

# **Coordination Agreement Between the National Aeronautics and Space Administration (“NASA”) and VIASAT, Incorporated (VIASAT) for Operation of the VIASAT Arclight® AMSS Terminals in the 14.0 – 14.5 GHz-Band**

VIASAT seeks to operate aeronautical mobile-satellite service (AMSS) stations over the United States and Possessions (US&P) in the 14.0 - 14.5 GHz band. The AMSS stations are part of the ViaSat Arclight® communications system earth stations aboard aircraft (ESAA) using transponders in the geostationary satellite orbit (GSO) arc. This Coordination Agreement has been prepared in compliance with the rules of the Federal Communications Commission (FCC) and the recommendations of the International Telecommunication Union (ITU).

## **1 Overview**

1.1 Within the US&P, the 14.0 – 14.5 GHz-band is currently allocated to the fixed-satellite service, including the use by earth stations aboard aircraft (ESAA), on a primary basis. FCC requires all ESAA using this band to protect Space Research Services (SRS) earth stations and the Tracking and Data Relay Satellite System (TDRSS) that operate and require protection in this band.

1.2 ViaSat, Inc. holds a license authorization to operate ESAA units in the 14.0 – 14.5 GHz-band.

1.3 The ViaSat Arclight® ESAAs receive from, and transmit to, GSO satellite transponders under control of a Ground Earth Station (GES) and Network Operations Center (NOC). They, and the terrestrial network to which they are connected, comprise the VIASAT system.

1.4 This Coordination Agreement has been prepared to ensure that operation of the ViaSat Arclight® ESAAs conform to FCC requirements for protection of the NASA SRS Network.

1.5 ViaSat, Inc. has the authority to negotiate and sign this Coordination Agreement for its Arclight® AMSS system and NASA has the authority to negotiate and sign this agreement for the TDRSS and SRS Network sites listed in Section 3.1.

## **2 AUTHORITY**

2.1 NASA concludes this agreement pursuant to 42 USC §2473(c)(5) and (6) and section 203(5) of the National Aeronautics and Space Act of 1958 as amended, in addition to the Manual of Regulations and Procedures for Federal Radio Frequency Management (National Telecommunications & Information Administration Redbook), May 2013 Edition.

### 3 Space Research Service Earth Stations

3.1 Table 1 provides a list of TDRSS earth station sites requiring interference protection. The TDRSS satellite orbital locations supported by each earth station site are also shown.

Earth Station Site	Latitude	Longitude	TDRSS Satellite Longitude.
	degrees	degrees	Degrees East
<u>Continental United States</u>  <b>White Sands, New Mexico</b> Antenna Size – 18.3 meter Antenna Gain – 66.4 dBi Elevation – 1456 m	32.5434N	106.6121W	-174 -171 -167.5 -150 -79 -62 -49 -46 -41
<u>Continental United States</u> <b>Blossom Point, MD</b> Antenna Size – 20 meter Antenna Gain – 67.2 dBi Elevation – 5 m	38.4289N	77.0839W	-12 -41 -46 -49 -62
<u>United States Territory</u> <b>Guam</b> Antenna Size – 11 meter Antenna Gain – 61.9 dBi Elevation – 129 m	13.5881N	144.8410E	85 89 -174 -171 -167.5 -150

**Table 1 TDRSS Earth Station Sites**

3.2 New TDRSS Earth Station Sites:

NASA may unilaterally add additional TDRSS earth station sites to the list in Table 1 above. NASA will notify NTIA/FCC when it knows that a new earth station is being planned and has the coordinates of the newly planned site and public notice(s) will be issued by the FCC as appropriate.

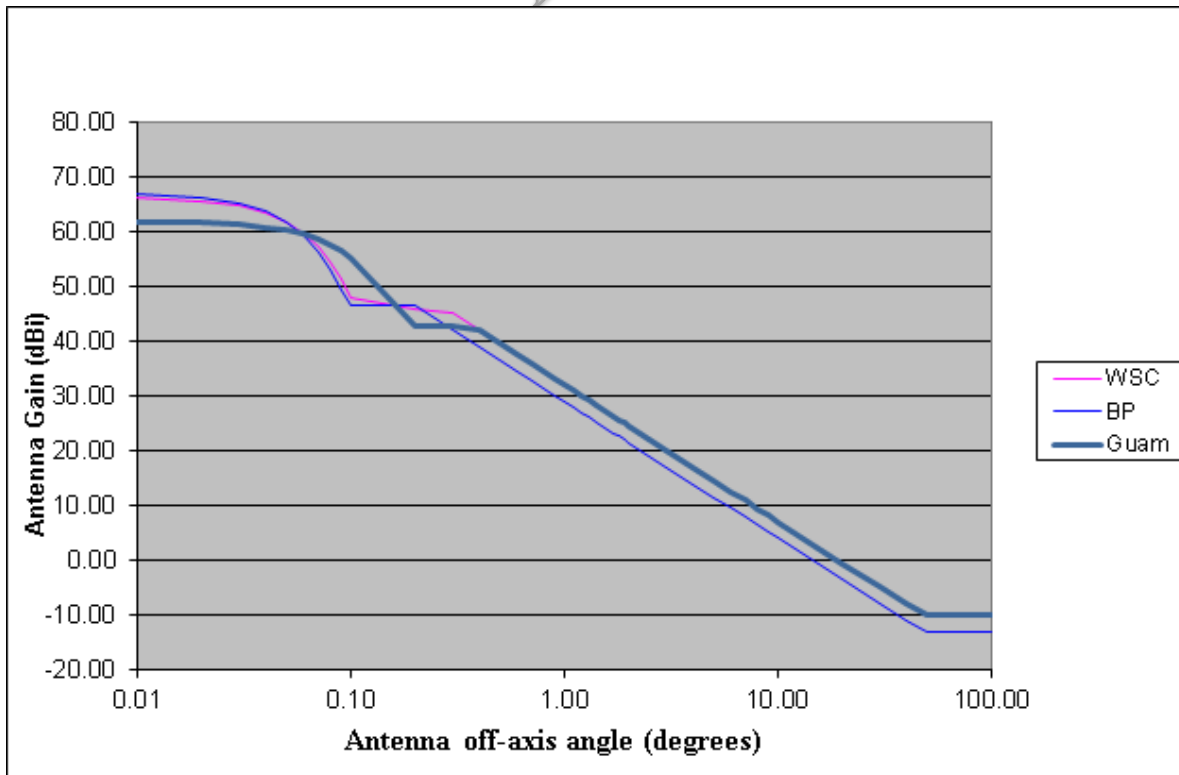
3.3 Earth Site Protection Limits:

3.3.1 The TDRSS protection limits are listed in Table 2 below for the WSC, Guam and BP sites.

Frequency Band	Interference Threshold Limit Measured at Antenna Output	Reference Percentage of Time
13.40 – 14.00 GHz	-176 dBW/kHz	Never to be Exceeded
14.00 – 14.05 GHz	-146 dBW/MHz	Never to be Exceeded
14.05 – 14.20 GHz	-100 dBW (WSC/Guam); -85 dBW (BP)	Never to be Exceeded

**Table 2. TDRSS Protection Limits**

3.3.2 For interference calculations, the TDRSS spacecraft can have an inclination angle up to 15 degrees. In calculating the interference threshold levels in Table 2, the antenna patterns in Figure 1 below should be used.



**Figure 1. TDRSS Earth Station Antenna Gain Patterns**

Note: The antenna off-axis patterns shown for WSC and Guam in Figure 1 are calculated using Annex III of Appendix 8 of the ITU Radio Regulations, with the following modifications:

$$G_1 = 5 + 15\log(D/\lambda)$$

$$\phi_r = 12.02 (D/\lambda)^{-0.6}$$

where  $G_{max}$  and  $D$  are given in Table 1. The antenna sidelobe pattern for BP is improved by 3 dB compared to that of WSC and Guam.

#### **4 Operational Coordination Agreement**

##### **4.1 NASA and VIASAT agree to the following:**

4.1.1 The purpose of this Coordination Agreement is to provide protection to the TDRSS earth station sites listed in Table 1 and any future TDRSS earth station sites.

4.1.2 The level of protection afforded to the earth stations in Table 1, and any future TDRSS earth station sites which NASA adds to Table 1 pursuant to Section 3.2.2 of this Agreement, shall be equal to or greater than the Interference Threshold Limits shown in Table 2.

4.2 This Coordination Agreement may be reviewed periodically by the signatories to the agreement following commencement of service by VIASAT under an operational license from the FCC. The purpose of the review is to assess the effectiveness of this agreement and update this, or subordinate operational agreements, as appropriate.

4.3 Each party shall inform the other party in a timely manner of changes in the points of contact as defined in Section 7.

##### **4.4 VIASAT agrees to:**

4.4.1 Monitor, control and cease transmissions from any ESAA that would exceed the thresholds given in Table 2 within radio line-of-sight of the sites listed in Table 1.

4.4.2 Monitor, control and cease transmissions from any ESAA that would exceed the thresholds given in the Table 2 within radio line-of-sight of such additional sites as NASA may require.

4.4.3 Respond expeditiously to a NASA request for protection of the sites listed in Section 3.1, in accordance with the threshold limits of Section 3.3.

4.4.4 Respond expeditiously to a NASA request to isolate a source of interference to a TDRSS earth station suspected to be from an ESAA.

4.4.5 Provide a central point of contact accessible and available (on a 24 hour, 7 day basis) for interference resolution and other contact.

##### **4.5 NASA agrees to:**

4.5.1 Maintain an open dialog with VIASAT concerning any perceived breach of interference thresholds that may be attributable to an ESAA that is not in compliance with this Coordination Agreement.

4.5.2 Provide timely notification to VIASAT of changes or additions to TDRSS earth station sites, TDRSS spacecraft orbital positions or interference thresholds listed in this Coordination Agreement.

## **5 Financial Obligations**

5.1: Each party shall be responsible for funding its own responsibilities under this Agreement. No provision of this Agreement shall be interpreted to require obligation of funds in violation of the Anti-Deficiency Act 31 U.S.C § 1341.

## **6 Assignment and Termination**

6.1 This Coordination Agreement shall be binding upon the parties hereto and their respective successors and assigns.

6.2 This Coordination Agreement may be terminated by either party upon 6 months written notice to the other.

6.3 CONTINUING OBLIGATIONS: The obligation of VIASAT to protect the NASA TDRSS earth stations from interference as described in this agreement will survive termination or expiration of this Agreement.

## **7 Points of Contact**

7.1 Points of contact concerning issues of a policy nature concerning this Coordination Agreement, or the designation of future technical contacts for updating or revising this Agreement:

Name: Victor Sparrow  
Title: Director NASA Spectrum Policy  
Organization: NASA  
Address: NASA Headquarters  
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Name: Daryl T. Hunter, P.E.  
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Carlsbad, CA 92009  
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7.2 Points of contact for technical issues or questions related to this Coordination Agreement:

Name: Vincent Scott Galbraith  
Title: Goddard Spectrum Manager  
Organization: NASA  
Address: Goddard Space Flight Center  
Exploration and Space Communications Office

Name: Daryl T. Hunter, P.E.  
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**8 Signatures**

This Coordination Agreement is being made in good faith by both parties and is effective on the date on of final signature.

For: The National Aeronautics and Space  
Administration:

For: ViaSat, Inc.

By: \_\_\_\_\_

By: \_\_\_\_\_

Name: Victor Sparrow

Name: Daryl T. Hunter, P.E.

Title: Director, Spectrum Plans and Policy

Title: Senior Director, Regulatory Affairs

Date: \_\_\_\_\_

Date: \_\_\_\_\_

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