmin International, a

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<sup>2</sup> Comments of the Aerospace Industries Association and the General Aviation Manufacturers Association, GN Docket No. 18-122, *et al.*, at 2-4 (Oct. 29, 2018).

<sup>3</sup> Comments of Aviation Spectrum Resources, Inc., GN Docket No. 18-122, *et al.*, at 5-6 (Oct. 29, 2018).

manufacturer of radio altimeters, which determined that radio altimeters could experience harmful interference at distances in excess of several kilometers from a single ground station antenna.<sup>4</sup>

Despite the significance of these findings, proponents of injecting additional spectrum use into the upper portion of the 3.7-4.2 GHz band seem to have largely disregarded the public safety ramifications of their proposals. For example, the Broadband Access Coalition filed lengthy comments arguing in favor of permitting fixed point-to-multipoint (“P2MP”) networks in the upper portion of the 3.7-4.2 GHz band, but completely failed to address the interference concerns that would result for radio altimeter operations in the adjacent frequencies.

In fact, only T-Mobile specifically addressed the issue of sharing with radio altimeters and WAICs in the adjacent 4.2-4.4 GHz band. Despite T-Mobile’s strenuous support for opening the entire 3.7-4.2 GHz band for mobile services, T-Mobile acknowledged the need for “the safe operation of WAIC and radio altimeter operations” and offered that the Commission may need “to continue to study whether terrestrial wireless services would interfere with [WAIC] and radio altimeter operations in the 4.2-4.4 GHz band.”<sup>5</sup> T-Mobile also urged the Commission “to work with other federal agencies, such as the National Telecommunications and Information Administration and the Federal Aviation Administration, to determine an appropriate technical framework to allow mobile use at 3.7-4.2 GHz without causing harmful interference to properly engineered adjacent aviation operations.”<sup>6</sup>

Although Boeing appreciates T-Mobile’s recognition of these important public safety issues, Boeing does not believe that a technical framework can be identified that would permit

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<sup>4</sup> Comments of Garmin International, Inc., GN Docket No. 18-122, *et al.*, at 10 (Oct. 29, 2018).

<sup>5</sup> Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 33 (Oct. 29, 2018).

<sup>6</sup> *Id.*

mobile services to operate safely within the 4.1-4.2 GHz portion of the band. Radio altimeters are already “properly engineered” to resist spurious emissions from external sources. The band pass filters that are incorporated into radio altimeters, however, have limited ability to reject transmissions close to the edges of the 4.2-4.4 GHz band. As a result, relatively powerful mobile communications in the adjacent band could overload the radio altimeter receivers on aircraft, inhibiting their accurate operation.

WAIC systems that are being developed for wireless monitoring and control systems on aircraft are also being carefully engineered to reject interference from external sources. Unfortunately, it is impossible for commercial airlines to reliably control the possession and use of personal communications devices by aircraft passengers. Therefore, regardless of the precautions employed in the design of WAIC systems, the only truly reliable means to prevent disruption of WAIC operations aboard aircraft is to refrain from authorizing the marketing or use of mobile devices that are capable of transmitting in the upper portion of the 3.7-4.2 GHz band.

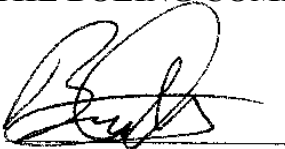
In summary, it would not be possible to permit P2MP transmitters or mobile base stations to operate in the 4.1-4.2 GHz band because of the interference that would result to radio altimeter receivers on aircraft. It would also not be possible to permit mobile end user devices to operate in the 4.1-4.2 GHz band because any transmissions from such devices onboard aircraft could interfere with WAIC communications, potentially compromising control of the aircraft. Given these facts, the Commission should adopt the proposal of the C-band Alliance to make available the lower portion of the 3.7-4.2 GHz band for terrestrial mobile services, while repacking the upper portion of the band to accommodate additional C-band satellites and end user earth stations.

### III. CONCLUSION

Boeing supports the proposal of the C-band Alliance to use a secondary market process to clear the lower portion of the 3.7-4.2 GHz band and make it available for terrestrial mobile services, while ensuring the continued availability and reliability of C-band satellite communications services that remain necessary to support numerous important industries and user groups, and also ensuring the safe and efficient operation of aeronautical safety services in the immediately adjacent 4.2-4.4 GHz band. The Commission should therefore promptly endorse and adopt the C-band Alliance proposal.

Respectfully submitted,

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