

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

VIASAT seeks to license and operate aeronautical mobile-satellite stations (AMSS) over the Continental United States (CONUS) on a secondary basis in the 14.0 to 14.5 GHz FSS band. The AMSS terminals are part of the ViaSat Arclight® satellite communications system aboard general aviation and commercial aircraft 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 member states of the International Telecommunication Union (ITU) following the World Radio Communication Conference WRC-03.

**1. Overview**

- 1.1 The 14.0 – 14.5 GHz-band has been allocated to mobile-satellite service, now including aeronautical mobile-satellite service, on a secondary basis, provided that Airborne Earth Stations (AES) include specific protection to the Space Research Services (SRS) earth stations and to the Tracking and Data Relay Satellite System (TDRSS) within the 13.40 – 14.4 GHz-band
- 1.2 ViaSat, Inc. is expected to file an application for license authorization to operate up to 1,000 number of technically identical AES units in the 14.0 – 14.5 GHz-band.
- 1.3 The ViaSat Arclight® AESs receive from, and transmit to, the same GSO satellite transponder 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® AESs conform to FCC requirements for protection of the SRS Network.
- 1.5 ViaSat, Inc. has the authority to negotiate and sign this Coordination Agreement for their Arclight® AMSS and NASA has the authority to negotiate and sign this agreement for the TDRSS and SRS Network sites listed in Section 2.1.

## 2. AUTHORITY

2.1 NASA concludes this agreement pursuant to 42 USC §2473 © (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 2003 Edition, May 2005 Revisions.

## 3. Space Research Services Earth Stations

### 3.1 TDRSS Earth Station Sites

Table 1 provides a list of TDRSS Earth Stations sites currently requiring interference protection. Also provided are the TDRSS satellite orbital locations currently supported by each Earth Station site.

| Earth Station Site                         | Latitude<br>(D,M,S) | Longitude<br>(D,M,S) | TDRSS Satellite<br>Degrees East Long.* |
|--------------------------------------------|---------------------|----------------------|----------------------------------------|
| <u>Continental United States</u>           |                     |                      |                                        |
| White Sands, New Mexico                    | N32 30'<br>18.686"  | W106 36' 37.153"     | -174                                   |
| Antenna Size – 18.3 meter                  |                     |                      | -171                                   |
| Antenna Gain – 66.4 dBi                    |                     |                      | -150                                   |
| Elevation – 1456 m                         |                     |                      | -79                                    |
|                                            |                     |                      | -62                                    |
|                                            |                     |                      | -49                                    |
|                                            |                     |                      | -47                                    |
|                                            |                     |                      | -41                                    |
| <u>United States Territory<sup>1</sup></u> |                     |                      |                                        |
| Guam                                       | N13 36' 0"          | E144 54' 0"          | 85                                     |
| Antenna Size – 11 meter                    |                     |                      | -171                                   |
| Antenna Gain – 61.9 dBi                    |                     |                      | -174                                   |

**Table 1. Existing TDRSS Earth Station Sites**

\* Ephemeris data on existing TDRS spacecraft indicated in Table 1 may be found at the following Web sites:

a. [http://fdf.gsfc.nasa.gov/prod\\_center/pc\\_frame\\_page.htm](http://fdf.gsfc.nasa.gov/prod_center/pc_frame_page.htm)  
Select Retrieve Other Products

<sup>1</sup> Should VIASAT extend operations outside of CONUS, it shall provide the same protection to NASA's TDRSS Earth Stations sites around the world (such as Guam) as will be provided to the other Station sites covered by this Agreement.

Select Retrieve 2-line Element Sets (Celestial BBS)  
Under NORAD Two-Line Element Sets, Select Current Data  
Select Tracking and Data Relay Satellite System (TDRSS)

b. Obtain the NORAD orbital elements directly at:

<http://celestrak.com/NORAD/elements/>

choose Tracking and Data Relay Satellite System (TDRSS)

### 3.2 Additional TDRSS Earth Station Sites

NASA may unilaterally add additional TDRSS earth station sites to the list in 2.1 above. NASA is currently planning to add a new earth station on the east coast of the U.S. to communicate to a new geostationary TDRS orbit position, and another earth station outside CONUS to communicate with an additional new geostationary TDRS orbit position, not yet defined. NASA will seek to provide more details on these additional sites and TDRS positions once they have been finalized. NASA shall provide VIASAT, Inc. at least two months written notice of these and/or additional sites which may be using the 13.40 – 14.5 GHz-band for satellite to earth data relay or of changes in status to the existing sites. In emergency situations, such notice may be significantly shorter or waived altogether.

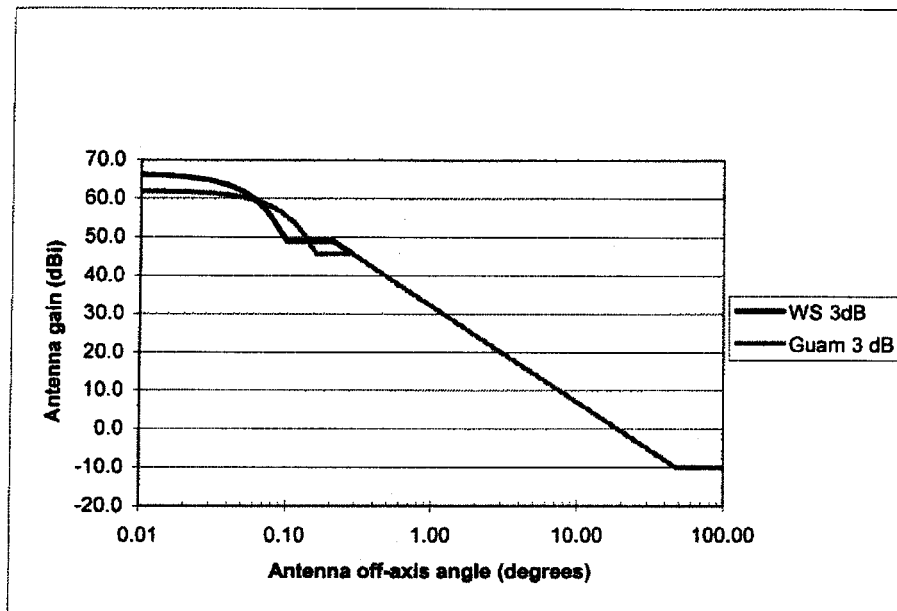
### 3.3 Earth Site Protection Limits

The TDRSS protection limits are listed in the Table 2 below.

| Frequency Band    | Interference Threshold Limit<br>Measured at Antenna Output | Reference Percentage<br>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 – 14.40 GHz | -100 dBW                                                   | Never to be Exceeded            |

**Table 2. TDRSS Protection Limits**

For interference calculations, the TDRS 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. TDRS Earth Station Antenna Gain Patterns**

Note: This antenna pattern is 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 Gmax and D are given in Table 1.

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

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

a. 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.

b. The level of protection afforded to the sites in Table 1., and any future TDRS earth station sites which NASA adds to Table 1 pursuant to Section 2.2 of this Agreement, shall be equal to or greater than the Interference Threshold Limits shown in Table 2.

4.1 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.

4.2 Each party shall inform the other party in a timely manner of changes in the points of contact as defined in Section 5.

**4.3 FINANCIAL OBLIGATIONS:** 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.

**VIASAT agrees to:**

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

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

4.6 Respond expeditiously to a NASA request for protection of the sites listed in Section 2.1, or additions thereto as provided for in Section 2.2, in accordance with the threshold limits of Section 2.3.

4.7 Respond expeditiously to a NASA request to isolate a source of interference to a TDRSS Earth Station suspected to be from an AES.

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

**NASA agrees to:**

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

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

**5. Assignment and Termination**

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

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

5.3 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.

## **6. Points of Contact**

### **6.1 Points of contact concerning this Coordination Agreement:**

Name: David P. Struba  
Title: Director NASA Spectrum Policy  
Organization: NASA  
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Facsimile: (202) 358-2865  
e-mail: [David.Struba@nasa.gov](mailto:David.Struba@nasa.gov)

Name: Bruce Poole.  
Title:  
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Address: VIASAT, Inc.  
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Carlsbad, CA 92009-1699  
Telephone: 760-476-4820  
Facsimile: 760-929-3941  
e-mail: [bruce.poole@viasat.com](mailto:bruce.poole@viasat.com)

### **6.2 Point of contact for technical concerns related to this Coordination Agreement:**

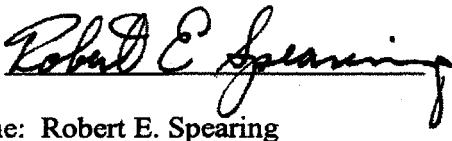
Name: Roger D. Porter  
Title: Goddard Spectrum Manager  
Organization: NASA  
Address: Goddard Space Flight Center  
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## **7. Signatures**

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:

By:   
Name: Robert E. Spearing

Title: Associate Assistant Administrator  
For Space Communications

Date: 10/26/05

For: ViaSat Incorporated:

By:   
Name: Kevin Lippert

Title: Associate General Counsel

Date: 10/26/05