

**A Coordination Agreement
Between the National Aeronautics and Space Administration
(hereinafter “NASA”)
and RaySat, Incorporated (hereinafter “RaySat”)
for Operation of the RaySat LMSS Terminals
in the 14.0 – 14.5 GHz-Band**

RaySat seeks to license and operate Land Mobile-Satellite Service (LMSS) terminals in the Continental United States (CONUS) on a secondary basis in the 14.0 to 14.5 GHz FSS band. The LMSS terminals are RaySat StealthRay satellite communications terminals aboard ground vehicles 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 In the United States, the 14.0 – 14.5 GHz-band has been allocated to the mobile-satellite service on a secondary basis, provided that Land Mobile Earth Stations (LMSS) include specific protection to the Space Research Service (SRS) earth stations and to the Tracking and Data Relay Satellite System (TDRSS) within the 13.40 – 14.05 GHz-band.
- 1.2 RaySat, Inc. is expected to file an application with the FCC for license authorization to operate up to 5,000 technically identical LMSS units in the 14.0 – 14.5 GHz transmit and 11.7 – 12.2 GHz receive bands.
- 1.3 The RaySat LMSSs are internally controlled and receive from and transmit to possibly different GSO satellite transponders without the control of a Ground Earth Station (GES) and Network Operations Center (NOC). Each individual RaySat terminal can be connected to different transponders (from different satellite providers) and each RaySat terminal has an internal global position system receiver.
- 1.4 This Coordination Agreement has been prepared to ensure that operations of the RaySat StealthRay terminals conform to FCC requirements for protection of the SRS Network.
- 1.5 RaySat, Inc. has the authority to negotiate and sign this Coordination Agreement for its StealthRay terminals, 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

NASA concludes this agreement pursuant to 42 USC §2473 (c) (5) and (6) and section 203 (c) (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, September 2005 Revisions.

3. Space Research Service 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 (D,M,S)	Longitude (D,M,S)	TDRSS Satellite Degrees East Long.*
<u>Continental United States</u>			
White Sands, New Mexico	N32 30' 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 Territory¹</u>			
Guam	N13 36' 0"	E144 54' 0"	85
Antenna Size – 11 meter			-171
Antenna Gain – 61.9 dBi			-174

Table 1. TDRSS Earth Station Sites

* Ephemeris data on existing TDRSS 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
 Select Retrieve Other Products
 Select Retrieve 2-line Element Sets (Celestial BBS)
 Under NORAD Two-Line Element Sets, Select Current Data
 Select Tracking and Data Relay Satellite System
- b. Obtain the NORAD orbital elements directly at:
<http://celestrak.com/NORAD/elements/>
 choose Tracking and Data Relay Satellite System

¹ NASA recognizes that RaySat is currently applying only for CONUS authorization. If RaySat applies for future authorization to operate outside of CONUS RaySat and NASA shall develop an addendum to this agreement to accommodate RaySat's protection of the NASA Guam TDRS site.

3.2 Earth Station Site Protection Limits

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

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 – 14.40 GHz	-100 dBW	Never to be Exceeded

Table 2. TDRSS Protection Limits

In order to meet the protection limits specified in Table 2, RaySat LMSS terminal operations will be prohibited within certain zones surrounding TDRSS Earth station. The size and shape of these zones may be calculated using TDRSS and RaySat radio frequency parameters and operational characteristics which are based on direct technical coordination between NASA and RaySat. Tables 3 and 4 list the exclusion zones (where LMSS transmitters will not operate), in kilometers, that are necessary to protect the NASA TDRSS.

Required Separation Distance (Note 1) Between RaySat Terminal and TDRSS Earth Station (RaySat Ops above 14.2 GHz) centered on N32 30' 18.686", W106 36' 37.153"		
TDRSS Earth Station	RaySat Emissions into TDRSS Earth Station Backlobe Region ²	RaySat Emissions into TDRSS Earth Station Mainlobe Region ^{2,3}
White Sands	10 km (North of TDRSS earth station)	10km (South of TDRSS earth station)
<p><i>Note 1: TDRSS "out-of-band" criteria is -100.0 dBW</i></p> <p><i>Note 2: RaySat emissions into TDRSS Earth station backlobe region assume RaySat "mainlobe"; RaySat emissions into TDRSS Earth station mainlobe region assume RaySat "backlobes"</i></p> <p><i>Note 3: TDRSS latitude excursions resulting in less than one degree Earth station antenna elevation.</i></p>		

Table 3. RaySat Ops above 14.2 GHz

	Required Separation Distance (NOTE 1) Between RaySat Terminal and TDRSS Earth Station (RaySat Ops below 14.2 GHz) centered on N32 30' 18.686", W106 36' 37.153"	
TDRSS Earth Station	RaySat Emissions into TDRSS Earth Station Backlobe Region2	RaySat Emissions into TDRSS Earth Station Mainlobe Region2,3
White Sands	46 km (North of TDRSS)	73 km (South of TDRSS)
<p><i>Note 1: TDRSS "in-band" criteria is -146.0 dBW/MHz</i></p> <p><i>Note 2: RaySat emissions into TDRSS Earth station backlobe region assume RaySat "mainlobe"; RaySat emissions into TDRSS Earth station mainlobe region assume RaySat "backlobes"</i></p> <p><i>Note 3: TDRSS latitude excursions resulting in less than one degree Earth station antenna elevation.</i></p>		

Table 4. RaySat Ops below 14.2 GHz

4. Operational Coordination Agreement

NASA and RaySat agree to the following:

- a. The purpose of this Coordination Agreement is to provide protection to the TDRSS Earth Station site located at White Sands, New Mexico as listed in Table 1. Should Raysat later identify a need to operate terminals in Guam, an addendum to this document will have to be developed and coordinated to protect the TDRS Guam site.
 - b. The level of protection afforded to the White Sands site identified in Table 1 shall be equal to or greater than the Interference Threshold Limits shown in Table 2, and the exclusion zones appearing in Tables 3 and 4.
- 4.1 This Coordination Agreement may be reviewed periodically by the signatories to the agreement following commencement of service by RaySat 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 6.

- 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.

RaySat agrees to:

- 4.4 Prevent transmissions from any LMSS that would exceed the thresholds given in Table 2. Based on RaySat technical parameters and operational characteristics agreed during direct RaySat/NASA coordination discussions, RaySat terminals will not operate within the distances of the White Sands TDRS site specified in Tables 3 and 4.
- 4.6 Respond expeditiously to a NASA request to isolate a source of interference to a TDRSS Earth Station suspected to be from a RaySat LMSS terminal.
- 4.7 Provide a central point of contact (on a 24 hour, 7 day basis) for interference resolution and other contact.
- 4.8 To facilitate RaySat terminal operations, on a case by case basis, within the distance separations specified in Tables 3 and 4, RaySat shall provide a written waiver request for NASA authorization of these distance constraints providing the specific terminal(s) to be used, the start/end date and time, a description of the user requirement and the closest distance separation to the White Sands site that will be needed to satisfy the user mission, and the starting and ending date of operation applicable to the waiver request. RaySat agrees to provide this request to the NASA contacts identified in section 6 at least 2 weeks prior to requested use. To expedite consideration and to ensure the request is not lost, Raysat agrees to used a method that provides tracking of the sent request and to contact the NASA point of contacts by telephone as soon as the request has been sent. RaySat will not allow terminals to transmit within the zones of exclusion specified in Tables 3 and 4 without NASA authorization, in accordance with sections 4.9 and 4.11
- 4.9 Raysat agrees to implement an internal means within its terminals, to ensure that its terminals cannot transmit within the agreed distance separations from White Sands, specified in Tables 3 and 4, unless the automated program is “overridden” using a terminal unique hardware or software “cipher key”. Raysat also agrees not to provide this cipher key to any terminal user without NASA authorization. Authorization may be requested by Raysat when requesting a waiver of the distance separations in Tables 3 and 4 using the method described in subsection 4.8.

NASA agrees to:

- 4.10 Maintain an open dialog with RaySat concerning any perceived breach of interference thresholds that may be attributable to an LMSS terminal that is not in compliance with this Coordination Agreement.

- 4.11 Provide timely notification to RaySat of changes or additions to TDRSS earth station sites, TDRSS spacecraft orbital positions or interference thresholds listed in this Coordination Agreement.
- 4.12 Consider Raysat waiver requests, on a case by case basis; to authorize the operation of individually identified RaySat terminals within a distance separation less than those established in Tables 3 and 4... NASA will endeavor to provide a response to RaySat's request within one week after receipt and review of such request from RaySat. The NASA written response will be sent, via a method that provides a tracking mechanism, to the RaySat points of contact in section 6.

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 RaySat 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
Address: NASA Headquarters
300 E Street SW
Washington D.C. 20546-0001
Telephone: (202) 358-4808
Facsimile: (202) 358-2865
e-mail: David.Struba@nasa.gov

Name: Ilan Kaplan
Title: VP, Product Management
Organization: RaySat, Inc.
Address: RaySat, Inc.
8460-D Tyco Road
Vienna, VA 22182
Telephone: 703-584-3770
Facsimile: 703-584-3775
e-mail: ilan@raysat.com

6.2 Points of contact for technical concerns related to this Coordination Agreement:

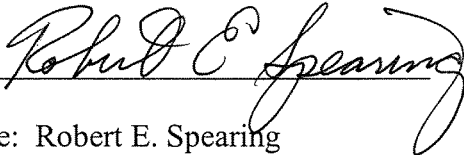
Name: Roger D. Porter
Title: Goddard Spectrum Manager
Organization: NASA
Address: Goddard Space Flight Center
Mission Services Program Office
Greenbelt, MD 20771
Telephone: (301) 286-5089
Facsimile: (301) 286-1724
e-mail: Roger.Porter@gssc.nasa.gov

Name: Robert Yip
Title:
Organization: RaySat, Inc.
Address: RaySat Inc.
8460-D Tyco Road
Vienna, VA 22182
Telephone: 703-584-3770
Facsimile: 703-584-3775
e-mail: ryip@raysat.com

7. Signatures

This Coordination Agreement is being made in good faith by both parties and is effective on the date of final signature. The parties signing this Agreement have the necessary authority to fulfill the promises and obligations contained herein.

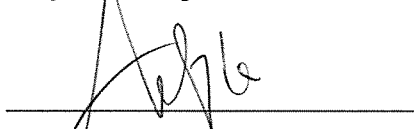
For: The National Aeronautics and Space Administration:

By: 

Name: Robert E. Spearing
Title: Associate Assistant Administrator
For Space Communications

Date: 4/13/06

For: RaySat Incorporated:

By: 

Name: Ian Kaplan
Title: VP, Product Management

Date: 5/3/06