

November 2, 2021

Marlene H. Dortch  
Secretary  
Federal Communications Commission  
45 L Street, NE  
Washington, DC 20554

**Re: GN Docket No. 18-122: Written Ex Parte Presentation – Outstanding 5G Operating Models and Parameters Needed to Assess Aviation Safety,**

Dear Ms. Dortch:

The Aerospace Industries Association (“AIA”), Air Line Pilots Association, International (“ALPA”), Aircraft Owners and Pilots Association (“AOPA”), Airborne Public Safety Association (“APSA”), Airbus, Aircraft Electronics Association (“AEA”), Airlines for America (“A4A”), Aviation Spectrum Resources Inc. (“ASRI”), Boeing, Cargo Airline Association (“CAA”), Collins Aerospace, Experimental Aircraft Association (“EAA”), FreeFlight Systems, Garmin International, Inc., General Aviation Manufacturers Association (“GAMA”), Helicopter Association International (“HAI”), Honeywell International Inc., International Air Transport Association (“IATA”), National Air Carrier Association (“NACA”), National Business Aviation Association (“NBAA”), Regional Airline Association (“RAA”) (hereinafter “the Aviation Community”) respectfully submits this *ex parte* letter to express its continued concern that the decisions reached in the *Report and Order* in above-captioned proceeding will fail to protect the public, aircraft passengers and crew from harm while also hurting our nation’s economic viability.<sup>1</sup> While the Aviation Community supports making spectrum available for next generation commercial wireless communications, as stated in the Aviation Petitioners’ pending Petition for Reconsideration of the Commission’s *Report and Order* in the above-captioned docket,<sup>2</sup> aviation has the single goal of maintaining current levels of safety of passengers and crews in the National Airspace System (“NAS”)—as well as the safety of people on the ground—through interference-free operation of radio altimeters (“RAs”) to the exacting level of certainty demanded by the aviation industry and aviation safety regulators.<sup>3</sup>

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<sup>1</sup> See *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, 35 FCC Rcd 2343, ¶ 343 (2020) (“*Report and Order*”).

<sup>2</sup> *Aviation Petitioners’ Petition for Partial Reconsideration of the 3.7-4.2 GHz Band Report and Order*, GN Docket No. 18-122 (filed May 26, 2020 by Aerospace Industries Association (“AIA”), the Aerospace Vehicle Systems Institute (“AVSI”), Air Line Pilots Association, International (“ALPA”), Airbus, Aviation Spectrum Resources, Inc. (“ASRI”), Garmin International, Inc. (“Garmin”), the General Aviation Manufacturers Association (“GAMA”), the Helicopter Association International (“HAI”), Honeywell International Inc. (“Honeywell”), the International Air Transport Association (“IATA”), and the National Air Transportation Association (“NATA”).

<sup>3</sup> Radio altimeters are also commonly referred to as Radar Altimeters, as they are a radar-based system for navigation, not a communications system.

The Federal Aviation Administration (“FAA”), the nation’s air safety regulator, has recognized these concerns and recently issued a bulletin advising on the potential impact of 5G flexible use operations in the 3.7-3.98 GHz band to RAs.<sup>4</sup> The bulletin has multiple recommendations to aircraft operators and manufacturers on the potential for interference and necessary reporting.

### **Aviation Data Submission to the Commission**

First and foremost, the Aviation Community notes that efforts are being made to provide pertinent RA data to the Commission and other interested parties. The Aerospace Vehicle Systems Institute (“AVSI”) recently filed highly confidential test data regarding 5G interference with RAs to the Commission.<sup>5</sup> In addition, aerospace manufacturers, through AVSI, are planning to release anonymized data publicly in the very near future as soon as the relevant manufacturers’ approvals can be secured.

### **Critical Need for Data on 5G Operations to Make Aviation Safety Decisions**

However, the Aviation Community would like to note that there are still multiple unanswered questions for the 5G carriers, equipment manufacturers, and the Commission on the exact operational parameters of 5G networks. The list at Annex A to this letter builds on the questions previously raised by the Aviation Community during the RTCA multi-stakeholder group (“MSG”) process discussions with the largely contemporaneous Technical Working Group-3 (“TWG-3”) MSG.<sup>6</sup> Providing the data requested by the Aviation Community and the necessary clarifications are essential for the aviation industry, and ultimately its regulator, the FAA, to complete a full aviation risk assessment for all affected aviation operations to maintain public safety. Such an assessment cannot rely on the typical values or non-specific estimates that have been provided for some of the 5G parameters in the public record, and instead must use precise parameters, such as regulatory limits or license conditions that can be assured to accurately define all operations.

Unfortunately, the material in the docket does not provide the needed precision in several critical areas, and in a few cases is contradictory. For example, the spurious emissions limits in the 4.2-4.4 GHz band have been described in multiple ways and terms without a consistent value. A -13 dBm/MHz conducted emissions limit was defined in the *Report and Order*.<sup>7</sup> However,

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<sup>4</sup> See FAA Special Airworthiness Information Bulletin: AIR-21-18, “Risk of Potential Adverse Effects on Radio Altimeters” (issued Nov. 2, 2021) available at [https://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library/rgSAIB.nsf/dc7bd4f27e5f107486257221005f069d/27ffcbb45e6157e9862587810044ad19/\\$FILE/AIR-21-18.pdf](https://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/dc7bd4f27e5f107486257221005f069d/27ffcbb45e6157e9862587810044ad19/$FILE/AIR-21-18.pdf).

<sup>5</sup> See Letter of David A. Redman, Director, AVSI, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Oct 28, 2021).

<sup>6</sup> See “Assessment of C-Band Mobile Telecommunications Interference on Low Range Radar Altimeter Operations,” RTCA Paper No. 274-20/PMC-2073 (rel. Oct. 7, 2020) (“MSG Report”), Appendix B at 116-150, attachment to Letter of Terry McVenes, President & CEO, RTCA, Inc. (“RTCA”), to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Oct. 8, 2020).

<sup>7</sup> *Report and Order*, ¶ 343.

following the release of the *Report and Order*, CTIA specified base station limits of between -20 to -40 dBm/MHz in its engagement with the aviation community in 2020.<sup>8</sup> Even more recently, submissions to the public record by several 5G equipment manufacturers have provided additional details based on the 3GPP standard of -30 dBm/MHz. In citing the 3GPP spurious emissions limits for both base stations and user equipment (“UE”) of -30 dBm/MHz, the 5G equipment manufacturers have stated that they operate comfortably below that limit without providing specific parameters against which the Aviation Community can assess current or future RAs.<sup>9</sup> This leaves the Aviation Community at a loss to discern which codified or assured parameters can be relied upon to make aviation safety decisions with potential legal, life, and safety consequences for RA and aircraft manufacturers, aircraft operators, and other involved parties.<sup>10</sup>

Given the current ambiguous data in the public record for many 5G parameters, the Aviation Community’s own risk assessments can only utilize the most conservative values that have been codified or shown to be controlled with an extremely high level of assurance, such as the FCC-specified limits. The Aviation Community is certain that the public wants the aviation industry to take such a conservative, data-driven approach to always maintaining air safety, and not rely on a single organization’s filing that simply states 5G transmitters perform better than a standard without any supporting or consistent data. While CTIA and its members may believe that these ambiguous statements of performance are appropriate for their own uses, they are not near the level of assurance needed for an assessment of aviation safety, for which neither CTIA nor its members have direct involvement.

Additionally, CTIA’s contention that UE such as mobile phones are not operated while in flight and therefore should not be of concern to the Aviation Community is not borne out by the known

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<sup>8</sup> MSG Report, Appendix B at 141-142.

<sup>9</sup> See Letter of Mark Racek, Sr. Director Spectrum Policy, Ericsson, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 at 2 (filed Sep. 13, 2021) (stating “Ericsson AAS products in the 3.7-3.98 GHz band have actual levels of emissions that are better than the 3GPP and ERC specifications,” but no actual limit is specified in the filing). Letter of John W. Kuzin, Vice President, Spectrum Policy & Regulatory Counsel, Qualcomm, to Marlene Dortch, Secretary, FCC, GN Docket No. 18-122 at 1 (filed Sept. 7, 2021) (“*Qualcomm Sept. 7 Ex Parte*”) (stating “mobile equipment using its chipsets comply with 3GPP specifications and that the actual levels of emissions in the 4.2 to 4.4 GHz band can be significantly lower depending on the specific deployment configuration, transmitter operating parameters, and antenna configuration,” but no actual limit is specified in the filing). Letter of Jeffrey A. Marks, Vice President, Regulatory Affairs, North America, Nokia, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 at 1 (filed Sep. 21, 2021) (stating “Nokia base stations operating in the 3.7-3.98 GHz band have Out of Band emissions considerably lower than 3GPP specification levels for Category B (-30 dBm/MHz),” but no actual limit is specified in the filing). It also should be noted that even the 3GPP standard has variation for certain parameters, for example a 3GPP compliant waveform may mean TM1.1 or another variation as per 3GPP TS 38.141-1, Section 4.9.2.2.1, which may affect the resulting tested performance of RAs.

<sup>10</sup> To give an example of the ambiguities in the record, Qualcomm itself argued against lower limits than those specified in the *Report and Order* as cited in the Commission’s decision to maintain a -13 dBm/MHz spurious limits for mobile devices. See *Report and Order*, ¶ 348; see also Comments of Qualcomm Inc. on July 19, 2019 Public Notice, GN Docket No. 18-122 (filed Aug. 7, 2019) at 4. This appears at odds to the representations made in the *Qualcomm Sept. 7 Ex Parte* and demonstrates the need for clarification with specific values from the Commission and 5G equipment manufacturers.

data. UE usage on aircraft is an active issue, and despite the aircraft operators' best efforts, still continues. Specifically, the FAA personal electronic devices ("PEDs") report from 2013 cites data from the Consumer Electronics Association ("CEA"), which states that 30% of passengers reported they had accidentally left a PED (not limited specifically to cell phones or wireless pagers) turned on while in-flight.<sup>11</sup> The issue remains a concern given mobile handset sales have grown considerably in the United States since 2013<sup>12</sup> and aviation is unaware of any fail safe mechanisms UE manufacturers and operators deploy that can ensure compliance with FAA rules.<sup>13</sup>

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<sup>11</sup> See "A Report from the Portable Electronic Devices Aviation Rulemaking Committee to the Federal Aviation Administration" (Dated September 30, 2013) Appendix H at H-32 *available at* [https://www.faa.gov/about/initiatives/ped/media/ped\\_arc\\_final\\_report.pdf](https://www.faa.gov/about/initiatives/ped/media/ped_arc_final_report.pdf). Appendix H includes information jointly compiled by the Airline Passenger Experience Association and the Consumer Electronics Association ("CEA").

<sup>12</sup> See "Smartphone Sales Forecasts in the United States from 2005 to 2021," Statista Inc. (rel. Jan. 2021) *available at* <https://www.statista.com/statistics/191985/sales-of-smartphones-in-the-us-since-2005/>.

<sup>13</sup> See 14 C.F.R. § 91.21 Portable electronic devices.

## Summary

The lack of necessary data in the FCC public record for the Aviation Community to make data-driven decisions on air safety further reinforces the need for direct discussions between the Commission, the FAA, 5G interests, and the aviation industry. Over the longer term, this lack of data also has implications for the aviation industry's ability to develop a new generation of RAs. While it will take many years to design and deploy the next generation of RAs, the work on the next generation RA minimum performance standard by RTCA SC-239 is already under way and will be severely compromised if an accurate model of the radio frequency ("RF") levels expected from 5G systems cannot be developed and disseminated, thereby giving assurance that new RAs will not be adversely affected by the substantive changes in the C-band RF environment. The current situation continues to support the Aviation Community's previous request that a group be formed with the involvement of the Commission, the FAA, 5G interests and the aviation industry to address these and other questions.<sup>14</sup> The present impasse in the Commission's public record does not help the Commission in its goals, or support the need for public safety with the needed clarification and accuracy.

Respectfully submitted,

/s/ Andrew Roy

Andrew Roy

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on behalf of the "Aviation Community" (organizations on next page)

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<sup>14</sup> See Letter of Edward A. Yorkgitis, Jr., Counsel to Collins Aerospace, to Marlene Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Aug. 10, 2021) at 5. See also Letter of Karina Perez Molina, Director, Unmanned and Emerging Aviation Technologies, AIA, to Marlene Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Aug. 27, 2021) at 3.

### **Member Organizations of the “Aviation Community”**

Aerospace Industries Association	Experimental Aircraft Association
Air Line Pilots Association, International	FreeFlight Systems
Aircraft Owners and Pilots Association	Garmin International, Inc.
Airborne Public Safety Association	General Aviation Manufacturers Association
Airbus	Helicopter Association International
Aircraft Electronics Association	Honeywell International Inc.
Airlines For America	International Air Transport Association
Aviation Spectrum Resources Inc.	National Air Carrier Association
Boeing	National Business Aviation Association
Cargo Airline Association	Regional Airline Association
Collins Aerospace	

## **Annex A: Information Needed from the Commission and the 5G Community**

The Aviation Community requests detailed information and parameters on the following questions, in a manner that can be applied to all current and future operators in the 3.7-3.98 GHz band. Given the range of operations allowed under the flexible use licenses, and the differences in parameters provided in the current docket, for each parameter it is requested the following details be provided:

- Clarification that the parameters provided are for the worst case (such as >99th percentile).
- If there are differences between each operators' implementation, it is requested these differences be clarified and a means be provided for the Aviation Community to identify and assess against these different operations (such as identifying the worst case across all 5G operators, or an alternative means).
- What assurance levels are provided for each parameter? Is there an integrity level that all operators must meet, and what measures are put in place by operators for proper equipment maintenance to ensure Base Stations and UEs continue to operate and transmit within the required parameters?
- Are any parameters subject to change as the networks and technology mature, and if so, how long are the current parameters valid, and what is likely to change?<sup>15</sup>
- Lastly, where are all the parameters (and the associated information requested above) codified for U.S. 5G operators, or how they should be? For example, if all flexible use licensee operators are complying with 3GPP specifications, why should these not be codified within the FCC rules or license conditions, including specific options such as waveform or base station classifications?

### **Base stations**

- What are the maximum spurious emissions at the transmitter output, accounting for all factors including phase noise, harmonics, etc. in 4.2-4.4 GHz band assuming a maximum network loading factor?
- What are the maximum possible main beam up-tilt or the maximum limit for the vertical electrical scan above the horizon of 5G base station Advanced Antenna System ("AAS") antennas across all manufacturers and operators?
  - Are there any "built in" limits (software, physical, electric) implemented in the AAS antennas to restrict the main beam above the horizon? For example, where the main beam might be directed upward to serve UE inside a building which is higher than the antenna base station, or in the case of an aircraft crossing that main beam with active UEs onboard?
  - Under the above scenarios, how much EIRP power is directed above the horizon by the main beam and side/grating lobes?
- Is there a minimum scan loss of 5G base station AAS antennas across all manufacturers and operators?

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<sup>15</sup> Aviation systems can have a 30- to 50-year lifecycle, so defining future RF environments are critical to aviation industry safety and stability.

- Is there a 5G statistical representative model that would offer a power flux density at each point in space and that would consider several base stations and a Cumulative Distribution Function bounding that covers the range of 1e-5 to 1e-9 cut off levels?
  - Would it be possible to have such a 5G statistical representative model defined for an airport operating within each of the urban, suburban, and rural environments?
  - What are the configurable parameters (such as antenna element numbers, etc.) of such a model and which values have been selected?
- The data exchange in the 2020 TWG-3 gave a reference to Recommendation ITU-R M.2101-0 as an appropriate model for 5G AAS antennas.<sup>16</sup> Recently, there has been information of a potential new update of the ITU-R M.2101-0, with measurements for the AAS antennas model validation that exhibit higher power side and grating lobes than the ITU-R M.2101-0 model.<sup>17</sup> In addition, the measurements also suggest some adjustments regarding the 5G Base Stations AAS elements assumptions (sub-array).
  - Is the use of AAS antenna models from ITU-R M.2101-0 correct, or should the draft measured data being considered at the ITU-R be used?
  - To increase the fidelity and the validation of the ITU-R M.2101-0, what are all potential scan angles, especially scan angles above the horizon, when the main beam is directed above the horizon?
- If operators are going to deploy in compliance with 3GPP specifications, which specific parameters are they going to use within that specification? For example, TM1.1 signals, Cat A or B base stations, etc.
  - Are any non-3GPP compliant operators expected within the band, and if so, what are their system parameters?

## UEs

- What are the maximum spurious emissions in 4.2-4.4 GHz band for UEs?
- When UEs do operate onboard an aircraft in an accidental manner, what aggregate emissions levels can be expected?

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<sup>16</sup> MSG Report, Appendix B at 144.

<sup>17</sup> See Report on the 38th meeting of ITU-R Working Party 5D (e-Meeting, 7-18 June 2021), Chapter 4 - Annex 4.6 - Working document towards a preliminary draft new Report ITU-R M.[IMT.AAS] - Measurements and mathematical modelling of Advanced Antenna Systems (AAS) in IMT-2020 systems. See also Report on the 39th meeting of Working Party 5D (e-Meeting, 4-15 October 2021), Chapter 2 - Annex 2.24.8 - Detailed workplan for ITU-R Report on Advanced antenna system (AAS) pattern for sharing studies between IMT-2020 systems and other services.