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October 9, 2015

BY ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th St., S.W.
Washington, DC 20554

Re: Presentation in 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

Notification of *Ex Parte* Presentation

Dear Ms. Dortch:

On behalf of Space Exploration Technologies Corp. ("SpaceX"), we hereby submit correspondence responding to the comments of Gogo Inc. ("Gogo") in an *ex parte* letter filed on August 26, 2015, in the above referenced proceeding.

In particular, the SpaceX response addresses issues of Gogo's interference calculations and the Rise over Thermal interference threshold.

Please direct any questions related to this matter to the undersigned.

Respectfully submitted,

Henry Goldberg
Counsel for
Space Exploration Technologies Corp.

October 9, 2015

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th St., S.W.
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Re: *Ex parte* Presentation in 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

Dear Ms. Dortch:

Space Exploration Technologies Corp. ("SpaceX") hereby responds to the comments of Gogo Inc. ("Gogo") in an *ex parte* letter filed on August 26, 2015, in the above referenced proceeding. SpaceX addresses below both Gogo's interference calculations and the Rise over Thermal ("RoT") interference threshold that should be required to be controlled by the Air-Ground Mobile Broadband ("AGMB") operator.

I. Gogo's Interference Calculations.

SpaceX believes the worst case for interference is when the NGSO satellite is pointing the Rx beam at nadir (1150km range). Only one Qualcomm AGMB ground station would be within the NGSO beam and for the worst case we assume it is at the spot center. The AGMB ground station antenna sidelobes radiate straight into the NGSO Rx beam and there is no gain roll-off on satellite's Rx antenna (interference comes right at beam center). In this case:

1 Rocket Road Hawthorne CA 90250
phone 310.363.6000 fax 310.363.6001
spacex.com

GS EIRP per Beam Per Polarization [dBW]	39.5
Sidelobe attenuation [dB]	-37
Atmospheric Loss at Ku Band [dB]	0
Satellite G/T [dB/K]	13
Sat Beam Gain Roll-off [dB]	0
1/BW (BW = 50 MHz) [dB Hz]	-76.99
1/Boltzmann [dB/K Hz]	228.60
Path Loss (at nadir) [dB]	-176.58
Polarization Discrimination [dB]	-3
Only one Ground Station (no reuse) [dB]	0
l/N at Satellite Receiver [dB]	-12.47
RoT [%]	**5.67%**

Note the calculations above are based on sidelobe attenuation numbers indicated in Qualcomm's petition. Gogo uses somewhat lower sidelobes numbers, apparently taken from Qualcomm's published antenna patterns.[1] Using those numbers and the worst case assumptions above:

GS EIRP per Beam Per Pol [dBW]	39.5
sidelobe attenuation [dB]	-40
Atmospheric Loss at Ku Band [dB]	0
Satellite G/T [dB/K]	13

[1] *See*, Petition for Rulemaking of Qualcomm, RM-11640, App. A; see also Letter from Dean Brenner, Vice President, Qualcomm, to Marlene Dortch, Secretary, FCC, RM-11640 (Sept. 11, 2012), Att. A (antenna pattern data spreadsheets).

Sat Beam Gain Roll-off [dB]	0
1/BW (BW = 50 MHz) [dB Hz]	-76.99
1/Boltzmann [dB/K Hz]	228.60
Path Loss (at nadir) [dB]	-176.58
Polarization Discrimination [dB]	-3
Only one Ground Station (no reuse) [dB]	0
I/N at Satellite Receiver [dB]	-15.47
RoT [%]	**2.84%**

RoT is lower, but still in excess of the allowed 1%.

For interference from aircraft, there could be up to four aircraft[2] within the illuminated spot and the aircraft antennas sidelobes radiate straight into the NGSO Rx beam (no gain roll-off on satellite's Rx antenna). Using the numbers shown in Qualcomm's original petition:

Plane EIRP [dBW]	3
Plane antenna Roll-off toward NGSO Sat at nadir [dB]	-20
Atmospheric Loss at Ku Band [dB]	0
Satellite G/T [dB/K]	13
Sat Beam Gain Roll-off [dB]	0
1/BW (BW = 2 MHz) [dB Hz]	-63.01
1/Boltzmann [dB/K Hz]	228.60
Path Loss (at nadir) [dB]	-176.58

[2] The Space X spot beam is approximately 40 Km in diameter. We assumed four airplanes will be using the AGMB system at cruising altitude within a SpaceX spot beam at any time. Hence we assume a frequency reuse factor of 4 within the spot beam.

Polarization Discrimination [dB]	-3
4 Reuses of 2 MHz Carrier in NGSO beam coverage area [dB]	6.02
I/N at Satellite Receiver [dB]	-11.97
RoT [%]	**6.36%**

Or with Gogo's numbers:

Plane EIRP [dBW]	3
Plane antenna Roll-off toward NGSO Sat at nadir [dB]	-28
Atmospheric Loss at Ku Band [dB]	0
Satellite G/T [dB/K]	13
Sat Beam Gain Roll-off [dB]	0
1/BW (BW = 2 MHz) [dB Hz]	-63.01
1/Boltzmann [dB/K Hz]	228.60
Path Loss (at nadir) [dB]	-176.58
Polarization Discrimination [dB]	-3
4 Reuses of 2 MHz Carrier in NGSO beam coverage area [dB]	6.02
I/N at Satellite Receiver [dB]	-19.97
RoT [%]	**1.01%**

In both cases, a higher sidelobe suppression is required in order to meet the 1% RoT requirement for the FSS link budget set out in ITU Recommendation S.1432.

II. The RoT Interference Threshold.

As stated in a joint *ex parte* letter filed on October 7, 2015, SpaceX and Qualcomm have agreed that, given that, at present, the AGMB service will be the only non-primary use of the band, the AGMB operator should control RoT to NGSO satellite systems to ensure that

aggregate interference from the AGMB service accounts for no more than 1% RoT of the FSS link budget set out in ITU Recommendation S.1432, as proposed in Qualcomm's February 7, 2014 *ex parte* filing. Qualcomm & SpaceX note that the ITU Recommendation provides that the RoT from all non-primary users in the band shall not exceed 1%.

III. The Minimum Elevation for the Earth Station.

The test satellite is designed to work from a minimum elevation of 40 degrees. Depending on various tradeoffs analyses and test results, the final satellites may use a different minimum elevation angle which can be lower than 40 degrees.

IV. Conclusion.

SpaceX respectfully requests that any rules adopted by the Commission in this proceeding reflect the interference calculations and RoT interference threshold set forth above.

Respectfully submitted,

By: /s/ Mihai Albulet

Mihai Albulet
Principal RF Engineer

cc (via email): Julius Knapp, FCC/OET
Bruce Romano, FCC/OET
Sean O'More, FCC/IB
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