



UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and
Information Administration
Washington, D.C. 20230

DEC 11 2012

Mr. Julius Knapp
Chief, Office of Engineering and Technology
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: In the Matter of Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands; Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz; Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands (WT Docket No. 12-70; ET Docket No. 10-142; WT Docket No. 04-356)

Dear Mr. Knapp:

The National Telecommunications and Information Administration ("NTIA") hereby transmits the enclosed operator-to-operator Agreement executed by New DBSD Satellite Services G.P. and Gamma Acquisition LLC (collectively "DISH") and seven U.S. Government agencies that operate earth stations and/or Aeronautical Mobile Telemetry ("AMT") stations in the 2200-2290 MHz Band for inclusion in the record of the above-referenced proceeding. The Commission is considering in this proceeding the appropriate out-of-band-emission ("OOBE") limitations for fixed and mobile use in the above-referenced bands as necessary to protect federal operations. DISH and these federal agencies have agreed to operational conditions for OOBE of DISH base stations operating in the 2 GHz band.

NTIA has reviewed and supports the Agreement. As set forth in the Agreement, it shall be "binding upon and inure to the benefit of the successors and assigns of DISH." In addition, on behalf of the agencies, NTIA requests that the DISH licenses, and any subsequent licenses, be conditioned on compliance with the OOBE limits contained in the agreement. Accordingly, this Agreement should be made a condition to any license issued to DISH, to any successor-in-interest, or to any other party in the 2180-2200 MHz band.

If you have any questions my point-of-contact on this issue is Edward Davison (202-482-5526; edavison@ntia.doc.gov).

Sincerely,

Karl B. Nebbia
Associate Administrator
Office of Spectrum Management

Enclosure

Operator-to-Operator Agreement
between
New DBSD Satellite Services G.P. and Gamma Acquisition L.L.C.
and
United States Federal Government Agencies
Operating Earth Stations and/or Aeronautical Mobile Telemetry (AMT) Stations in the 2200-
2290 MHz Band

1. Introduction

This Operator-to-Operator Agreement between New DBSD Satellite Services G.P. and Gamma Acquisition L.L.C. and United States Federal Government Agencies Operating Earth Stations and/or AMT Stations in the 2200-2290 MHz Band (the "Agreement") is made and effective as of the 14 day of December 2012 by and between New DBSD Satellite Services G.P.; Gamma Acquisition L.L.C.; and the Federal Agencies (as defined below).

In response to an ICO Global Communications ("ICO") request to the Federal Communications Commission ("FCC"), made pursuant to Section 25.252(a)(6) of the FCC's rules, the National Telecommunications and Information Administration ("NTIA") sent a letter, dated March 8, 2007, to Mr. Julius Knapp, Chief, Office of Engineering and Technology of FCC, identifying federal earth stations, operating in the 2200-2290 MHz band, within the United States of America.¹ On October 2, 2007, NTIA provided an updated list of federal earth station facilities.²

On March 5, 2008, the FCC released a Public Notice listing ICO's application for authority to provide ancillary-terrestrial component ("ATC") service in the 2000-2020 MHz and 2180-2200 MHz bands (the "2 GHz band") where it already had an authorization to provide Mobile-Satellite Service ("MSS").³ In the

¹ Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration to Julius Knapp, Chief, Office of Engineering and Technology, Federal Communications Commission, dated March 8, 2007.

² Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration to Julius Knapp, Chief, Office of Engineering and Technology, Federal Communications Commission, dated October 2, 2007 ("NTIA Corrected Letter").

³ Federal Communications Commission, Public Notice, Report No. SES-01012 (March 5, 2008) corrected by Public Notice, Report No. SES-01014 (March 12, 2008). In its ATC Application, ICO requested waiver of the distance restriction in 47 C.F.R. § 25.252(a)(6) and requested that ATC operators be permitted instead to coordinate with U.S. Earth Station facilities in the 2200-2290 MHz band on a case-by-case basis. See File Nos. SES-LIC-20071203-01646 (ICO ATC Application) at 22-23, Attachment D.

application, ICO sought waivers of specific portions of Section 25.252 of the FCC's rules, including Sections 25.252(a)(1)⁴ and 25.252(a)(6).⁵

Consistent with its ATC request, ICO initiated a consultation process with the federal agencies that operate earth stations in the 2200-2290 MHz band.⁶ The federal agencies identified in the NTIA Corrected Letter are:

U.S. Department of the Air Force (Air Force)
National Aeronautics and Space Administration (NASA)
U.S. Department of Commerce (DOC)
U.S. Department of the Navy (Navy)
U.S. Department of Energy (Energy)

On January 5, 2009, ICO and the Federal Agencies entered into an Operator-to-Operator Agreement to, among other things, ensure that the FCC's grant of the ICO waiver requests (e.g., Sections 25.252(a)(1) and 25.252(a)(6)) would not result in unacceptable interference to the federal earth stations operating in the 2200-2290 MHz band due to ICO ATC base station out-of-band emissions (OOBE) and assure protection of the Federal Agency operation of such earth stations from unacceptable interference due to ICO ATC base stations' OOBE (the "ICO Operator-to-Operator Agreement").

Since the time that the ICO Operator-to-Operator Agreement was signed, one of the earth stations formerly operated by NASA is now operated by the U.S. Department of Interior (DOI). As a result, DOI has been added to the list of Federal Agency parties to this Agreement.

The federal agencies listed above, the U.S. Department of Army, which operates AMT stations included in Annex C, and the U.S. Department of Interior (DOI) are the points of contact, the responsible entities for this consultation process, and the federal agency parties to this Agreement (collectively the "Federal Agencies").

At the time that ICO entered into the ICO Operator-to-Operator Agreement, ICO owned DBSD Satellite Services G.P. ("DBSD"), the entity responsible for operating ICO's MSS and ATC networks. On March 9, 2012, DISH Network Corporation finalized a transaction and acquired control over, New DBSD Satellite

⁴47 C.F.R. § 25.252(a)(1): Applicants for an ancillary terrestrial component in these bands must demonstrate that ATC base stations shall not: (1) Exceed an EIRP of -100.6 dBW/4kHz for out-of-channel emission at the edge of the MSS licensee's selected assignment.

⁵47 C.F.R. § 25.252(a)(6): Applicants for an ancillary terrestrial component in these bands must demonstrate that ATC base stations shall not: (6) be located less than 820 meters from a U.S. Earth Station facility operating in the 2200-2290 MHz band.

⁶The federal agencies holding the 2200-2290 MHz frequency assignment(s), under Section 6.08 of the NTIA Manual, and the associated earth station facility authorizations under Section 6.03 of the NTIA Manual have been identified in the NTIA Corrected Letter.

Services G.P. ("New DBSD"), the successor entity to DBSD.⁷ That same day, Gamma Acquisition L.L.C. ("Gamma"), a wholly owned subsidiary of DISH, consummated another transaction to acquire substantially all of the assets of another 2 GHz band operator, TerreStar Networks Inc. and its subsidiary TerreStar Licensee Inc. (collectively "TerreStar"), including all of TerreStar's FCC licenses.⁸ These licenses include TerreStar's authorization to provide MSS and ATC services in the 2 GHz band. New DBSD and Gamma are referred to collectively hereinafter as "DISH".

On March 21, 2012, the FCC released a Notice of Proposed Rulemaking and Notice of Inquiry ("NPRM") in Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands.⁹ In the NPRM, the FCC proposes, among other things, to modify the 2 GHz ATC authorizations of New DBSD and Gamma, converting them into authorizations for Advanced Wireless-4 ("AWS-4") services under Part 27 of the FCC's rules and eliminating MSS ATC rule applicability to the 2 GHz band.

The Federal Agencies, DBSD and Gamma have therefore agreed to enter into this Agreement to, among other things: 1) apply the terms of the ICO Operator-to-Operator Agreement (as revised by this Agreement) to the Gamma ATC network; 2) reflect the consolidation of the 2 GHz band under DISH; 3) make the new operating entities for the DBSD and TerreStar terrestrial networks (New DBSD and Gamma, respectively) parties to this Agreement; 4) make clear that this Agreement extends to all terrestrial services to be provided by DISH in the 2 GHz band, including terrestrial services to be provided under any AWS-4 licenses; and 5) include AMT stations and other satellite earth stations that were previously not listed in the ICO Operator-to-Operator Agreement.

This Agreement shall supersede and replace all prior agreements and understandings between DISH (and its predecessors in interest) and the Federal Agencies relating to the subject matter of this Agreement, including without limitation the ICO Operator-to-Operator Agreement.

Annex A is hereby incorporated by reference into this Agreement and, among other things, sets forth the procedures to be followed by DISH and the Federal Agencies when coordination is required under this Agreement and sets forth the procedures to be followed by DISH and the Federal Agencies to address observed Unacceptable Earth Station Interference (defined herein) and Harmful Interference (defined herein) for AMT stations.

Annex B is hereby incorporated by reference into this Agreement and provides the locations of the existing federal earth stations operating in the 2200-2290 MHz band (collectively, the "Existing Earth Stations," or in the singular, an "Existing Earth Station").

Annex C is hereby incorporated by reference into this Agreement and provides the locations of the existing AMT stations and the locations of the existing mobile AMT stations, operating in the band 2200-

⁷See Letter from Pantelis Michalopoulos, Counsel for DISH, to Marlene H. Dortch, Secretary, Federal Communications Commission (Mar. 19, 2012), available at <http://apps.fcc.gov/ecfs/comment/view?id=6017025862>.

⁸See *id.*

⁹Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, WT Docket No. 12-70, Notice of Proposed Rulemaking and Notice of Inquiry, FCC 12-32 (Mar. 21, 2012).

2290 MHz (collectively, the "Existing AMT Stations" or, singular, an "Existing AMT Station"; "Existing Earth Stations and "Existing AMT Stations" are collectively referred to as "Existing Stations").

2. Conditions for compatible operation

The Federal Agencies and DISH exchanged potential interference assessments for DISH terrestrial base stations OOB into the federal earth stations and AMT stations in the 2200-2290 MHz band. Based on these assessments, and under the provisions of this Agreement, it has been found that a nationwide broadband base station network can be deployed by DISH that protects the federal earth stations and AMT stations in the 2200-2290 MHz band. Consequently, the parties agree to the following operational conditions for OOB of DISH AWS-4 and/or ATC base stations or other Fixed Stations operating in the 2 GHz band (collectively "Base Stations"):

1. DISH agrees that it will operate each Base Station so that the power spectral density ("PSD") of the signal received at an Existing Earth Station from such Base Station does not exceed -224 dBW/Hz as determined in accordance with the calculation methodology set forth in Annex A, Section D to this Agreement. If the PSD received from any single Base Station at an Existing Earth Station is in excess of -224 dBW/Hz as determined in accordance with the calculation methodology set forth in Annex A, Section D to this Agreement, DISH shall notify the Federal Agencies of such Base Station in accordance with the procedures set forth in Annex A, Section A.1 to this Agreement. In the event that Base Stations are being operated by DISH in a manner that results in the actual aggregate received PSD within 2200-2290 MHz at an Existing Earth Station being in excess of -221 dBW/Hz (or such other applicable protection level previously established under the waiver request procedures set forth in Annex A, Section A.3), it shall be addressed in accordance with the provisions of Annex A, Section A.2.
2. DISH agrees that it will operate each Base Station so that the power flux density ("PFD") at an Existing AMT Station from such Base Station does not exceed -183 dB(W/m²)/4kHz as determined in accordance with the calculation methodology set forth in Annex A, Section D to this Agreement. If the PFD from any single Base Station at an Existing AMT Station is in excess of -183 dB(W/m²)/4kHz as determined in accordance with the calculation methodology set forth in Annex A, Section D to this Agreement, DISH shall notify the Federal Agencies of such Base Station in accordance with the procedures set forth in Annex A, Section B.1 to this Agreement. In the event that Base Stations are being operated by DISH in a manner that results in the actual aggregate PFD within 2200-2290 MHz at an Existing AMT Station being in excess of -180 dB(W/m²)/4kHz (or such other applicable protection level previously established under the coordination procedures set forth in Annex A, Section B.3), it shall be addressed in accordance with the provisions of Annex A, Section B.2.
3. Once per quarter, starting on January 1, 2013, DISH agrees that it will provide to the ES POC (defined herein) and the AMT POC (defined herein) the coordinates and actual heights above ground level (AGL) for the radiation center of sector antennas for all deployed Base Stations and Base Stations planned to be deployed within 3 months.
4. All new federal earth stations and new AMT stations (i.e., those not listed as Existing Earth Stations in Annex B or Existing AMT Stations in Annex C) operating in the 2200-2290 MHz band belonging to or operated by or for the Federal Agencies or any of them (collectively, the "New Federal Stations" or, in the singular, a "New Federal Station") are subject to coordination with

DISH on a case-by-case basis in accordance with the procedures set forth in Annex A, Section C to this Agreement.

5. In addition, there may be occasional federal government ground-based rocket launch events, and rare spacecraft vehicle emergencies, that require a higher level of protection of a small number of Federal Stations on short notice for limited periods of time (collectively "Events"). It is understood that DISH will in good faith work to accommodate the Federal Agencies' needs in these time-critical situations, including the possibility of adjusting Base Station OOB, promptly, in the directions of these Federal Stations in response to a Federal Agency's request. The Federal Agencies shall give DISH as much advance notice as practicable of such Events.
6. In the event there are other unanticipated impacts to Federal stations from DISH's operations, including, but not limited, to any impact to Federal Stations from the in-band power of Base Stations, DISH and the Federal Agencies agree to work in good faith to resolve these issues.
7. The power of any Base Station emission above 2200 MHz shall be attenuated below the transmitter power, P (in Watts), by a factor of not less than $43 + 10 * \log_{10}(P)$ dB. Compliance with this level shall be based on Title 47 Code of Federal Regulations Part 27.53(h), sections (1), (2), and (3).

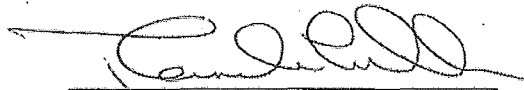
3. Conclusion

Subject to the above operating conditions, all parties agree that operations consistent with this Agreement should protect the federal earth stations and AMT stations in the 2200-2290 MHz band from potential Unacceptable Earth Station Interference (defined herein) and Harmful Interference (defined herein) for AMT stations due to Base Station operations in the 2180-2200 MHz band. Instances of Unacceptable Earth Station Interference (defined herein) or Harmful Interference (defined herein) to a federal earth station or AMT station, as the case may be, operating in the 2200-2290 MHz band based on the standards set forth in this Agreement shall be resolved as set forth in Annex A, Sections A.2 and B.2 to this Agreement, respectively.

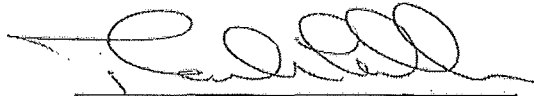
Nothing in this Agreement shall be construed to relieve DISH of its obligation to comply with laws and FCC Rules and policies (except as may be waived by the FCC and in accordance with the terms of said waiver(s)), and with other agreements or obligations of DISH outside the scope of this Agreement. Similarly, nothing in this Agreement shall be construed to relieve the Federal Agencies of their obligations to comply with laws and NTIA regulations and policies and with other agreements or obligations outside the scope of this Agreement.

This Agreement shall be binding upon and inure to the benefit of the successors and assigns of DISH and the Federal Agencies. The parties shall request (DISH through the FCC and the Federal Agencies through NTIA) that this Agreement be made a condition to any license issued to DISH, any successor-in-interest, or any third party for an AWS-4 or ATC license in the 2180-2200 MHz band. This agreement may only be modified or terminated by mutual consent of all parties.

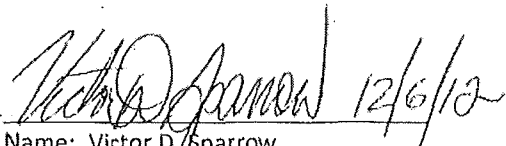
DISH and the Federal Agencies have each caused this Agreement to be signed by their duly authorized representatives.



Name: Thomas Cullen
Title: Executive Vice President
New DBSD Satellite Services G.P.



Name: Thomas Cullen
Title: Executive Vice President
Gamma Acquisition L.L.C.

 12/6/12

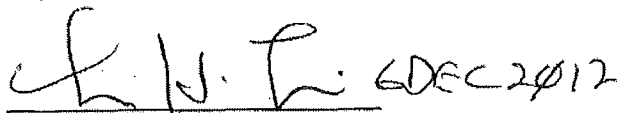
Name: Victor D. Sparrow
Title: Director, Spectrum Policy and Planning
National Aeronautics and Space Administration

 12/6/2012

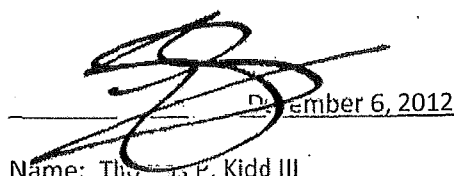
Name: Jimmy Nguyen
Title: IRAC Representative
U.S. Department of the Air Force



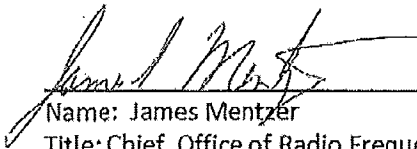
Name: TheAnne E. Gordon
Title: Associate CIO for IT Planning,
Architecture, and E-Government
U.S. Department of Energy

 6 DEC 2012

Name: Christopher H. Lewis
Title: IRAC Representative
Department of Interior

 December 6, 2012

Name: Thomas P. Kidd III
Title: IRAC Representative
U.S. Department of the Navy

 12/06/12
Name: James Mentzer
Title: Chief, Office of Radio Frequency Management
Department of Commerce

 6 DEC 2012
Name: Richard G. Desalvo
Title: IRAC Representative
U.S. Department of Army

ANNEX A

Section A -- Notification Procedure for Existing Earth Stations; Unacceptable Earth Station Interference for Existing Earth Stations; Waiver Request Procedure for Existing Earth Stations

1. Notification Procedure for Existing Earth Stations. DISH and the Federal Agencies agree that if the PSD received from any single Base Station at an Existing Earth Station is initially predicted to be in excess of -224 dBW/Hz as determined in accordance with the calculation methodology set forth in Section D of this Annex A, the following notification process shall apply:
 - a. DISH will notify the ES POC of the location of such Base Station no later than three (3) months prior to the expected initial operation of such Base Station in such manner, with such notice including:
 - coordinates (latitude and longitude) of such Base Station;
 - antenna height above ground level (AGL);
 - a written analysis demonstrating that the single entry PSD level predicted to be received at the Existing Earth Station from such single Base Station will not exceed -224 dBW/Hz; and
 - Identification of the modifications made to such Base Station (if any) that resulted in achieving the protection level set forth above.
2. Unacceptable Earth Station Interference for Existing Earth Stations. In the event that Base Stations are being operated by DISH in a manner that results in the actual aggregate received PSD within 2200-2290 MHz at an Existing Earth Station being in excess of -221 dBW/Hz (or such other applicable protection level previously established under the waiver request procedures set forth in Section A.3 below), the federal agency that observed such interference shall notify DISH, and the parties shall expeditiously work in good faith to determine if specific Base Station(s) may be causing the interference. The federal agency shall also notify DISH of the interference level that was observed. If it is mutually determined that Base Station(s) are causing actual aggregate received PSD within 2200-2290 MHz at an Existing Earth Station being in excess of -221 dBW/Hz (or such other applicable protection level previously established under the waiver request procedures set forth in Section A.3 below) (collectively the "Unacceptable Earth Station Interference"), DISH will expeditiously correct the identified Base Station(s) in a manner designed to prevent such Unacceptable Earth Station Interference. If DISH's actions do not resolve the Unacceptable Earth Station Interference, the parties will ask NTIA to work with the FCC to obtain a mutually satisfactory resolution as promptly as possible. Notwithstanding the previous sentence, if such Unacceptable Earth Station Interference is deemed harmful by the Federal Agency, DISH shall take all practicable steps to immediately eliminate such Unacceptable Earth Station Interference.

3. Waiver Request Procedure for Existing Earth Stations. DISH and the Federal Agencies agree that if DISH desires to operate a Base Station in a manner that is predicted (in accordance with the calculation methodology set forth in Section D of this Annex A) to result in the PSD level received at an Existing Earth Station from such single Base Station in excess of -224 dBW/Hz, the following coordination process shall apply:

a. DISH will notify the ES POC of the location of such DISH Base Station no later than nine (9) months prior to the expected initial operation of such DISH Base Station in such manner, with such notice (for purposes of this Subsection 3 of this Section A only, the "Initial Notice") including:

- coordinates (latitude and longitude) of such Base Station;
- antenna height above ground level (AGL);
- a written analysis demonstrating what single entry PSD level from such Base Station is predicted to be received at an Existing Earth Station as determined in accordance with the calculation methodology set forth in Section D of this Annex; and the amount by which those levels exceed the single entry PSD level specified in Section 2 of this Agreement;
- a written analysis demonstrating what aggregate PSD level from the network of Base Stations is predicted to be received at an Existing Earth Station as determined in accordance with the calculation methodology set forth in Section E of this Annex, and the amount, if any, by which those levels exceed the aggregate PSD level specified in Section 2 of this Agreement; and
- This notification and analyses shall be accompanied by a request from DISH asking that the affected Federal Agencies concur with and approve the individual base station's deviation from the terms of this Agreement.

b. The affected Federal Agencies shall make a good faith effort to notify DISH within twelve (12) weeks following DISH's sending of the Initial Notice of their decision regarding the request. If the affected Federal Agencies agree to accept the additional interference caused by DISH's proposed operation of such Base Station, DISH may proceed to so operate such Base Station in the manner requested. If the Federal Agencies do not concur, then such Base Station may not be operated unless and until DISH takes actions necessary to bring it into compliance with this Agreement.

Section B-- Notification Procedure for Existing AMT Stations; Harmful Interference for Existing AMT Stations; Waiver Request Procedure for Existing AMT Stations

1. Notification Procedure for Existing AMT Stations. DISH and the Federal Agencies agree that if the PFD from any single Base Station at an Existing AMT Station is initially predicted to be in excess of -183 dB(W/m²)/4kHz as determined in accordance with the calculation methodology set forth in Section D of this Annex A, the following notification process shall apply:

- a. DISH will notify the AMT POC of the location of such Base Station no later than three (3) months prior to the expected initial operation of such Base Station in such manner, with such notice including:
- coordinates (latitude and longitude) of such Base Station;
 - antenna height above ground level (AGL);
 - a written analysis demonstrating that the single entry PFD level predicted at the Existing AMT Station from such single Base Station will not exceed $-183 \text{ dB(W/m}^2\text{)/4kHz}$; and
 - Identification of the modifications made to such Base Station (if any) that resulted in achieving the protection level set forth above.
2. Harmful Interference for Existing AMT Stations. In the event that Base Stations are being operated by DISH in a manner that results in the actual aggregate PFD within 2200-2290 MHz at an Existing AMT Station being in excess of $-180 \text{ dB(W/m}^2\text{)/4kHz}$ (or such other applicable protection level previously established under the waiver request procedures set forth in Section B.3 below), the federal agency that observed such interference shall notify DISH, and the parties shall expeditiously work in good faith to determine if specific Base Station(s) may be causing the interference. The federal agency shall also notify DISH of the interference level that was observed. If it is mutually determined that DISH's Base Station(s) are causing actual aggregate PFD within 2200-2290 MHz at an Existing AMT Station being in excess of $-180 \text{ dB(W/m}^2\text{)/4kHz}$ (or such other applicable protection level previously established under the waiver request procedures set forth in Section B.3 below) (collectively "Harmful Interference"), DISH shall take all practicable steps to immediately correct the identified Base Station(s) so as to eliminate such Harmful Interference. If DISH's actions do not resolve the Harmful Interference, the parties will ask NTIA to work with the FCC to obtain a mutually satisfactory resolution as promptly as possible.
3. Waiver Request Procedure for Existing AMT Stations. DISH and the Federal Agencies agree that if DISH desires to operate a Base Station in a manner that is predicted (in accordance with the calculation methodology set forth in Section D of this Annex A) to result in the PFD level at such Existing AMT Station from such single Base Station to be in excess of $-183 \text{ dB(W/m}^2\text{)/4 kHz}$, the following coordination process shall apply:
- a. DISH will notify the AMT POC of the location of such DISH Base Station no later than nine (9) months prior to the expected initial operation of such DISH Base Station in such manner, with such notice (for purposes of this Subsection 3 of this Section B only, the "Initial Notice") including:
- coordinates (latitude and longitude) of such Base Station;
 - antenna height above ground level (AGL);
 - a written analysis demonstrating what single entry PFD level from such Base Station is predicted to be received at an Existing AMT Station as determined

- in accordance with the calculation methodology set forth in Section D of this Annex, and the amount by which those levels exceed the corresponding single entry PFD level specified in Section 2 of this Agreement;
 - a written analysis demonstrating what the aggregate PFD level from the network of Base Stations is predicted to be received at an Existing AMT Station as determined in accordance with the calculation methodology set forth in Section E of this Annex, and the amount, if any, by which those levels exceed the corresponding aggregate PFD level specified in Section 2 of this Agreement; and
 - This notification and analyses shall be accompanied by a request from DISH asking that the affected Federal Agencies concur with and approve the individual base station's deviation from the terms of this Agreement.
- b. The affected Federal Agencies shall make a good faith effort to notify DISH within twelve (12) weeks following DISH's sending of the Initial Notice of their decision regarding the request. If the affected Federal Agencies agree to accept the additional interference caused by DISH's proposed operation of such Base Station, DISH may proceed to so operate such Base Station in the manner requested. If the affected Federal Agencies do not concur, then such Base Station may not be operated unless and until DISH takes actions necessary to bring it into compliance with this Agreement.

Section C -- Coordination Procedure for New Federal Stations

DISH and the Federal Agencies agree that for each New Federal Station, the coordination process shall apply in the following order:

1. The responsible federal agency will notify DISH of the proposed location of a New Federal Station no less than eighteen (18) months prior to initial operation of such New Federal Station with such notice including:
 - coordinates (latitude and longitude) of the New Federal Station;
 - antenna height above ground level (AGL);
 - whether such New Federal Station is an AMT station or an earth station;
 - antenna size;
 - minimum elevation angle; and
 - azimuth range;
2. DISH shall provide the Federal Agencies with the coordinates, heights, and sector orientations of Base Stations that are existing, or scheduled for deployment within 3 years, within 100 km or radio line of sight ("RLOS"), whichever is greater, of the proposed New Federal Station, and the

22

single entry PSD or PFD levels, as applicable, predicted to be received at the New Federal Station as determined in accordance with the calculation methodology set forth in Section D of this Annex, from each of the Base Stations provided by DISH;

3. DISH and the Federal Agencies shall enter into good faith negotiations with respect to modifications to operations or locations of the New Federal Station and/or the Base Station(s) to achieve a protection level that is mutually agreed upon during such negotiations. Upon mutual agreement of conditions regarding the deployment of the New Federal Station, this Agreement shall be amended to include such New Federal Station and such associated conditions; and
4. Any Federal Agency may elect to establish a New Federal Station in proximity to any Base Station and choose to accept the risk of receiving Unacceptable Earth Station Interference or Harmful Interference from properly operating or planned DISH Base Stations, and, in such case, shall be deemed to have elected not to invoke or follow the coordination process incorporated in this Agreement nor be entitled to protection hereunder.
5. For the purposes of this Agreement, new earth stations deployed on a federal facility where there is an Existing Earth Station, and new AMT stations deployed on a federal facility where there is an Existing AMT Station shall be deemed Existing Stations, and Annexes B or C, as appropriate, shall be amended to add such stations to the list of Existing Stations. Prior to operation of such stations, however, the Federal Agencies shall notify DISH at least 12 months in advance and shall work in good faith with DISH in order to, to the extent practicable, determine a location for such New Federal Station on the existing federal facility such that the corresponding single entry protection level specified in Section 2 of this Agreement from properly operating or planned DISH Base Stations is not exceeded. Once the location for such New Federal Station is determined, the New Federal Station shall be entitled to all of the protections afforded Existing Stations under this Agreement.

Section D – Protection Level Methodology and Assumptions

In order to determine the received PSD or PFD level, as applicable, from any single Base Station that is predicted to be received at an Existing Earth Station, an Existing AMT Station or a New Federal Station (collectively "Federal Station"), the following methodology shall be used:

(A) Propagation Model Assumptions:

"Section A Output" is the combination of the base station transmit antenna gain and the total propagation loss (in dB) between transmit Base Station and receive Federal Station calculated based on the following assumptions:

- Base Station Sector Antenna Pattern: The propagation model will include the actual manufacturer(s) specified antenna pattern for both the horizontal and vertical axes of the Base Station;



- Heights: The actual heights above ground level (AGL) for the radiation center of both the Base Station and the Federal Station;
 - Receiver antenna heights to be provided by Federal Agencies;
 - If the Base Station antenna pattern uses a relative pattern, then the maximum gain shall be used in determining the actual gain of the antenna;
 - Based upon the Base Station sector antenna boresight pointing, Base Station and earth station locations and antenna heights; calculations will be done to determine the off-axis angle of the transmit interference path from the sector antenna boresight axis and this angle used with the sector antenna gain pattern to determine the gain of the sector antenna in the direction of the interference path towards the earth station (In dBi);
 - Sector Antenna Pointing Azimuths: The actual azimuths of the intended site configuration for each sector of the Base Station;
 - Antenna down-tilts: The actual mechanical down-tilts of the intended site configuration for each sector of the Base Station;
 - Frequency: The frequency assigned to the Base Station or Federal Station for propagation modeling purposes will be 2200 MHz; and
 - Path loss Model:
1. For Base Stations within 10km of a Federal Station, a commercially available propagation modeling tool may be used to determine the predicted path loss between a Base Station and a Federal Station, incorporating the following parameters:
 - Terrain Database: 10m Resolution Data for Urban and Dense Urban environments; 30m Resolution Data for Suburban and Rural environments;
 - Clutter Data: 10m Resolution Data for Urban and Dense Urban environments; 30m Resolution Data for Suburban and Rural environments; and
 - Propagation Model: The propagation model used in the tool will be based on the COST-231 model and will be tuned based on empirical data collected to best fit the propagation modeling to the specific environment between the Base Station and the Federal Station locations.
 - If specific empirical data is not available for the path between a Base Station and a Federal Station, the path loss shall be predicted using ITU-R Recommendation P.452-14 as given below irrespective of the distance.
 2. For Base Stations further than 10km from a Federal Station, the ITU-R Recommendation P.452-14 model will be used to determine the predicted path loss between a Base Station and a Federal Station, incorporating the following parameters:
 - Required time percentage for which the calculated transmission loss is not exceeded (reliability) = 50%;
 - Average radio-refractive index lapse-rate through the lowest 1 km of the atmosphere (ΔN) = 50 N-units/km;
 - Sea-level surface refractivity (N_0) = 301 N-units;
 - Zone type = Inland;
 - Field Clutter Category = set based on the Base Station's and Federal Station's locations; and
 - Terrain Database: 30m Resolution Data.

(B) Base Station Transmitter Assumptions:

"Section B Output" is an effective Base Station Transmit Power (in dBW/Hz for earth stations and dBW/4kHz for AMT stations) of the OOBE, derived at the input of the Base Station transmit sector antenna

- The above calculations will be performed for each site Base Station sector antenna independently.

(C) Earth Station Receiver Assumptions:

"Section C Output" is the receiver gain adjusted for the polarization loss for earth stations:

- Receiver antenna gain will be based upon actual antenna pattern provided for each site or on the use of antenna patterns in Annex III of Appendix 8 of the ITU Radio Regulations for the actual victim antenna size if specific information cannot be provided by Federal Agencies;
- Federal Agencies shall provide antenna diameters;
- The elevation angle will be set to 3 degrees and azimuth pointing will be directly pointing at the Base Station;
- Polarization loss = 3 dB; and
- Based upon the earth station antenna boresight pointing, Base Station and earth station locations and antenna heights, calculations will be done to determine the off-axis angle of the receive interference path at the earth station from the earth station antenna boresight axis, and this angle used with the earth station antenna gain pattern to determine the gain of the earth station antenna in the direction of the interference path from the Base Station (in dBi).

The associated earth station received PSD level will be calculated based on:

$$\text{PSD (dBW/Hz)} = \text{Section B Output (dBW/Hz)} - \text{Section A Output (dB)} + \text{Section C Output (dBi)}$$

The PFD level at an AMT station will be calculated based on:

$$\text{PFD (dB(W/m}^2\text{))/4kHz)} = \text{Section B Output (dBW/4kHz)} - \text{Section A Output (dB)} + \text{CF, where}$$

$$\text{CF} = 10 * \text{Log} (4\pi/\lambda^2) \text{ dB/m}^2$$

Section E – Aggregation Methodology and Assumptions for Waiver Request Procedure for Existing Earth Stations and Existing AMT Stations

In the event that DISH desires pursuant to Section A.3 ("Waiver Request Procedure for Existing Earth Stations") above to operate a Base Station in a manner that is predicted (in accordance with the calculation methodology set forth in Section D of this Annex A) to result in the PSD level received at an Existing Earth Station from such single Base Station in excess of -224 dBW/Hz, or desires pursuant to Section B.3 ("Waiver Request Procedure for Existing AMT Stations") above to operate a Base Station in a manner that is predicted (in accordance with the calculation methodology set forth in Section D of this

Annex A) to result in the PFD level at an Existing AMT Station from such single Base Station in excess of -183 dB(W/m²)/4 kHz, the following aggregation methodology shall be used to determine the PSD or PFD level, as applicable, that is predicted to be received at such Existing Station from the aggregate OOB level from the Base Stations (the "Aggregation Methodology"):

- Aggregation will be computed for each azimuth direction of the Existing Station by assuming that such Station's receive antenna is pointing in the direction of the specified azimuth angle. The aggregate received power will be computed by summing, incoherently, the received power from each Base Station, calculated using the method in Section D, as adjusted for the appropriate antenna gain as a function of azimuth angle for all values from 0 – 360 degrees in 0.1 degree increments;
- All existing Base Stations, plus those planned for deployment, to the extent known, within 3 years from the date of the analysis, within a 100km radius or RLOS, whichever is greater, of each Existing Station will be included in the computation;
- For Existing Station antennas, the assumed antenna elevation angle will be 3 degrees with respect to the horizon;
- Base Station traffic loading will be assumed to have a truncated Gaussian distribution (truncated at 0 and 1) with a mean loading assumed to be 50%. The Gaussian standard deviation will be 0.266 such that 3% of traffic carriers would be blocked if Gaussian distributed;
- For earth station antennas, the pattern will be based upon the actual antenna pattern provided for each site or on the use of antenna patterns in Annex III of Appendix 8 of the ITU Radio Regulations for the actual victim antenna size if specific information cannot be provided by Federal Agencies;
- For AMT station antennas, the pattern will be the composite pattern provided in Recommendation ITU-R M.1459, and the assumed elevation angle will be 0 degrees with respect to the horizon;
- For AMT stations, protection is stipulated as a power flux density level. To compute, accurately, the aggregate OOB level, the contribution from each Base Station is to be converted to a power level at the antenna terminals, summed as described above for earth stations, and then converted back to a PFD level. An appropriate factor of $4\pi/G\lambda^2$ will be used to perform the conversions from received power to power flux density, and vice versa, as described in Recommendation ITU-R M.1459;
- The impact of traffic loading across the network of Base Stations is calculated using a Monte Carlo simulation in which the only random variable is the traffic loading, and the traffic loading is varied independently across all Base Stations, and all other parts of the calculation will be deterministic;

- Iterative techniques shall include a minimum of 100,000 independent iterations; and
- The aggregate received OOB level is defined as the 99th percentile of the calculated Cumulative Distribution Function (CDF) for the Existing Station.

For the avoidance of doubt, the parties intend that, and this Agreement shall be construed such that, the Aggregation Methodology shall only be binding upon DISH in connection with requests by DISH pursuant to Section A.3 and Section B.3 above to exceed the applicable single entry criteria, and the parties further intend that, and this Agreement shall further be construed such that, the Aggregation Methodology shall not be binding upon DISH in connection with any other Sections of this Agreement.

DISH Points of Contact

Jeffrey H. Blum
SVP & Deputy General Counsel
DISH Network L.L.C.
1110 Vermont NW, Suite 750
Washington, DC 20005
(202) 293-0038 (Direct)
(720) 250-6973 (Cell)
jeffrey.blum@dish.com

Mariam Sorond
Vice President, Technology Development
DISH Network L.L.C.
1110 Vermont NW, Suite 750
Washington, DC 20005
(202) 293-1183 (Direct)
(703) 928-9228 (Cell)
mariam.sorond@dish.com

Federal Earth Station Points of Contact ("ES POC")

Air Force Earth Stations:

Jimmy Nguyen
AF IRAC Representative
Defense Information Systems Agency
ATTN: Air Force Spectrum Management Office (AFSMO/SMP)
P.O. Box 549
Ft. Meade, MD 20755-0549
Ph. 301-225-3729
Email: Jimmy.Nguyen@pentagon.af.mil

Department of Commerce Earth Stations:

Mark F. Mulholland
Senior Advisor/Chief Systems Engineer
1335 East West Hwy
Building: SSMC1
Silver Spring, MD 20910-3283

Ph. 301-713-7325
Fax 301-713-3599
Cell 240-678-4286
Email: mark.f.mulholland@noaa.gov

Department of Energy Earth Stations:
Randy Minyard
National Nuclear Security Agency (NNSA)
P.O. Box 98521 M/S NLV-071
Las Vegas, NV 89193-8521
Ph. 702-295-4766
Email: minyardr@nv.doe.gov

Department of Interior Earth Stations:
Keith Alberts, PMP (Primary POC)
US Geological Survey, Central Region,
Earth Resources Observation and Science (EROS) Center
47914 252nd Street
Sioux Falls, South Dakota 57198
Ph. 605-594-2651
Email: kalberts@usgs.gov

Thomas Kalvelage, PMP (Alternate POC)
Data Management Branch Chief
US Geological Survey, Central Region,
Earth Resources Observation and Science (EROS) Center
47914 252nd Street, Sioux Falls, SD 57198-0001
Ph. 605-594-6556
Fax 605-594-6906
Cell 605-759-6537
Email: kalvelage@usgs.gov

NASA Earth Stations:
John E. Zuzek
NASA National Spectrum Program Manager
NASA Glenn Research Center
21000 Brookpark Rd.
Mail Stop 54-2
Cleveland, OH 44135
Ph. 216-433-3469
Fax 216-977-7444
Cell 440-319-1309
Email: John.E.Zuzek@nasa.gov

Navy Earth Stations:
Thu A. Luu
Navy Marine Corps Spectrum Center
Defense Information Systems Agency
ATTN: Navy Marine Corps Spectrum Center



P.O. Box 549
Ft. Meade, MD 20755-0549
Ph. 301-225-3838, DSN 375
Fax 301-225-0583
Email: Thu.A.Luu@navy.mil

Federal AMT Points of Contact ("AMT POC")

Air Force AMT Stations:

Jimmy Nguyen
AF IRAC Representative
Defense Information Systems Agency
ATTN: Air Force Spectrum Management Office (AFSMO/SMP)
P.O. Box 549
Ft. Meade, MD 20755-0549
Ph. 301-225-3729
Email: Jimmy.Nguyen@pentagon.af.mil

Army AMT Stations:

Stevan Jovancevic
Army Spectrum Management Office
Operations Building
6916 Cooper Avenue
Ft. Meade, MD. 20755-7901
Ph. 301-225-3774
Email: stevan.jovancevic.civ@mail.mil

NASA AMT Stations:

John E. Zuzek
NASA National Spectrum Program Manager
NASA Glenn Research Center
21000 Brookpark Rd.
Mail Stop 54-2
Cleveland, OH 44135
Ph. 216-433-3469
Fax 216-977-7444
Cell 440-319-1309
Email: John.E.Zuzek@nasa.gov

Navy AMT Stations:

Thu A. Luu
Navy Marine Corps Spectrum Center
Defense Information Systems Agency
ATTN: Navy Marine Corps Spectrum Center
P.O. Box 549
Ft. Meade, MD 20755-0549
Ph. 301-225-3838, DSN 375
Fax 301-225-0583
Email: Thu.A.Luu@navy.mil

