

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

In the Matter of

Expanding Access to Broadband and Encouraging Innovation through Establishment of an Air-Ground Mobile Broadband Secondary Service for Passengers Aboard Aircraft in the 14.0-14.5 GHz Band )  
GN Docket No. 13-114  
RM-11640

To: The Commission

**COMMENTS OF  
THE BOEING COMPANY**

The Boeing Company (“Boeing”) provides these comments in response to the Commission’s Notice of Proposed Rulemaking (“NPRM”) on establishing an air-ground mobile broadband service in the 14.0-14.5 GHz band.<sup>1</sup> As both an operator of in-flight broadband satellite services and a world-leading manufacturer of aircraft, Boeing has serious concerns about the interference protection assurances and the technical viability of the proposed service.

Boeing relies on the 14.0-14.5 GHz Earth-to-space uplink band to provide in-flight broadband via the Earth Stations Aboard Aircraft (“ESAA”) service in support of critical communications involving the highest levels of the federal government.<sup>2</sup> Although Qualcomm pledges to protect the primary Fixed Satellite Service (“FSS”) in the band, ESAA remains a secondary service and thus must be elevated to full primary status before a new and potentially

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<sup>1</sup> Expanding Access to Broadband and Encouraging Innovation through Establishment of an Air-Ground Mobile Broadband Secondary Service for Passengers Aboard Aircraft in the 14.0-14.5 GHz Band, *Notice of Proposed Rulemaking*, FCC 13-66 (May 9, 2013) (“NPRM”)

<sup>2</sup> Boeing currently operates its ESAA service pursuant to a Commission experimental license, but intends to seek a formal ESAA authorization once the new ESAA application and service rules come into effect.

interfering secondary service can be considered. Beyond the need for protection of ESAA specifically, myriad inaccurate assumptions and unreasonably optimistic estimates in the technical record leave serious doubt as to whether the proposed air-ground service will protect existing and future FSS from harmful interference.

Second, Boeing is a world leader in the manufacture of commercial jet aircraft. As a manufacturer, Boeing strives to ensure the reliable performance of all aircraft, components, and communications systems that it delivers to its customers. The current record indicates a significant risk that the proposed air-ground mobile system will be unable to operate effectively as an unprotected secondary service in the intensively-used 14.0-14.5 GHz band. The uncertainty created by customer requests to install what may prove to be an unworkable communications system would harm Boeing's customers and Boeing's relationship with its customers. Boeing therefore urges the Commission not to adopt this service without further in-depth review of Qualcomm's assumptions and claims, and in any case to take no further action until ESAA is fully primary.

**I. THE COMMISSION MUST ENSURE THAT ESAA AND OTHER FSS SERVICES ARE FULLY PROTECTED BEFORE AUTHORIZING A NEW AIR-GROUND SERVICE IN THE 14.0-14.5 GHZ BAND**

As Boeing has expressed at length in prior proceedings, the Commission should not introduce a new service into an intensively-used spectrum band without first ensuring that all existing services will be protected.<sup>3</sup> At present, the ESAA service operates as an application of the FSS service on a secondary, unprotected basis in the 14.0-14.5 GHz Earth-to-space

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<sup>3</sup> Comments of The Boeing Company, RM-11640, at 2 (July 31, 2012).

communications band.<sup>4</sup> Thus, it is premature to introduce a new secondary service in the band. Furthermore, there remain serious questions as to whether the air-ground mobile service as described will protect primary FSS services as claimed. The Commission should therefore postpone further action on the proposed service until it has established that FSS will be protected and, in any case, should not do so until ESAA has been elevated to full primary status in the 14.0-14.5 GHz Earth-to-space band.

**A. The Commission Should Elevate ESAA to Full Primary Status Prior to Introducing New Services in the Intensively Used 14.0-14.5 GHz Band**

Qualcomm’s claims that its proposed service will protect primary FSS services have little relevance to ESAA as long as it remains a secondary service. Under the proposed rules, “[a]ir-ground mobile would be required to protect *primary* FSS in the band from harmful interference.”<sup>5</sup> The NPRM explains that “[t]he goal of these technical rules is to ensure that any air-ground mobile broadband system that we may authorize in the 14.0-14.5 GHz band will not cause harmful interference to FSS systems.”<sup>6</sup> The Commission has also acknowledged that “the mobility and ubiquity of FSS earth stations in the band necessitate great caution in preventing harmful interference.”<sup>7</sup> Nonetheless, ESAA—the “third leg”<sup>8</sup> of the mobile FSS triad—remains a

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<sup>4</sup> Revisions to Parts 2 and 25 of the Commission’s Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations perating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands, *Notice of Proposed Rulemaking and Report and Order*, FCC 12-161, ¶¶ 2, 142 (2012) (“*ESAA Order*”).

<sup>5</sup> *NPRM*, ¶ 1 (emphasis added).

<sup>6</sup> *Id.*, ¶¶ 8, 27.

<sup>7</sup> *Id.*, ¶ 27.

<sup>8</sup> *ESAA Order*, ¶ 2.

secondary service in the 14.0-14.5 GHz Earth-to-space band.<sup>9</sup> The Commission has already concluded that co-primary status would be inappropriate for air-ground mobile and FSS.<sup>10</sup> The current proposal with air-ground service as a *de facto* co-secondary service with ESAA is likewise inappropriate. Unless and until ESAA is elevated to primary status in the band, ESAA operators would have no claim of interference protection in the critical uplink portion of the ESAA service, seriously compromising its value as a two-way communications system.

As Boeing has explained previously, prompt elevation to full primary status is necessary to provide existing operations a stable and predictable regulatory operating environment that will validate current investment and encourage further investment.<sup>11</sup> Several commenters previously have urged the Commission not to address the possibility of a new air-ground mobile service until it had “resolved” the issue of service rules and status of ESAA.<sup>12</sup> Because ESAA remains a secondary service in the critical 14.0-14.5 GHz Earth-to-space uplink band and the Commission’s proposed rulemaking on elevating ESAA remains pending, the Commission has not yet “resolved” the issue. The Commission should promptly issue an order establishing ESAA as a fully primary service and convert all existing licenses to full primary status, and in any event should not proceed further with the instant NPRM until the primary status of ESAA has been fully resolved.

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<sup>9</sup> *Id.*, ¶ 142.

<sup>10</sup> *NPRM*, ¶ 27.

<sup>11</sup> Comments of The Boeing Company, IB Docket No. 12-376, at 5 (May 22, 2013).

<sup>12</sup> *NPRM*, ¶ 23 (citing comments of The Boeing Company, Panasonic Avionics Corporation, and Row 44, Inc.)

**B. The Record Indicates that the Proposed Air-Ground System Poses Significant Risk of Harmful Interference to FSS Operations in the 14.0-14.5 GHz Band**

Boeing and other parties have previously explained that the data provided by Qualcomm thus far is not sufficient to show that the proposed air-ground service will protect primary FSS operations.<sup>13</sup> SIA has filed a comprehensive technical analysis that casts serious doubt on whether the air-ground service as describe would adequately protect FSS.<sup>14</sup> Boeing supports SIA's analysis and highlights several points of concern.

First, the proposed rules would permit interference from the air-ground service to cause an aggregate rise over thermal delta T/T (" $\Delta T/T$ ") of up to one percent.<sup>15</sup> As the Commission notes, however, ITU-R Recommendation S.1432 specifies that one percent of  $\Delta T/T$  is the recommended total for *all* sources of interference to FSS from non-primary services.<sup>16</sup> Qualcomm nonetheless proposes a service that could consume this entire interference budget,<sup>17</sup> without accounting for potential interference from existing and future services such as the Tracking and Data Relay Satellite System ("TDRSS") and the secondary mobile satellite allocation.<sup>18</sup> SIA instead proposes that the air-ground service rules should limit  $\Delta T/T$  to no more than 0.33 percent, so that when combined with other actual and potential non-primary interferers

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<sup>13</sup> See, e.g., Comments of the Satellite Industry Association, RM-11640 at 11-12 (filed July 16, 2012) ("*SIA Petition Comments*"); Comments of Row 44, RM-11640 at 5-6 (filed July 16, 2012).

<sup>14</sup> *Comments of SIA*, Technical Annex at Sections A.2 and A.3 (filed Aug. 25, 2013) ("*SIA Comments*").

<sup>15</sup> *NPRM*, ¶ 103.

<sup>16</sup> *Id.*, ¶ 162.

<sup>17</sup> Petition for Rulemaking of Qualcomm Incorporated, RM-11640, Appendix B at B-2 (July 7, 2011) ("*Qualcomm Petition*").

<sup>18</sup> See 47 C.F.R. §2.106, Table of Frequency Allocations.

in the band, primary FSS users can be confident that there will be, at most, an aggregate  $\Delta T/T$  of one percent from all non-primary sources.<sup>19</sup> Such a limitation is more in keeping with ITU recommendations and should not be difficult if Qualcomm's service can in fact achieve its claims of a  $\Delta T/T$  that is "significantly less than the levels that adjacent satellites are allowed."<sup>20</sup>

Second, the proposed rules are based on Qualcomm's assumption that the average FSS satellite receiver gain-to-noise temperature (G/T) is 2.0 dB/K for Ku-band satellite receivers.<sup>21</sup> This assumption significantly underestimates the sensitivity of modern geostationary ("GSO") FSS satellites and thus their potential to receive harmful interference from air-ground operations. As SIA explains, a more accurate average G/T is 6 dB/K, meaning that the proposed EIRP density limits from air-ground service base stations and aircraft must be correspondingly reduced. For reasons such as these, the technical record does not indicate that the air-ground service as proposed will adequately protect primary FSS operations.

Third, the proposed "spatial diversity" may still result in significant interference into FSS operations under various circumstances. Boeing uses the 14.0-14.5 GHz band for tracking, telemetry, and command ("TT&C") and testing during transfer orbits of its satellites. As SIA notes, transfer orbit operations involve non-geostationary orbits, which could significantly increase the potential interference from air-ground sources because they reduce the special diversity between air-ground base station transmissions and FSS satellites during transfer orbit.<sup>22</sup> In this regard, Boeing's newest satellite design, the 702SP, employs an electric xenon ion

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<sup>19</sup> *SIA Comments* at Section III.B.

<sup>20</sup> *See e.g. Qualcomm Petition*, Appendix A at A-10, A-17.

<sup>21</sup> *NPRM*, ¶ 101, Table 1.

<sup>22</sup> *SIA Comments* at Section V.A.

propulsion system capable of significantly extended mission duration. These systems require increased time to complete transfer orbits, further elevating concern about interference during these operations.

Certain atmospheric conditions may also increase interference potential in spite of the proposed spatial diversity. As the Commission acknowledges, the 14.0-14.5 GHz band is susceptible to rain fade, which produces scattering of radiofrequency signals that could affect total signal energy toward the GSO arc.<sup>23</sup> Despite the north-facing ground stations, atmospheric conditions could result in re-direction of significant amounts of energy via reflection from, for example, ice crystals and snowflakes.<sup>24</sup> Boeing therefore urges the Commission not to proceed further until the proposal is based on accurate and reasonable technical assumptions.

## **II. THE COMMERCIAL AVIATION INDUSTRY AND CONSUMERS WOULD BE HARMED IF A NEW AIR-GROUND SERVICE THAT CANNOT PERFORM RELIABLY WERE AUTHORIZED**

In addition to Boeing's role as an operator of a mission-critical ESAA network, Boeing is also one of the world's leading aircraft manufacturers. As a manufacturer, Boeing seeks to ensure the reliable performance of its aircraft, including the components and communications systems that it installs in its aircraft. Boeing is very concerned that, as a result of this proceeding, it may be asked by its airline customers to equip aircraft with an air-ground mobile broadband system that may not work as claimed. The uncertainty created by a poorly-considered new service would negatively affect Boeing's airline customers and their passengers as well as Boeing's relationship with those customers.

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<sup>23</sup> *Id.*, ¶ 115.

<sup>24</sup> Comments of Row 44, RM-11640, IB Docket No. 05-20, at 5 (filed July 16, 2012) (citing S.Y. Matrosov, "Radar Reflectivity in Snowfall," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 30, No. 3, at 454-61 (May 1992)).

It would be exceedingly expensive to include hardware for new air-to-ground communications systems on aircraft only to be forced to modify or remove the hardware later due to poor performance. The aviation industry has historically shown great caution in incorporating new technologies on commercial aircraft and the Commission should exercise this same level of caution in this proceeding.

To secure access to the intensively-used 14.0-14.5 GHz band, Qualcomm has made highly optimistic claims regarding the ability of the proposed air-ground service to operate on a secondary, unprotected basis in the presence of ubiquitous FSS operations.<sup>25</sup> In response to these claims, the Commission has explicitly foreclosed the possibility of future elevation of Qualcomm's service to primary status should users of the service find the claims unworkable in practice.<sup>26</sup> The record also suggests that operation of the proposed service within the constraints of secondary status could easily fall far short of user expectations with regard to data throughput rate, number of aircraft served simultaneously, and geographic operating area. These limitations may compromise the commercial viability of the service. The combination of these technical, regulatory, and economic risks pose a serious concern for Boeing as an aircraft manufacturer and systems integrator with respect to ensuring the reliability of the products it delivers to customers.

The Commission has previously denied petitions for rulemaking for new services based on such concerns. Most recently, the Commission observed that the petition of UTC-Winchester "makes assumptions about allocations, licensing and system operation that are not fully

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<sup>25</sup> *NPRM*, ¶ 27 (citing Qualcomm Petition at 17-18; *NPRM* Section IV.H.12).

<sup>26</sup> *Id.*

explained and that appear to rely on incorrect premises.”<sup>27</sup> In particular, because the petitioners had not adequately addressed the potential for intense and unpredictable harmful interference from primary services, the Commission concluded that the new proposed service was not viable in the band.<sup>28</sup>

Boeing and SIA have brought to the Commission’s attention myriad similar inappropriate assumptions and incorrect premises that represent significant risks to the technical and commercial viability of the proposed air-ground service.<sup>29</sup> The extraordinary expense and inconvenience of refitting aircraft due to a communications service that does not work as claimed would harm Boeing’s airline customers and Boeing’s relationship with those customers. Boeing therefore urges the Commission not to authorize the new service until it is able to resolve these persisting technical concerns.

### **III. CONCLUSION**

Any new secondary services contemplated in an intensively-used band must be carefully considered and designed to ensure both that they protect existing and future primary uses of the band and that they can reliably operate under the constraints of unprotected secondary status. The technical record of the current proceeding does not indicate that the proposed air-ground service will be able to accomplish either of these requirements.

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<sup>27</sup> Utilities Telecom Council and Winchester Cator, LLC Petition for Rulemaking to Establish Rules Governing Critical Infrastructure Industry Fixed Service Operations in the 14.0-14.5 GHz Band, *Order*, FCC 13-1093, ¶ 4 (2013).

<sup>28</sup> *Id.*, ¶ 10.

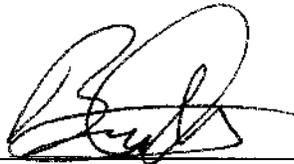
<sup>29</sup> Letter from Patricia Cooper, President, SIA, to Marlene H. Dortch, Secretary, Federal Communications Commission, RM-11640, at 4 (May 2, 2013); Comments of The Boeing Company, RM-11640 at 4-6 (July 31, 2012).

The newest and fastest-growing mobile FSS service, ESAA, currently remains unprotected and could suffer significant interference from the introduction of a new air-ground service. Beyond ESAA, Boeing has serious concerns about the validity of the assumptions upon which Qualcomm bases its claims that the proposed service will protect existing and future FSS services. Finally, the viability of the proposed air-ground service is highly questionable given the level of harmful interference that it will experience from ubiquitous primary FSS operations, and such an unworkable system could harm both FSS operators and the aviation industry. Boeing therefore urges the Commission not to adopt this service without further in-depth review of Qualcomm's assumptions and claims, and in any case to take no further action until ESAA is fully primary.

Respectfully submitted,

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