

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

In the Matter of)	
)	
Recommendations Approved by)	IB Docket No. 16-185
World Radiocommunication Conference)	
Advisory Committee)	

**JOINT COMMENTS OF ELEFANTE GROUP, INC. AND
LOCKHEED MARTIN CORPORATION, SUPPORTING THE TECHNOLOGIES OF
ELEFANTE GROUP, INC., ON THE VIEWS REGARDING AGENDA ITEM 1.14**

Scott A. Kotler
Director, Technical Regulatory Affairs
Trade & Regulatory Affairs
LOCKHEED MARTIN CORPORATION
2121 Crystal Drive
Suite 100
Arlington, VA 22202
(703) 413-3102

Edward A. Yorkgitis, Jr.
J. Bradford Currier
KELLEY DRYE & WARREN, LLP
3050 K Street, NW
Suite 400
Washington, DC 20007
(202) 342-8540

Counsel to Elefante Group, Inc.

Chris DeMarche
Chief Operating Officer
ELEFANTE GROUP, INC.
4725 South Monaco Street
Suite 330
Denver, CO 80237

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Elefante Group, Inc. (“Elefante Group”) and Lockheed Martin Corporation (“Lockheed Martin”), supporting the technologies of Elefante Group, hereby respond to the Commission’s October 3, 2018, Public Notice seeking comments on the draft recommendations of the World Radiocommunication Conference Advisory Committee (“WAC”) provided for Commission consideration on Agenda Items that will be considered by the 2019 World Radiocommunication Conference (“WRC-19”).¹

I. INTRODUCTION AND SUMMARY

Elefante Group and Lockheed Martin (collectively, the “Joint Commenters”) limit their comments to Views A through D on Document WAC/065, which deals with Agenda Item 1.14 (“AI 1.14”).² AI 1.14 is examining certain new designations in the International Telecommunication Union (“ITU”) Table of Frequency Allocations (“ITU Table”) for high altitude platform stations (“HAPS”) in Region 2, namely the 21.4-22.0 and 24.25-27.50 GHz

¹ *International Bureau Seeks Comment on Recommendations Approved by World Radiocommunication Conference Advisory Committee*, IB Docket No. 16-185, DA 18-1017 (Oct. 3, 2018) (“*Public Notice*”).

² *See Public Notice* at Attachment A, Draft Proposals presented at October 1, 2018 Meeting of the World Radiocommunication Conference Advisory Committee, Document WAC/065 (01.10.18) (“WAC/065”).

ranges (the “21 GHz Band” and “25-26 GHz Band,” respectively) as well as a global designation for HAPS at 38.0-39.5 GHz (the “38 GHz Band”). The Joint Commenters submit, as described herein, that the United States should adopt the positions in View C with respect to HAPS uplinks in the 21.5-22.0 GHz band, and with regard to HAPS downlinks in the 25.25-27.50 GHz band.³ As discussed herein, the Joint Commenters submit that Views A, B, and D can be reconciled with View C, which Lockheed Martin submitted in support of the technologies of Elefante Group. The Joint Commenters do not offer comments here on additional designations in the foregoing bands providing for HAPS operation in the opposite directions – HAPS downlinks in the 21 GHz Band, and HAPS uplinks in the 25-26 GHz Band – as discussed in View A.⁴

The Joint Commenters also provide comments on the draft proposals for No Change to the frequency allocations in the ITU Table that have been provided to the Commission by the National Telecommunications and Information Administration (“NTIA”) on AI 1.14 concerning the 21 GHz and 25-26 GHz Bands.⁵ In light of the compatibility between HAPS in the 21 and 25-26 GHz Bands and the Earth Exploration-Satellite Services (“EESS”) and Space Research Services (“SRS”) operating in adjacent or nearby frequencies, the Joint Commenters demonstrate

³ See WAC/065, View C.

⁴ The Joint Commenters also have no comment on the Views with regard to the 6, 24, 28, 31, 38, 47, and 48 GHz Bands (collectively, the “Other Bands”), *see, e.g.*, WAC/065, View A, which addresses the Other Bands in addition to the 21 and 25-26 GHz Bands, other than to assert that the language that is ultimately adopted to ensure compatible operations of the Fixed and Mobile Services in the range 25.25-27.50 GHz should be equally applied to the regulatory provisions with regard to Fixed or Mobile operations in these Other Bands. The 6 GHz Bands are the 6440-6520 and 6560-6640 MHz bands, the 24 GHz Band is the 24.25-25.25 GHz band, the 28 GHz Band is the 27.9-28.2 GHz Band, the 31 GHz Band is the 31.0-31.3 GHz band, the 47 GHz Band is the 47.2-47.5 GHz band, and the 48 GHz Band is the 47.9-48.2 GHz band.

⁵ See *Public Notice* at Attachment B, Draft Proposals formulated and Approved within the National Telecommunications and Information Association, Document WAC/061 (16.08.18) (“*NTIA Proposals*”).

that, rather than “No Change” as proposed by NTIA, the U.S. position should be a designation of the 21 GHz and 25-26 GHz Bands for HAPS in Region 2.

II. DISCUSSION

A. Document WAC/065 View A (supported by Facebook and Loon, LLC (“Loon”))

1. 21 GHz Band

The HAPS System 6 characteristics included as part of the Chairman’s Report contemplate that HAPS systems may operate in both the uplink and downlink direction in the 21 GHz and 25-26 GHz Bands.⁶ Nonetheless, the language in View A regarding the 21 GHz Band is limited to the platform-to-ground direction in its proposed footnote 5.B114 to the ITU Table.⁷ (View C, supported by the Joint Commenters, as discussed below, advocates for a position recognizing uplink operation of HAPS in the band.) The accompanying proposed regulatory text in View A is silent on the potential of using the 21 GHz Band in the *uplink* direction.⁸ View A is similarly silent on sharing HAPS with federal services, such as the aeronautical mobile services (“AMS”), which operate below 21.5 GHz. The proposed DRAFT NEW RESOLUTION [B114] in View A does include regulatory provisions for technical compatibility of HAPS *downlink* operations with EESS (passive) operations in the 21.2-21.4 or 22.21-22.50 GHz bands.⁹

⁶ See ITU, Radiocommunication Study Groups, WRC-19 Agenda Item 1.14, Annex 14 to Document 5C/531-E, Annex 14 to Working Party 5C Chairman’s Report, Preliminary Draft New Recommendation/Report ITU-R F. [Broadband HAPS Characteristics], Deployment and technical characteristics of broadband high altitude platform stations in the bands 6440-6520 MHz, 6560-6640 MHz, 21.4 22.0 GHz, 24.25-27.5 GHz, 27.9-28.2 GHz, 31.0-31.3 GHz, 38.0 39.5 GHz, 47.2-47.5 GHz and 47.9-48.2 GHz to be used in sharing and compatibility studies (June 5, 2018) (“*Chairman’s Report Annex 14*”).

⁷ See WAC/065, View A, Section 2, *add* USA/1.14/7.

⁸ *Id.*

⁹ See WAC/065, View A, DRAFT NEW RESOLUTION [B114], *resolves* 2.

Because View A does not consider the *uplink* direction in the 21 GHz Band, not only does View A not include enabling regulatory language for HAPS uplinks in the band, but it also does not include sharing constraints with other services in DRAFT NEW RESOLUTION [B114]. View A's DRAFT NEW RESOLUTION [B114] does not include the necessary regulatory provisions that provide for technical compatibility between HAPS uplinks and other services, including EESS and SRS adjacent to the band (*e.g.*, 21.2-21.4 GHz and 22.21-22.50 GHz) and Radio Astronomy Service ("RAS") operations in the near-adjacent 22.21-22.50 GHz band. View C, discussed below, supported by the Joint Commenters, complements View A by providing the discussion and regulatory text for HAPS operation in the uplink direction in the 21 GHz Band to accommodate differing HAPS configurations than those accounted for in View A.¹⁰

2. 25-26 GHz Band

a. Compatibility with EESS/SRS

In View A, Facebook/Loon does not consider *downlink* operations in the 25.25-27.00 GHz sub-band in its proposed footnote 5.D114 to the ITU Table.¹¹ View A proponents suggest that this was done with the intention of providing protection for NASA and NOAA EESS/SRS earth station receivers operating in the band by excluding transmissions in the same direction, *i.e.*, platform-to-ground transmissions, in this sub-band.¹²

However, compatibility between HAPS downlinks and these earth station receivers does not require the exclusion of platform-to-ground operations in the 25.25-27.00 GHz range. Not

¹⁰ See *infra* Section II.C.1.

¹¹ See WAC/065, View A, Section 3, *add* USA/1.14/12.

¹² *Id.*

only are these earth stations deployed at known locations, making compatibility something that the Joint Commenters submit can be readily achieved in the deployment of HAPS and HAPS ground terminals, but HAPS downlinks and these earth stations can be coordinated using the threshold criteria included in ITU studies. In short, the regulatory means exist for permitting platform-to-ground links in the sub-band. View A would thus exclude downlink operations in the 25.25-27.00 GHz band unnecessarily.

The Joint Commenters propose instead, as set out in View C, that View A be augmented by permitting downlinks in the sub-band subject to adding the necessary coordination threshold criteria to proposed *resolves* 8 of View A's DRAFT NEW RESOLUTION [C114].¹³ The language provided in View C will ensure the compatibility of HAPS downlink operations and EESS/SRS services in the 25.25-27.00 GHz sub-band and should be adopted by the United States.

b. Compatibility with Fixed Service

In addition, Facebook/Loon propose a power flux density ("pfd") level in *resolves* 1 of DRAFT NEW RESOLUTION [C114] of View A applicable in those portions of the 25-26 GHz Band they consider for HAPS in the platform-to-ground direction to ensure HAPS system compatibility with Fixed Services in neighboring administrations based on a probability of exceedance of no more than 0.0001% in a study annexed to the May 2018 Chairman's Report.¹⁴

¹³ WAC/065, View A, DRAFT NEW RESOLUTION [C114], *resolves* 8.

¹⁴ WAC/065, View A, DRAFT NEW RESOLUTION [C114], *resolves* 1. See ITU, Radiocommunication Study Groups, Annex 17 to Document 5C/531-E, Annex 17 to Working Party 5C Chairman's Report, Preliminary Draft New Report ITU-R F. [HAPS-25GHZ], Sharing and compatibility studies of HAPS systems in the 24.25-27.5 GHz frequency range, Attachment 1, Figure 3 (June 6, 2018) ("*May 2018 Chairman's Report*"). The proposed mask includes all Monte Carlo cases to -60 dB probability, corresponding to 0.0001% probability.

As discussed *infra* in Section II.C.2, the Joint Commenters explain why this mask should be modified to use a more reasonable exceedance factor of 0.01%.¹⁵

Additionally, while the Joint Commenters' View C also utilizes a similar mask with regard to the Fixed Services throughout the 25-26 GHz Band, View A fails to provide administrations flexibility in its regulatory language to allow systems other than those envisioned by the System 6 characteristics to allow for deployment of systems that differ from or are more technologically advanced than were envisioned within the System 6 reference design characteristics, which were first defined some time ago.¹⁶

To address this, View C includes language that would allow administrations to make the demonstration that another, alternative pfd mask will ensure compatibility.¹⁷ The View C approach promotes a wider variety of HAPS systems (and alternative masks) while still ensuring compatible operations with any Fixed Service in the territory of neighboring administrations. The View C language ensures that administrations seeking to enable HAPS deployment can either rely on the provided pfd mask effectively as a regulatory safe harbor, to ensure compatibility with Fixed Services in a neighboring administration or make a demonstration that an alternative mask achieves the same results as the safe harbor mask, which would advance the objective of maximizing efficient spectrum use by HAPS and Fixed Services alike in accommodation with a neighboring administration. Accordingly, the Joint Commenters support a result where the pfd mask operates as a safe harbor to ensure that neighboring administrations

¹⁵ For similar reasons, the downlink mask in View A for the 21 GHz Band should be modified in the same way.

¹⁶ See *Chairman's Report Annex 14* at Annex 2.

¹⁷ See *infra* Section II.C.2.

have a fallback baseline pfd on which HAPS systems and Fixed Service operators can rely without precluding other technically supportable solutions.

c. Compatibility with Mobile Service

Facebook/Loon propose a pfd level in *resolves* 2 of DRAFT NEW RESOLUTION [C114] for ensuring compatibility of HAPS downlinks with any terrestrial mobile services operating in the 25-26 GHz Band.¹⁸ The comments the Joint Commenters make immediately above regarding the regulatory language and pfd for compatible operations between HAPS downlinks and Fixed Services apply equally here as well. In View C, language is provided ensuring that administrations seeking to enable HAPS deployment can either rely on the given mask to ensure that HAPS will not cause harmful interference into Mobile Services deployed in the 25-26 GHz Band in a neighboring administration or demonstrate that an alternative mask would achieve the same effect as the safe harbor mask and reach an accommodation with its neighboring administration with the objective of maximizing efficient spectrum use by HAPS and Mobile Services alike.¹⁹

Finally, as noted earlier, the Joint Commenters have no comments on View A proposals respecting the 6, 24, 28, 31, 38, 47, and 48 GHz Bands, with one exception. The Joint Commenters urge that the language that is ultimately adopted to ensure compatible operations of HAPS with the Fixed and Mobile Services in the 25.25-27.50 GHz range should be equally

¹⁸ WAC/065, View A, DRAFT NEW RESOLUTION [C114], *resolves* 2.

¹⁹ The Joint Commenters submit that the HAPS downlink pfd compliance equation in both Views A and C should properly remove the rain fade factor. As explained in the *Chairman's Report Annex 14*, due to additional propagation impairments in the main beam of the HAPS due to rain, the pfd mask for the HAPS downlink can be increased through automatic transmitter power control ("ATPC") in the corresponding beam by a value equivalent to the level of rain fading but limited to a maximum of 20 dB. See *Chairman's Report Annex 14* at Annex 6; see also discussion in Section C.2, *infra*.

applied to the regulatory provisions concerned with ensuring compatibility of HAPS systems with Fixed and Mobile operations in these Other Bands.

B. Document WAC/065 View B (supported by CTIA *et al.*)

1. 25-26 GHz Band

The mobile industry proponents supporting View B seek to demote the potential regulatory status of HAPS applications using the existing Fixed Services allocations (which are co-primary) in its draft footnote 5.D114 to the ITU Table by including language that *future* services in the frequency range 25.25-27.50 GHz shall not be constrained by HAPS.²⁰ While certain specific constraints are appropriate to ensure that continued deployment of existing services under existing allocations do not experience harmful interference – EESS/SRS, for example – the same is not true for all services in the band. Other services that, like HAPS, are seeking to identify spectrum for applications at WRC-19 in the 25-26 GHz Band – for example, IMT-2020 Mobile Services – should not be entitled to such a constraint because it would promote one new technology within co-primary services over another. In addition, such a constraint would dissuade HAPS deployment, which can be implemented compatibly with incumbent services. The Joint Commenters submit that the ITU Table designations should not take such approaches as View B advocates, leaving such matters for national administrations to determine. Therefore, the proposed language in View B’s draft footnote 5.D114 to the effect that the future development of services in other allocations shall not be constrained by HAPS should be removed or, alternatively, limited to HAPS not constraining continued deployment of EESS/SRS that is otherwise consistent with the Radio Regulations.

²⁰ WAC/065, View B, Broadband HAPS Applications, *add* USA/1.14/12.

a. Compatibility with Fixed Service

Mobile industry proponents in DRAFT NEW RESOLUTION [C114] use a similar mask to that of Facebook/Loon discussed above for ensuring that the Fixed Service does not suffer harmful interference from HAPS 25-26 GHz Band downlinks in draft *resolves* 1.²¹ As noted earlier, the Joint Commenters propose a modification to the mask in Section II.C.2 of these comments to incorporate a more reasonable percentage exceedance factor. Additionally, the same observations and suggested changes the Joint Commenters made on View A draft *resolves* 1 above apply here with regard to the regulatory language that precedes the pfd mask in View B conferring flexibility.²² Specifically, as stated in View C and discussed below in Section II.C.2, the language should provide that administrations seeking to enable HAPS deployment can either rely on a pfd mask such as the 0.01% exceedance mask the Joint Commenters discuss in their comments on View C below as an effective safe harbor to ensure that HAPS will not cause harmful interference to Fixed Services deployed in the 25-26 GHz Band in a neighboring administration or make a demonstration that an alternative mask achieves a comparable measure of compatibility and reach an accommodation with its neighbor in good faith with the objective of maximizing efficient spectrum use by HAPS and Fixed Services alike.

However, unlike Views A or C, the mobile industry proposes in View B to remove the compliance equation, leaving it for each national administration to address within its own borders.²³ The Joint Commenters submit that removal of the compliance equation would be inappropriate. The purpose of the compliance equation in Views A and C is to ensure that the

²¹ WAC/065, View B, DRAFT NEW RESOLUTION [C114], *resolves* 1.

²² *See supra* Section II.A.2.b.

²³ *See* WAC/065, View B, DRAFT NEW RESOLUTION [C114], *resolves* 1.

Fixed Service in *neighboring* administrations does not encounter harmful interference from HAPS (not for individual national administrations to be bound to in their own domestic regulatory frameworks). Moreover, inclusion of a compliance equation will remove uncertainties as to what parameters HAPS may choose to adhere to while satisfying the necessary regulatory provisions of one administration on the territory of another. Without a compliance equation in DRAFT NEW RESOLUTION [C114] in View B, a bilateral agreement would be necessary on a compliance formula, even if a pfd mask is considered acceptable to the administration planning to deploy HAPS. Consequently, the Joint Commenters submit that the U.S. position should include a compliance equation, augmented with the regulatory language permitting other demonstrations of a pdf mask as set forth in View C.

b. Compatibility with Mobile Service

Mobile industry proponents in DRAFT NEW RESOLUTION [C114] contained within View B seek to use a modified HAPS downlink pfd mask for ensuring that the Mobile Service does not receive harmful interference from HAPS.²⁴ However, like its pfd mask to ensure compatibility of HAPS with Fixed Services, View B eliminates the compliance equation with regard to HAPS-Mobile Services compatibility.²⁵ The Joint Commenters do not oppose the modified pfd mask provided the compliance equation from View C is added for the reasons indicated above. Also, View B's DRAFT NEW RESOLUTION [C114] does not include the necessary accommodating regulatory language for the Mobile Service permitting demonstration of comparable compatibility discussed above with regard to View A and View B with the Fixed Service.

²⁴ WAC/065, View B, DRAFT NEW RESOLUTION [C114], *resolves* 2.

²⁵ *See id.*

Mobile industry proponents of View B propose that HAPS “shall not claim” protection from Fixed and Mobile Services in the 25.25-27.50 GHz band.²⁶ However, the Joint Commenters note that HAPS are an application of the Fixed Service. Having one application of an allocation being unable to claim protection of another application of the same allocation would create a preference for certain types of Fixed Service applications and technologies independent of the density of the deployment and impacts on other services. With regard to applying the “shall not claim” protection language from the Mobile Service, as noted above, both the Mobile and the Fixed Services are seeking designation of spectrum for applications in this band at WRC-19.²⁷ Such language, as proffered in View B, would promote one technology over another technology within a national administration, something which the ITU Table and footnotes should not presume to do. Therefore, the Joint Commenters do not support View B’s *resolves 3* in DRAFT NEW RESOLUTION [C114].

c. Compatibility with Other Services

The Joint Commenters also note that the mobile industry acknowledges in View B that its proposed regulatory framework in DRAFT NEW RESOLUTION [C114] is not a complete Resolution and is intended only to address particular aspects of the proposal in View A.²⁸ Consequently, View B’s DRAFT NEW RESOLUTION [C114], by itself, does not purport to provide the regulatory framework needed to ensure compatibility with the EESS/SRS, RAS, Inter-Satellite Service (“ISS”), or Fixed Satellite Service (“FSS”). View C, described below,

²⁶ WAC/065, View B, DRAFT NEW RESOLUTION [C114], *resolves 3*.

²⁷ *See supra* Section II.B.1.

²⁸ *See* WAC/065, View B, Introduction, *recognizing a* (“[T]he proposals in View B are provided as a subset of the document with revisions shown relative to View A.”).

fully addresses compatibility of HAPS downlinks in the 25-26 GHz Band with the other co-primary services.²⁹

Finally, as with View A, the Joint Commenters have no comments on View B's proposals respecting the 24, 28, 31, 38, 47, and 48 GHz Bands, except to reiterate that the language ultimately adopted to ensure compatible operations of HAPS with the Fixed and Mobile Services in the 25-26 GHz Band should be equally applied to the regulatory provisions regarding compatibility of HAPS systems with Fixed and Mobile operations in these Other Bands.

C. Document WAC/065 View C (supported by Lockheed Martin)³⁰

The Joint Commenters strongly support the inclusion of the regulatory framework in View C for the 21.5-22.0 and 25.25-27.50 GHz bands.³¹ View C's proposed footnotes 5.B114 and 5.D114 to the ITU Table would provide the necessary regulatory text to accommodate HAPS uplinks in the 21.5-22.0 GHz frequency band and HAPS downlinks in the 25.25-27.50 GHz frequency range.³² In that respect, View C complements View A to allow the fullest degree of flexibility in HAPS system deployments while supporting compatibility with and continued deployment of incumbent services.³³

In addition, View C lends itself to joinder with other Views on WAC/065. The regulatory framework provided for compatible HAPS operations in the 21.5-22.0 GHz band and

²⁹ See *infra* Section II.C.2.

³⁰ Lockheed Martin submitted this View in support of the technologies of Elefante Group.

³¹ See WAC/065, View C, DRAFT NEW RESOLUTION [B114], DRAFT NEW RESOLUTION [C114].

³² See WAC/065, View C, BROADBAND HAPS APPLICATIONS, *add* USA/1.14/2, USA/1.14/4.

³³ View A would provide for HAPS downlinks in the 21 GHz Band and HAPS uplinks in the 25.25-27.00 GHz sub-band. See *supra* Section II.A.

the 25.25-27.50 GHz frequency range can be either adopted independently or jointly with other provisions intended for HAPS in the reverse direction or in portions of these bands.

1. 21.5-22.0 GHz Band

As explained in View C, studies support a *primary* designation of HAPS in the ground-to-platform direction in the 21.5-22.0 GHz band with the appropriate constraints specified in *resolves* 1 through 3 of the proposed DRAFT NEW RESOLUTION [B114] to ensure compatibility with other services.³⁴ Proposed *resolves* 1 would ensure compatible operations of HAPS uplinks with out-of-band EESS passive services in the 22.21-22.50 GHz band.³⁵ The e.i.r.p. density limit for the 22.21-22.50 GHz band proposed in *resolves* 1 is based on studies that were prepared by NOAA and submitted by the United States to the ITU.³⁶

However, the Joint Commenters note that in the latest version of those studies in preparation for the November 2018 Working Party 5C meeting, NOAA seeks to slightly further constrain HAPS customer premises equipment uplinks to -33.4 dBW/100 MHz compared to View C's proposed -32.6 dBW/100 MHz.³⁷ Upon examination of this change, the Joint

³⁴ WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 1-3.

³⁵ WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 1.

³⁶ ITU, Radiocommunication Study Groups, Annex 16 to Document 5C/531-E, Annex 16 to Working Party 5C Chairman's Report, Preliminary Draft New Report ITU-R F. [HAPS-21GHZ], Sharing and compatibility studies of HAPS systems in the 21.4-22 GHz frequency range, Attachment 4, Section 1.1.6 (June 5, 2016) ("*Chairman's Report Annex 16*").

³⁷ *Compare* ITU, Radiocommunication Study Groups, Annex 16 to Document 5C/531, Preliminary Draft New Report ITU-R F. [HAPS-21GHZ], Sharing and compatibility studies of HAPS systems in the 21.4-22 GHz frequency range, Study A, Section 1.1.6 (Sept. 2018), *with* ITU, Radiocommunication Study Groups, Document USWP5C19-83-final, Proposed update to the Preliminary Draft New Report ITU-R F. [HAPS-21 GHz], Sharing and Compatibility Studies of HAPS Systems in the 21.4-22 GHz Frequency Range, Study A, attached to Department of State ITU-R National Committee Memo 2520 (Oct. 8, 2018) (NOTE: This has not yet been sent to the ITU).

Commenters submit that this level can be accommodated and do not oppose it. The Joint Commenters note that this new level should only be applied in the direction of the passive EESS satellite because HAPS systems can employ the necessary technology to ensure those levels are implemented while retaining the flexibility to efficiently use the spectrum at other times, such as when a passive satellite is below the horizon.

With regard to out-of-band EESS passive services in the 21.2-21.4 GHz band, the proposed limits in View C are based on the mask developed in studies submitted to the ITU by the United States for HAPS in the platform-to-ground direction modified to account for a transmitter on the ground in the case of a ground-to-platform uplink rather than at 20 km.³⁸ The worst-case potential uplink interferer to the EESS passive receiver pointed *directly* at the receiver dominates all others pointed at the platform at different angles, and therefore not pointed at the EESS receiver.³⁹ Consequently, the aggregate effect of all other transmitters in addition to the dominant one is negligible. For example, analysis that Lockheed Martin and Elefante Group have undertaken and provided during the US Working Party 5C process shows that 100 additional ground stations all presenting off-boresight gain to an EESS satellite receiver no more than 40 dB down would increase the interference by $10 \times \text{LOG}_{10}(1 + 6 \times 10^{\frac{-30.5}{10}} + 100 \times 10^{\frac{-40}{10}}) = 0.066 \text{ dB}$.⁴⁰

³⁸ See WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 1. *Chairman's Report Annex 16* at Attachment 3, Section 1.1.3.

³⁹ See ITU, Radiocommunication Study Groups, Document USWP5C19_93_02, Preliminary Draft New Report ITU-R F. [HAPS-21GHz], Sharing and compatibility studies of HAPS systems in the 21.4-22 GHz frequency range, Attachment 3, Section 1.1.4.2 (Oct. 3, 2018).

⁴⁰ See *id.* at Attachment 3, Section 1.1.4.1. The Joint Commenters note that an adjustment of the mask 3 dB down would be appropriate to apply to each uplink terminal to reflect the possibility that a HAPS operator could operate two co-channel terminals in a receive beam

resolves 2 and 3 of proposed DRAFT NEW RESOLUTION [B114] in View C contain provisions to ensure compatibility with the RAS for stations in service prior to the last day of WRC-19.⁴¹ *resolves* 2 is based on ITU studies⁴² and provides the necessary regulatory framework for compatible operations with RAS from a HAPS uplink. The Joint Commenters support the inclusion of these *resolves* 1 through 3 in View C to protect other services.

2. The 25.25-27.50 GHz Sub-Band

With regard to the 25.25-27.50 GHz band in DRAFT NEW RESOLUTION [C114] of View C, *resolves* 1, the Joint Commenters propose that the United States utilize a slightly different pfd mask than contained in Views A and C, as submitted.⁴³ The slightly revised mask would still ensure compatible operations with the Fixed Service while preserving operational flexibility for HAPS operations. The Joint Commenters support the following pfd which is based on a probability of exceedance of no more than 0.01 % rather than the less-than-0.0001% factor used as the Fixed Service pfd mask in View A, which View C had adopted:

$$\begin{aligned}
 pfd_{max}(El) &= 0.39 \times El - 132 \text{ for } 0 \leq El < 10^\circ \\
 pfd_{max}(El) &= 6.2 \times El - 190 \text{ for } 10^\circ \leq El < 12.5^\circ \\
 pfd_{max}(El) &= 1 \times El - 125 \text{ for } 12.5^\circ \leq El < 25^\circ \\
 pfd_{max}(El) &= \frac{1}{3} \times El - 108.3 \text{ for } 25^\circ \leq El < 55^\circ \\
 pfd_{max}(El) &= -90 \text{ for } 55^\circ \leq El \leq 90^\circ
 \end{aligned}$$

The justification for selecting a less than 0.0001% exceedance as the basis for defining the pfd limit mask was never provided by the View A supporters. A 0.01% exceedance as the

simultaneously using two polarizations which would double the instantaneous e.i.r.p. within the receive beam which has the dominant potentially interfering ground terminals.

⁴¹ WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 2-3.

⁴² See *Chairman's Report Annex 16* at Attachment 5, Section 2.

⁴³ WAC/065, View C, DRAFT NEW RESOLUTION [C114], *resolves* 1.

cutoff level at which to define the pfd limit mask is more appropriate as Fixed Service elevation angle normal probability distribution statistics assumed in the analysis do not apply to such rare occurrences, and 0.01% is often used as a reasonable statistical limit in compatibility studies.

The Joint Commenters propose another modification to View C as well. While a rain fade factor is included in View C (as well as View A) in the respective compliance equations for compatibility with the Fixed and Mobile Services, as discussed above, it would not be inappropriate to remove that rain fade factor from the equations.⁴⁴ This change requires that, as discussed above, appropriate clarifications are made that ATPC could be used to increase the e.i.r.p. to offset any rain fade loss based on the HAPS characteristics document, resulting in a net 0 dB change to the pfd, and the rain fade term could be eliminated.⁴⁵ This would be consistent with the *Chairman's Report Annex 14*.⁴⁶

Regarding compatibility of HAPS downlinks in the 25.25-27.50 GHz band with the Fixed and Mobile Services, the Joint Commenters support the regulatory language in *resolves* 1 and 2 of View C's proposed DRAFT NEW RESOLUTION [C114].⁴⁷ These *resolves* provide regulatory language, including in the necessary compliance equation, to ensure that HAPS systems, including those being studied by the ITU and others, can be accommodated through a regulatory framework that permits demonstrations of compatibility under other sufficient masks. The pfd-based compliance equations in View C, as noted earlier, give administrations an internationally-recognized baseline for ensuring that HAPS operation of one administration is being implemented in such a way as to be compatible with the Fixed and Mobile Services of

⁴⁴ See WAC/065, View C, DRAFT NEW RESOLUTION [C114], *resolves* 1-2.

⁴⁵ See *supra* note 19.

⁴⁶ See *Chairman's Report Annex 14* at Annex 6.

⁴⁷ WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 1-2.

another administration. Without the compliance equations, administrations would need to develop bilateral agreements when using a pfd mask.⁴⁸ By adding the qualifications that the pfd mask in *resolves* 1 and 2 apply, “unless otherwise demonstrated,” View C allows for a wider deployment of HAPS designs without compromising compatible operations with the Fixed and Mobile Services.⁴⁹

View C, unlike View B, provides for compatible operation with the satellite services operating in or near to the 25.25-27.50 GHz band. *resolves* 3 and 4 of proposed DRAFT NEW RESOLUTION [C114] in View C provide the necessary framework for ensuring HAPS downlinks can operate in the relevant portions of the 25.25-27.50 GHz compatibly with ISS and FSS.⁵⁰ Further, *resolves* 6 of View C’s proposed DRAFT NEW RESOLUTION [C114] is based on NASA studies conducted in preparation for the November 2018 meeting of Working Party 5C that match the conclusions that are in the *May 2018 Chairman’s Report*.⁵¹ These proposals provide the necessary regulatory framework for initiating coordination between HAPS downlinks and EESS/SRS earth stations. The Joint Commenters support adoption of the foregoing provisions to ensure compatibility with the FSS, ISS, EESS, and SRS.

⁴⁸ See *supra* Section II.B.1.a.

⁴⁹ WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 1-2.

⁵⁰ WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 3-4.

⁵¹ See WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves* 6. See ITU, Radiocommunication Study Groups, Document USWP5C19_96, Proposed Revision of Preliminary Draft New Report ITU-R F. [HAPS-25GHZ], Sharing and compatibility studies of HAPS systems in the 24.25-27.5 GHz frequency range (Nov. 2018); *May 2018 Chairman’s Report* at Attachment 7, Section 2.

D. Document WAC/065 View D (supported by Echostar *et al.*)

1. The 21 GHz Band

View D proponents include in their proposal footnote 5.B114 to the ITU Table and DRAFT NEW RESOLUTION [B114] that come from document IWG-2/078r3 with regard to the 21 GHz Band.⁵² The proposed footnote specifically provides the appropriate designations for HAPS uplinks in the 21.5-22.0 GHz band, and is wholly consistent with View C.⁵³ *resolves 3* in DRAFT NEW RESOLUTION [B114] included in View D’s proposal sets out a mask to ensure HAPS uplink compatibility with passive EESS.⁵⁴ View D’s masks includes slightly different elevation angles than *resolves 1* in DRAFT NEW RESOLUTION [B114] of View C, specifically a 35.5 degrees breakpoint rather than the 35.25 degrees in View C.⁵⁵

⁵² WAC/065, View D, DRAFT NEW RESOLUTION [B114], Section 2, *add* USA/1.14/7. *See* Draft Proposal for the Work of the Conference, IWG-2/078r3 (18.09.2018), DRAFT NEW RESOLUTION [B114], *add* USA/1.14/7 (“IWG-2/078r3”).

⁵³ WAC/065, View D, Section 2, *add* USA/1.14/7.

⁵⁴ WAC/065, View D, DRAFT NEW RESOLUTION [B114], *resolves 3*.

⁵⁵ *Compare* WAC/065, View D, DRAFT NEW RESOLUTION [B114], *resolves 3*, with WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves 1*. The Joint Commenters note that View D interchangeably uses the term “ensure compatibility with” and “ensure the protection of” other services. *See, e.g.*, WAC/065, View D, DRAFT NEW RESOLUTION [B114], *resolves 2-3*. The Joint Commenters submit that, as used in View C, “ensures compatibility with” is the more appropriate terminology to be used consistently. *See, e.g.*, WAC/065, View C, DRAFT NEW RESOLUTION [B114], *resolves 1*. This terminology, which does not pre-judge priority of access in the band, where it exists, underscores that there has been a determination of what constitutes harmful interference to a service in a co-primary allocation, such as pfd levels, which cannot be exceeded (subject to other factors, such as a percentage of time exceedance factor), pursuant to which compatible operations can be established by both types of services operating under co-primary allocations in the same or adjacent bands, especially in light of the certainty fostering coexistence of the services created by the metric defining compatibility.

2. The 25-26 GHz Band

With regard to the 24.25-27.50 GHz frequency range, View D proponents propose footnote 5.D114 and DRAFT NEW RESOLUTION [C114] that have their origins in the proposals for these bands contained in document IWG-2/078r3.⁵⁶ But the Joint Commenters note that the View D proposal eliminates the HAPS provisions and corresponding designations for the 27.0-27.5 GHz band. View D's proposals for *resolves* 1, 2, 4, 7, and 8 are quantitatively similar to those contained in View C's proposal, with slightly (but not materially) different metrics.⁵⁷

The Joint Commenters note that, given the regulatory provisions proposed in View C that extend through these frequencies, the concerns of possible harmful interference to the FSS that apparently led to a proposal of No Change by View D could be accommodated without precluding or unnecessarily constraining operation of HAPS in the platform-to-ground direction in 27.0-27.5 GHz.⁵⁸ Consequently, the Joint Commenters submit that the United States need not adopt a position of No Change in the 27.0-27.5 GHz band. Doing so would needlessly remove an important 500 megahertz from the HAPS designation for downlinks in Region 2 in the 25-26 GHz Band.

⁵⁶ WAC/065, View D, DRAFT NEW RESOLUTION [C114], Section 3, *add* USA/1.14/12. *See* IWG-2/078r3, DRAFT NEW RESOLUTION [C114], *add* USA/1.14/12.

⁵⁷ WAC/065, View D, DRAFT NEW RESOLUTION [C114], *resolves* 1-2, 4, 7-8. As discussed above, the Joint Commenters propose that the United States position should acknowledge measures, whether pfd or otherwise, which will be deemed to constitute harmful interference, but that, given the purpose of allowing HAPS and other services to co-exist, the terminology of ensuring compatibility among services using co-primary allocations is more appropriate than ensuring "protection" of one co-primary service versus another. *See supra* note 55.

⁵⁸ *See* WAC/065, View D, DRAFT NEW RESOLUTION [C114], *noc* USA/1.14/13bis.

E. Draft No Change Proposals of NTIA Regarding AI 1.14

Finally, the Joint Commenters offer their views on the draft proposals of NTIA on AI 1.14.⁵⁹ While NTIA's proposals were not considered by IWG-2 of the WAC, the *Public Notice* contains proposals on bands that were addressed by the WAC based on the work of IWG-2.

1. The 21 GHz Band

NTIA proposes No Change to the 21 GHz Band.⁶⁰ It bases this proposal on ITU studies that purportedly have shown that the protection criteria for certain Mobile Services will be exceeded by HAPS deployments, presumably referring to the AMS that operate below 21.5 GHz.⁶¹ As a result, although there may be exceedance of the protection criteria when HAPS operate *between 21.4-21.5 GHz*, the Joint Commenters believe that interference from HAPS uplinks in channels whose occupied bandwidth is located *above 21.5 GHz* would not pose a threat of harmful interference to AMS. View C proposes to designate HAPS in the ground-to-platform direction from 21.5-22.0 GHz, foregoing the bottom 100 megahertz from the 21 GHz Band from consideration.⁶² The Joint Commenters aver that precluding uplink operations in the 21.4-21.5 GHz sub-band would sufficiently address the concern raised by NTIA.

2. The 25-26 GHz Band

With regard to the 25.25-27.50 GHz frequency range, NTIA's draft proposes No Change to the 25.50-27.00 GHz band.⁶³ The NTIA draft makes no proposal on the 25.25-25.50 and 27.0-27.5 GHz frequency bands. NTIA's justification for proposing No Change in the 25.5-27.0 GHz

⁵⁹ See *NTIA Proposals*.

⁶⁰ *NTIA Proposals*, Agenda Item 1.14, *noc* USA/4809A14/1.

⁶¹ *Id.*

⁶² See *supra* Section II.C.1.

⁶³ *NTIA Proposals*, Agenda Item 1.14, *noc* USA/4809A14/3.

band in its draft is due to a perception that the ITU studies have not demonstrated that HAPS systems can operate without causing harmful interference to EESS/SRS earth stations in this range.⁶⁴ However, the Joint Commenters urge the Commission to consider that, as set forth in View C, adequate criteria exist within this frequency range for compatibility between HAPS platform-to-ground transmissions and the EESS/SRS earth stations, especially given that the latter are at known locations.⁶⁵ Significantly, these criteria have been accepted by NASA as a basis for its inputs into the U.S. process in preparing for the November 2018 WP 5C meeting and match those that are in the conclusions of the ITU studies, and should be acceptable for the purpose of establishing a regulatory framework that will ensure compatibility with the EESS/SRS services.

III. CONCLUSION

For the foregoing reasons, the Joint Commenters submit that View C can be resolved with most elements of the other views. The United States should adopt a position that, leaving aside how the Other Bands and directions are treated, allows for HAPS uplinks in the 21.5-22.0 GHz band subject to the regulatory framework proposed in View C, and allows for HAPS downlinks in the 25.25-27.50 GHz band under View C conditions. The U.S. position should be adopted with the understanding that it will be up to each national administration to decide how it

⁶⁴ *Id.*

⁶⁵ *See supra* Section II.C.2. As discussed in Section II.C.2, adequate criteria exist to ensure compatibility between HAPS downlinks and other services generally throughout the entire 25.25-27.50 GHz range.

implements the HAPS designations in the spectrum, determining how best to take advantage of the benefits offered by stratospheric solutions.

Respectfully submitted,

LOCKHEED MARTIN CORPORATION
(supporting the technologies of Elefante Group)

ELEFANTE GROUP, INC.



Scott A. Kotler
Director, Technical Regulatory Affairs
Trade & Regulatory Affairs
LOCKHEED MARTIN CORPORATION
2121 Crystal Drive
Suite 100
Arlington, VA 22202
(703) 413-3102

Edward A. Yorkgitis, Jr.
J. Bradford Currier
KELLEY DRYE & WARREN, LLP
3050 K Street, NW
Suite 400
Washington, DC 20007
(202) 342-8540

Counsel to Elefante Group, Inc.

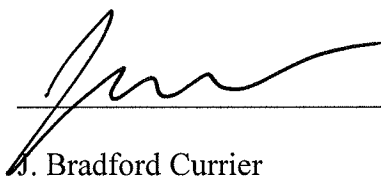
Chris DeMarche
Chief Operating Officer
ELEFANTE GROUP, INC.
4725 South Monaco Street
Suite 330
Denver, CO 80237
(303) 229-5555

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CERTIFICATE OF SERVICE

I, J. Bradford Currier, hereby certify that on October 17, 2018, a copy of the foregoing Joint Comments of Elefante Group, Inc. and Lockheed Martin Corporation, Supporting the Technologies of Elefante Group, Inc., on the Views Regarding Agenda Item 1.14 was served by U.S. Mail and email on the following:

Michael Mullinix
Designated Federal Official
Global Strategy and Negotiation Division
International Bureau
Federal Communications Commission
445 12th Street, S.W.
Room 6-A821,
Washington, DC 20554
Michael.Mullinix@fcc.gov



J. Bradford Currier
KELLEY DRYE & WARREN, LLP
3050 K Street, NW
Suite 400
Washington, DC 20007
(202) 342-8465