

**Coordination Agreement Between the National Aeronautics  
and Space Administration (“NASA”) and The Boeing Company (“Boeing”)  
for Operation of the  
Boeing Broadband SatCom Network (BBSN) Ku-Band ESAA Terminals in  
the 14.0 – 14.5 GHz-Band**

The Boeing Company currently operates the Boeing Broadband SatCom Network (BBSN) which consists of Earth Stations Aboard Aircraft (ESAAs) in the United States and Possessions (US&P) in the 14.0 - 14.5 GHz band using transponders on geostationary satellites. FCC regulations for licensing such systems require that Boeing coordinate the BBSN with NASA to protect the Tracking and Data Relay Satellite System (TDRSS).

This Coordination Agreement between NASA and Boeing 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 of Earth Stations Aboard Aircraft (ESAA), on a primary basis. FCC requires all earth stations aboard aircraft (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 Boeing holds an experimental license authorization from the FCC to operate BBSN aircraft earth stations in the 14.0 – 14.5 GHz-band and will soon submit an application to the FCC to operate these same earth stations under an ESAA license. This coordination agreement addressing ESAAs is equally applicable to the aircraft Earth stations operating under the current experimental license.

1.3 The BBSN 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 BBSN system.

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

1.5 Boeing has the authority to negotiate and sign this Coordination Agreement for its ESAA 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> (WSC) 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> (BP) 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.

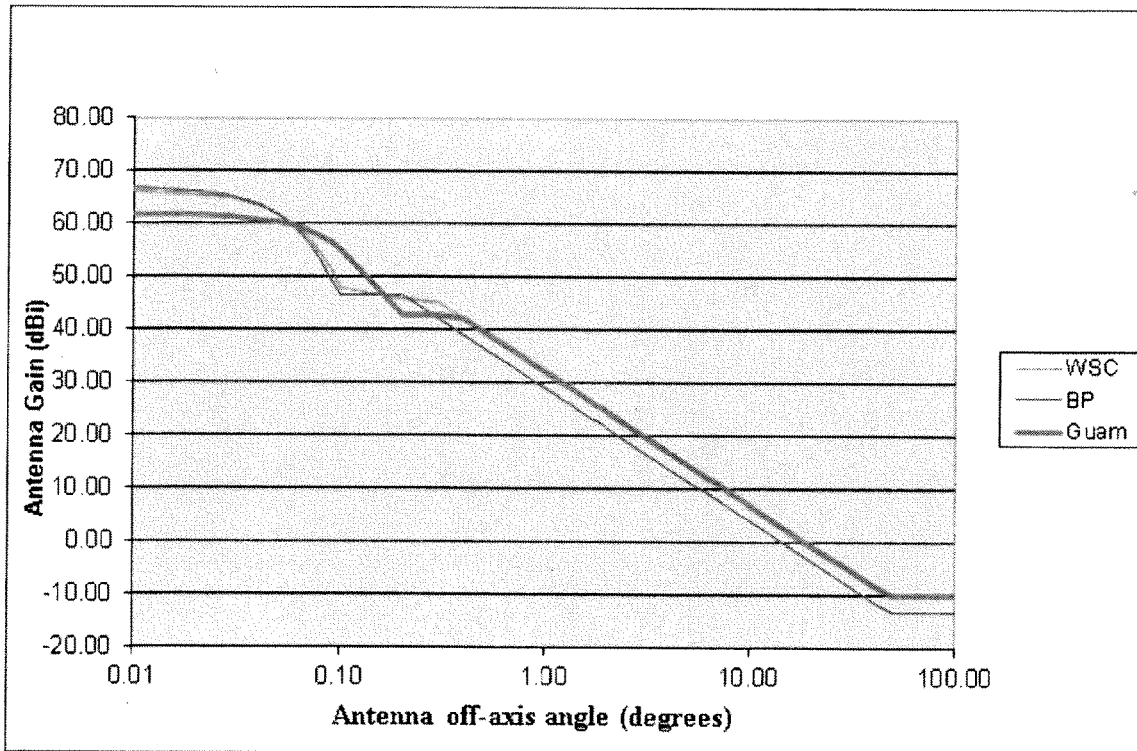


Figure 1. TDRSS Earth Station Antenna Gain Patterns

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 BBSN 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 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 BBSN 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 This Coordination Agreement supersedes the previous coordination agreement dated Dec 18, 2001.

4.5 BBSN agrees to:

4.5.1 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.

4.5.2 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.

4.5.3 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.

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

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

4.6 NASA agrees to:

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

4.6.2 Provide timely notification to BBSN 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 BBSN 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  
Org: NASA  
Address: NASA Headquarters  
300 E Street SW  
Washington D.C. 20546-0001  
Telephone: (202) 358-0681  
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Name: Ron Center  
Title: Manager, U.S. Spectrum Management  
Org: Boeing  
Address: ATTN: Ronald E Center M/C: 2T-22  
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Seattle, WA 98124-2207  
Telephone: (206) 544-6044  
e-mail: [Ronald.E.Center@boeing.com](mailto:Ronald.E.Center@boeing.com)

7.2 Points of contact for technical issues or questions related to this Coordination Agreement:

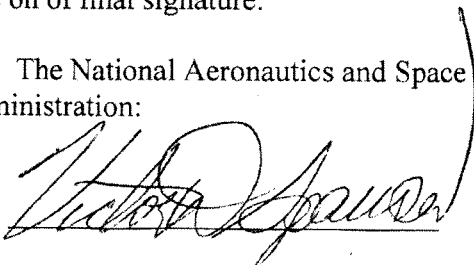
Name: Vincent Scott Galbraith  
Title: Spectrum Manager  
Org: NASA  
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Communications Division, Code  
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**8 Signatures**

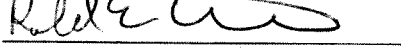
This Coordination Agreement is being made in good faith by both parties and is effective on the date on of final signature.

For: The National Aeronautics and Space Administration:

By:   
Name: Victor Sparrow  
Title: Director, Spectrum Plans and Policy

Date: 1/30/2015

For: The Boeing Company

By:   
Name: Ron Center  
Title: Manager U.S. Spectrum Management

Date: 2/5/2015