APPLICATION FOR EXPERIMENTAL
SPECIAL TEMPORARY AUTHORITY

Raysat Antenna Systems, LLC ("RAS") hereby files this application for experimental special temporary authority ("STA") to operate up to twenty-five (25) StealthRay terminals with the Intelsat Galaxy-16 satellite at 99ºW and Galaxy-25 satellite at 93°W at higher power and wider bandwidth than previously authorized by the Federal Communications Commission ("FCC" or "Commission") (*see* File No. 0203-EX-PL-2008 and previous file numbers). RAS seeks to test this new operational mode and conduct limited market studies associated with use of the StealthRay antenna in the satellite news gathering ("SNG") context. In addition, RAS seeks to operate these terminals with the Galaxy-25 satellite in connection with the provision of service pursuant to government contract.

RAS requests expedited treatment for processing of the instant request. As discussed below, some time ago RAS filed an STA request to communicate with the Galaxy-16 satellite that was dismissed without prejudice. The resulting delay has led to increased urgency in grant of this authority. Moreover, RAS is filing a separate confidential statement regarding the U.S. military's needs to transition traffic to the Galaxy-25 satellite within the next several weeks. Thus, RAS is requesting expedited treatment for this request and grant no later than January 30, 2009.

No other technical aspect of previously authorized StealthRay operations will change, and RAS otherwise accepts the terms and conditions set forth in its prior experimental

authorizations. For the reasons set forth herein, expeditious grant of the limited authority requested herein will strongly serve the public interest.[1]

I. BACKGROUND

RAS holds an experimental license to operate the StealthRay antenna with a number of satellites across the geostationary arc from 72ºW (AMC-6) to 129ºW (G-27) for the provision of service under government contract.[2] RAS also holds commercial earth station licenses that are in the process of being modified to include necessary authority to operate across a broader range of satellites, including the Galaxy-16 satellite.[3] However, RAS does not intend to modify the commercial licenses to include higher power transmissions with Galaxy-16 or add the Galaxy-25

[1] RAS previously submitted a similar request for experimental STA, which was dismissed without prejudice because it sought authority similar to that held pursuant to File No. 0203-EX-PL-2008. *See* Letter from James R. Burtle, Chief, Experimental Licensing Branch, Federal Communications Commission to Ilan Kaplan, President, Raysat Antenna Systems, LLC, 0069-EX-ST-2008, dated January 7, 2009. RAS's authority pursuant to 0203-EX-PL-2008, however, does not currently authorize the bandwidth, power level, satellite points of contact, and limited market study authority sought by the STA application. In addition, RAS learned subsequent to the dismissal of the urgent need to add an additional point of communication (Galaxy-25), as described herein. Therefore, RAS is concurrently filing an application for modification of its experimental license (File No. 0203-EX-PL-2008) and, in view of its request for expedited treatment, submitting a new experimental STA request that includes this additional authority. If the experimental modification application can be addressed on an expedited basis, the Experimental Licensing Branch need not act on this experimental STA request.

[2] *See* Call Sign WE2XTX, File No. 0203-EX-PL-2008**.** RAS has also held several experimental STAs for government and non-government limited market study operations. Because no further technical changes to StealthRay operations are proposed (other than higher power and wider bandwidth), RAS hereby incorporates by reference the technical information that supported prior grants of experimental authority for StealthRay operations). To the extent the Commission believes that this prior or any other technical information is necessary for grant of the instant STA application, RAS respectfully requests an opportunity to supplement the record.

[3] *See* Call Signs E060101, E060447, E060448, E060449, E060450 and E060451. License modification applications to add the Galaxy-16 satellite to these call signs were recently dismissed for unrelated, minor technical inconsistencies and were re-filed on December 21, 2008. *See* File Nos. SES-MOD-20081221-01677, SES-MOD-20081221-01672, SES-MOD-20081221-01673, SES-MOD-20081221-01674, SES-MOD-20081221-01675, and SES-MOD-20081221-01676.

satellite until this operational mode can be validated pursuant to the experimental authority requested herein.

RAS has a critical need to operate the StealthRay antenna with the Galaxy-16 satellite for ongoing development and validation of its Ku-band land mobile-satellite service operations. Specifically, RAS seeks to validate the use of higher data rate operations of the StealthRay antenna in the SNG context. Among other things, these limited operations will be tested to facilitate enhanced coverage of important news and public interest events, including remote coverage of Administration transition and other newsworthy events. Although RAS's terminals have previously operated in a more limited SNG capacity, they have not done so with Galaxy-16 or at the higher throughput levels associated with the proposed operations. Given the limited nature of the proposed operations, the public benefits of enhanced coverage of important events and the non-interfering operations proposed herein, grant of the requested experimental STA would serve the public interest.

RAS also must operate its StealthRay antenna with the Galaxy-25 satellite in order to continue providing service to the U.S. military pursuant to government contract. The U.S. military seeks to move existing communications services under contract to Galaxy-25 by the end of January, 2009. Accordingly, RAS requests expedited treatment of the instant application. Additional information regarding the need for expedited treatment and the underlying government contract is provided in the confidential exhibit associated with this application.

II. NEW POWER LEVEL AND EMISSION DESIGNATOR

RAS has developed a higher-power version of the StealthRay antenna that permits the use of higher power and wider bandwidth emissions, thereby enhancing throughput and link performance. This, in turn, results in higher data rates and more robust service. The use of

wider bandwidth emissions allows the higher-power signal to remain within the off-axis EIRP spectral density limits mandated by RAS's existing experimental authorization and the FCC's two-degree spacing requirements.

RAS seeks to operate at up to a wider 3.9 megahertz emission (3M97G7W) rather than the previously authorized 512 kilohertz emission (512KG7W). In addition, RAS seeks to operate at an input power up to 8.0 kW ERP rather than the previously authorized 1.6 kW ERP. Accounting for transmission losses through the antenna, the maximum uplink EIRP per carrier is increased from 30.5 dBW (for the 512 kHz emission) to up to 41.2 dBW (for the new 3.9 MHz emission). RAS seeks authority to operate up to these new maximum levels, depending on the skew angle to the satellite with which the antenna is communicating. However, given the wider bandwidth, the maximum off-axis EIRP spectral density remains within the limits of the original filing as coordinated and authorized.

Importantly, the Galaxy-16 satellite at 99ºW and Galaxy-25 satellite at 93°W are located near the center of the geostationary arc over the continental United States ("CONUS"). As a result, the skew angles to the satellites are significantly less than the angles from CONUS to previously authorized satellite points of communication on the eastern and western edges of the arc.[4] Table 1 demonstrates that regardless of location within CONUS, the StealthRay terminal will operate with the Galaxy-16 and Galaxy-25 satellites at skew angles of no more than 35º rather than the more conservative figure of 50º set forth in RAS's prior experimental application.

[4] "Skew angle" (the offset between the longest axis of the antenna and the GSO arc) is a function of the geographic location of the mobile terminal and the orbit longitude of the serving satellite.

Latitude	Longitude	Galaxy-16 Skew Angle	Galaxy-25 Skew Angle
48.5	122.5	-19.4	-23.5
40.25	124.5	-27	-31.7
32.7	117.1	-25.8	-32.5
25	80.5	34.2	24.9
35.5	75.5	29.2	22.9
47.3	68.5	25.1	21

Table 1. Representative Skew Angles for Galaxy-16 and Galaxy-25

Because RAS fully accounts for skew angle in its operations, the reduced skew angel translates to a narrower beam for the StealthRay antenna. The predicted beam pattern for a 35˚ skew angle is shown in Figure 1.

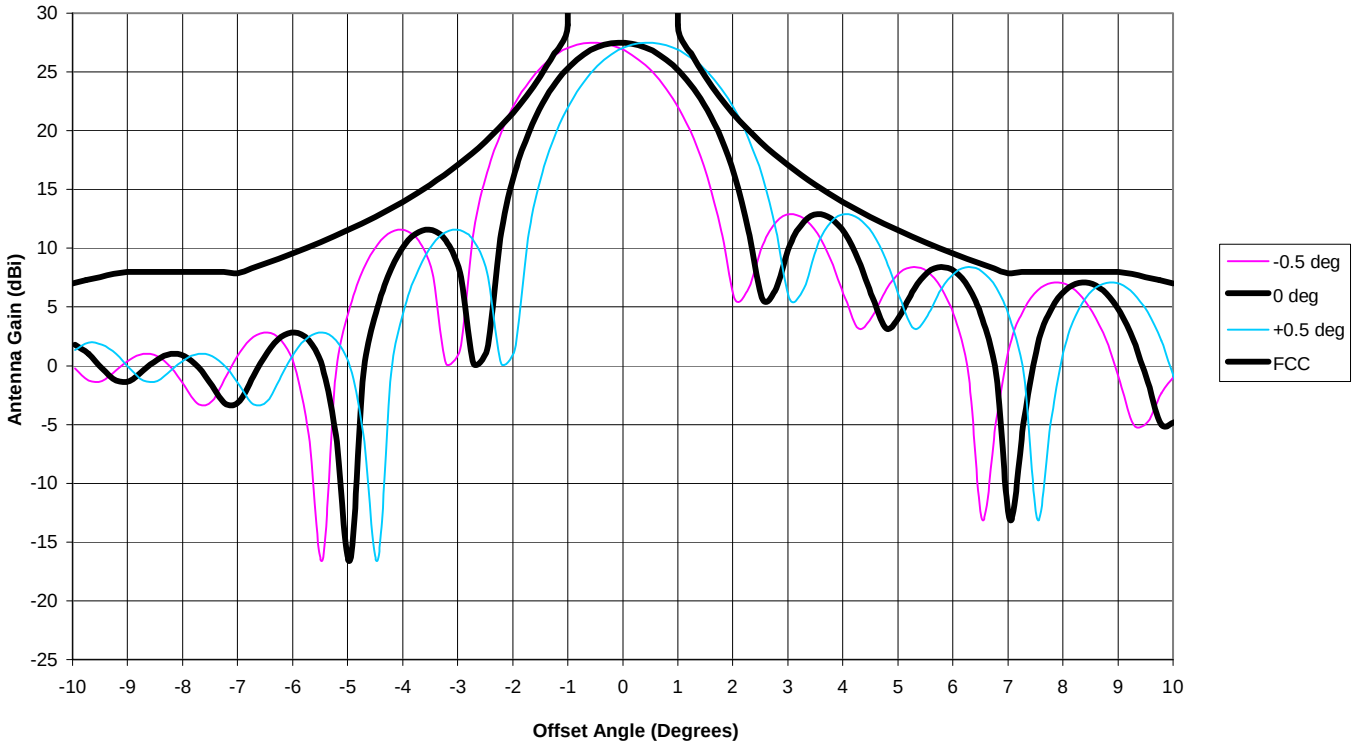

Figure 1. StealthRay Antenna Gain at 35º Skew Angle

Figure 2, below, shows the off axis EIRP with an input flange power spectral density of -15.7dBW/4kHz at a 35º skew angle. The off axis EIRP density falls below the 15-25log(θ) dBW/4kHz mask which is the formed form the combination of the off-axis sidelobe mask (29-25log(θ)dBi) and the maximum input flange power density of -14 dBW/4kHz) of a routinely licensed Ku-band VSAT antenna, even when the antenna is mispointed +/- 0.5 degrees. Because the antenna automatically ceases transmission at an offset angle of 0.5 degrees, *at no time will StealthRay transmissions exceed the off-axis EIRP spectral density limits associated with two-degree satellite spacing.*

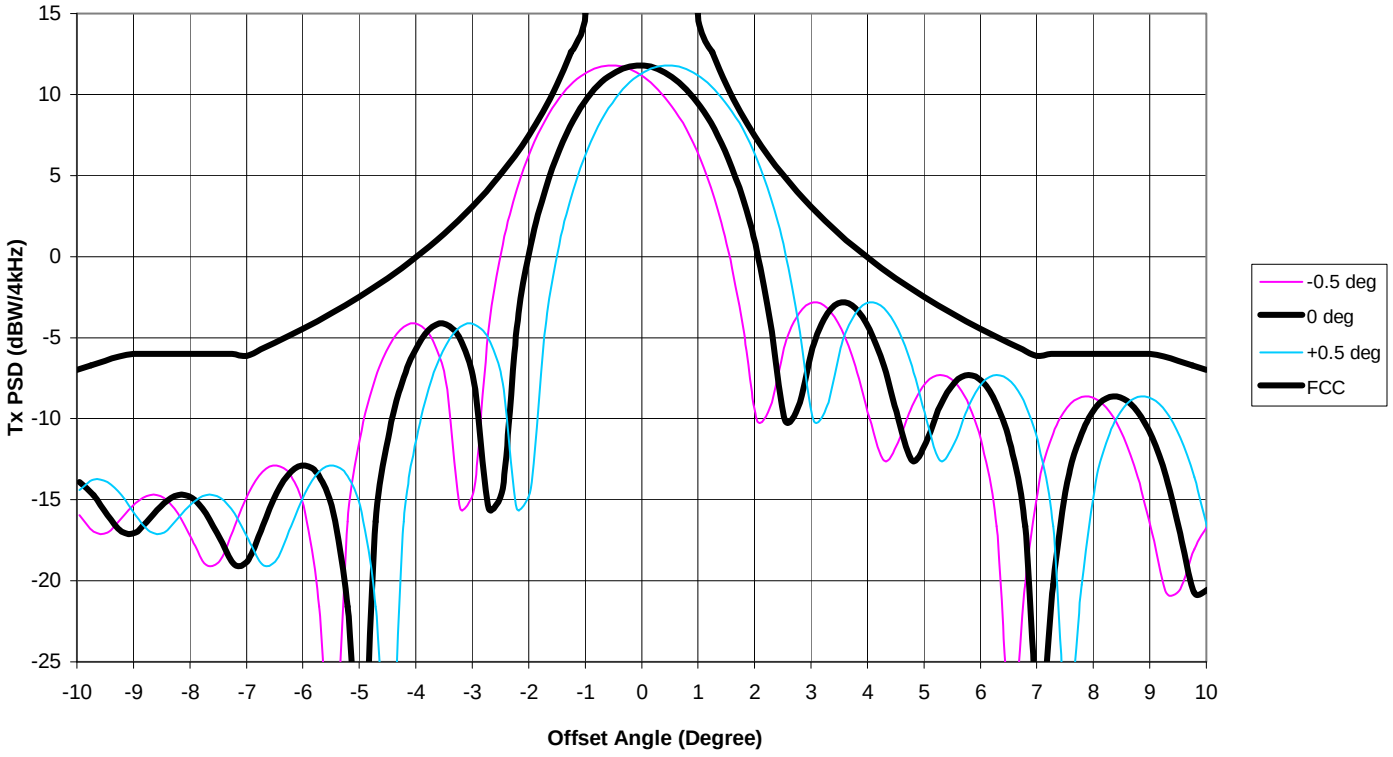

Figure 2. Off Axis EIRP Density with -15.7dBW/4kHz at Input Flange

The foregoing information demonstrates that RAS's proposed operations will not result in interference to adjacent Ku-band FSS satellite operations. RAS also confirms that it will continue to meet the stated levels and other requirements necessary to protect NASA TDRSS operations and Radio Astronomy stations.[5]

III. SATELLITE POINTS OF COMMUNICATION

RAS requests authority to communicate with the Intelsat Galaxy-16 satellite at 99ºW and the Galaxy-25 satellite at 93°W. RAS has a pressing need to communicate with these additional satellites to further refine the operational characteristics of its network and to facilitate the provision of service pursuant to government contract. Importantly, because the proposed operations remain below the required off-axis EIRP spectral density limits at all times (even when mispointed at the maximum 0.5º offset), there is no increased potential for interference to adjacent satellite operators from adding the new satellite points of communication.

Moreover, in three years of operating the StealthRay antenna on an experimental basis, there have been no instances of harmful interference. While the maximum power levels requested herein are slightly higher than previously authorized, use of a wider emission will reduce the spectral density of the emission and thereby reduce the potential for interference to adjacent satellites.

[5] *See* Attachment 1 (Coordination Agreements with the National Science Foundation and NASA).

IV. CONCLUSION

Except as described herein, RAS hereby confirms that it will operate the StealthRay antenna in conformance with the technical conditions contained in its existing experimental authorization. In particular, RAS will operate such that off-axis EIRP spectral density levels are no greater than that permitted for routinely licensed VSATs, and on an unprotected non-harmful interference basis only (immediately ceasing transmissions in the event of interference to co-frequency operations).

RAS must communicate with the Galaxy-16 satellite at slightly higher powers to validate this mode of operation for its network and must move communications to the Galaxy-25 satellite to meet requirements under government contract. RAS's proposed modifications will serve the public interest and have no adverse effect on other users of the spectrum. Finally, RAS seeks to validate this new operational model through experimentation before seeking full commercial authority. Therefore, RAS respectfully requests grant of this experimental STA application at the earliest possible time.

ATTACHMENT 1

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.*
Continental United States			
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
United States Territory[1]			
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)
Note 1: TDRSS "out-of-band" criteria is –100.0 dBW *Note 2: RaySat emissions into TDRSS Earth station backlobe region assume RaySat "mainlobe"; RaySat emissions into TDRSS Earth station mainlobe region assume RaySat "backlobes"* *Note 3: TDRSS latitude excursions resulting in less than one degree Earth station antenna elevation.*		

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)
Note 1: TDRSS "in-band" criteria is –146.0 dBW/MHz *Note 2: RaySat emissions into TDRSS Earth station backlobe region assume RaySat "mainlobe"; RaySat emissions into TDRSS Earth station mainlobe region assume RaySat "backlobes"* *Note 3: TDRSS latitude excursions resulting in less than one degree Earth station antenna elevation.*		

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@gsfc.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: Robert E. Spearing

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

Date: 4/13/06

For: RaySat Incorporated:

By: _____

Name: Ilan Kaplan
Title: VP, Product Management

Date: 5/3/06

TECHNICAL OPERATIONAL COORDINATION AGREEMENT FOR THE JOINT USAGE OF THE BAND 14.0 - 14.5 GHz BETWEEN THE NATIONAL SCIENCE FOUNDATION AND LAND MOBILE SATELLITE SERVICE EARTH STATIONS (LMSS) OPERATED BY RAYSAT, INC.

Version 1.0

May 25, 2006

TECHNICAL OPERATIONAL COORDINATION AGREEMENT FOR THE JOINT USAGE OF THE BAND 14.0 - 14.5 GHz BETWEEN THE NATIONAL SCIENCE FOUNDATION AND LAND MOBILE SATELLITE SERVICE EARTH STATIONS (LMSS) OPERATED BY RAYSAT, INC.

Radio Astronomy observations are conducted in the 14.47-14.5 GHz band in the USA at a number of Radio Astronomy sites. RaySat, Inc. ("RaySat") desires to operate a network of in-motion Land Mobile Satellite Service stations in the continental United States only, which will operate in the 14.0 to 14.5 GHz transmit and the 11.7 to 12.2 GHz receive band. The present agreement is intended to facilitate operation of the RaySat system, without causing interference to Radio Astronomy stations.

1. General Information

1.1 The band 14.47 to 14.5 GHz is allocated to the radio astronomy service on a secondary basis.

1.2 The band 14.0 – 14.5 GHz is allocated in the United States to the Land Mobile Satellite Service ("LMSS") on a secondary basis, provided that LMSS stations include special protection to radio astronomy stations that observe in this band.

1.3 RaySat plans to file an application with the FCC to operate up to four thousand (4,000) technically identical transmit/receive in-motion satellite earth stations to operate in the 11.7 – 12.2 and 14.0 – 14.5 GHz frequency bands.

1.4 This agreement document has been developed to govern the use of all RaySat in-motion stations operating in CONUS to ensure the protection of radio astronomy stations operations in the 14.47 to 14.5 band.

1.5 The Electromagnetic Spectrum Unit of the National Science Foundation (NSF) has the authority to negotiate and sign this agreement for the radio astronomy sites listed in Section 2.1, and RaySat has the authority to negotiate and sign this agreement on behalf of itself.

2. List of NSF supported Radio Astronomy observatories observing or planning to observe in the band 14.47 - 14.5 GHz within the US and its territories

2.1 The following is a list of ten radio astronomy sites supported by NSF that are included in this agreement. Two of these sites, Green Bank, WV and Socorro, NM, require more stringent levels of protection, while the remaining eight sites, which are associated with

TECHNICAL OPERATIONAL COORDINATION AGREEMENT FOR THE JOINT USAGE OF THE BAND 14.0 - 14.5 GHz BETWEEN THE NATIONAL SCIENCE FOUNDATION AND LAND MOBILE SATELLITE SERVICE EARTH STATIONS (LMSS) OPERATED BY RAYSAT, INC.

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2.1 The following is a list of ten radio astronomy sites supported by NSF that are included in this agreement. Two of these sites, Green Bank, WV and Socorro, NM, require more stringent levels of protection, while the remaining eight sites, which are associated with

the Very Long Baseline Array (VLBA), require less stringent protection. See section 3.1 below.

Name	Latitude	Longitude	Type
Green Bank, WV	38.4331	-79.8397	SINGLE DISH
Socorro, NM	34.0789	-107.6183	INTERFEROMETER
Brewster, WA	48.1311	-119.6833	VLBA
Owens Valley, CA	37.2317	-118.2769	VLBA
Kitt Peak, AZ	31.9564	-111.6125	VLBA
Pie Town, NM	34.3011	-108.1192	VLBA
Los Alamos, NM	35.775	-106.2456	VLBA
Fort Davis, TX	30.635	-103.9447	VLBA
North Liberty, IA	41.7714	-91.5742	VLBA
Hancock, NH	42.9336	-71.9866	VLBA

This list of stations is subject to change. NSF shall give RaySat no less than 2 months advance notice of changes in the status of existing sites, or of any additional radio astronomy site being brought into use in the 14.47 - 14.5 GHz band. In case of any change to this list of stations, either party may reopen this agreement to address issues arising in connection with such change.

3. Technical Operational Coordination Agreement

NSF and RaySat agree to the following:

3.1 The purpose of this agreement is to provide protection to the radio astronomy sites listed in Section 2.1 in the 14.47 - 14.5 GHz band to the following aggregate pfd levels within that band:

- -221 dB(W/m^2/Hz) for the Green Bank and Socorro sites
- -189 dB(W/m^2/Hz) for the eight CONUS VLBA sites

3.2 This agreement shall be reviewed on an annual basis by all parties signing this document beginning within one year after RaySat has informed NSF of the start of service in CONUS under an operational license. The purpose of this review is to assess the effectiveness of this agreement as well as to update as applicable this or successor operational coordination agreements.

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

RaySat agrees to:

3.4 Prevent transmissions from any LMSS that would exceed the threshold given in Section 3.1 above. Based on RaySat technical parameters and operational characteristics agreed to during direct RaySat/NSF coordination discussions, RaySat will achieve this by ensuring that the RaySat terminals will not operate within an exclusion zone around the radio astronomy sites listed in Section 2.1 The agreed upon separation distances for each NSF type are shown below:

Green Bank, WV (GBT).....	160 km
Socorro, NM (VLA).....	160 km
Seven Very Long Baseline Array (VLBA) Sites	
Other Than Hancock, NH	50 km
VLBA Site at Hancock, NH.....	25 km*

Until such time as RaySat terminals are able to coordinate based on both time and location, the terminals will not operate when within the given separation distances of the observatories. In the future, if RaySat terminals add the ability to coordinate based on time, restrictions on use will only apply when the terminals are within the specified separation distances and the observatory is scheduled to be observing in this band.

*The 25 km exclusion zone for the Hancock, NH VLBA site is based up the need to protect this site from RaySat stations operating outside of the Boston Metropolitan Area, recognizing that the noise floor within the Boston Metropolitan Area is significantly higher than the noise floor in the surrounding areas.

NSF agrees to:

3.5 Maintain an observation schedule for the band 14.47 - 14.5 GHz for the sites listed in Section 2.1 and make this schedule available upon request to the designated RaySat point-of-contact listed in Section 5.2, upon notification that RaySat terminals have achieved the capability of coordinating frequency use based upon time.

3.6 Provide, through NRAO, full access to RaySat representatives to data on interference that may be collected during observations that fall within the scope of this agreement.

4. Assignment and Termination

4.1 This agreement shall be binding upon the parties hereto and their respective successors and assigns.

4.2 This agreement may be terminated by the written mutual agreement of the parties, upon 6 months notice.

5 Points of Contact

5.1 Points of contact concerning this agreement.

Name: Dr. Tomas E. Gergely	Name: Ilan Kaplan
Organization: National Science Foundation	Organization: RaySat, Inc.
Title: Electromagnetic Spectrum Manager	Title: VP, Product Management & Business Development
Address: 4201 Wilson Boulevard, Room 1030	Address: RaySat, Inc. 8460-D Tyco Road
City State Zip: Arlington VA 22230	City State Zip: Vienna, VA 22182
Phone: (703) 292-4896	Phone: (703) 584-3770
Fax: (703) 292-9034	Fax: (703) 584-3775
E-mail: esm@nsf.gov	E-mail: ilan@raysat.com

5.2 Contacts concerning the notification of radio astronomy observation schedules:

Dr. Harvey Liszt	Name: Daniel DiFonzo
Title: Director, Spectrum Management	Title: Chief Technical Officer
Organization: NRAO	Organization: RaySat, Inc.
Address: NRAO 520 Edgemont Road Charlottesville, VA 22903-2475	Address: RaySat, Inc. 8460-D Tyco Road
Phone 434.296.0344	Phone: (703) 584-3770
Fax: 434.296.0278	Fax: (703) 584-3775
E-mail: hliszt@nrao.edu	E-mail: dan@raysat.com

6 Signatures

This Agreement is being made in good faith by both parties and is effective on the date on which the last party signs it. It may be executed in one or more counterparts, each of which will be deemed an original and all of which together will constitute one and the same instrument.

For the National Science Foundation

By: _____

Name: Dr. Tomas Gergely

Title: Electromagnetic Spectrum Manager

Date: 6/27/06

For RaySat, Inc.

By: _____

Name: Ilan Kaplan

Title: VP, Product Management & Business Development

Date: 05/31/06

Technical Annex

This annex shows the calculations upon which the coordination distances were based. The operating parameters of the RaySat terminals and technical data upon which the calculations are based are as follows:

	In-Band		Out-of-Band	
Transmit Power	-18	dBW	-18	dBW
Transmit Reference BW	4000	Hz	4000	Hz
Transmit PSD	-54	dB(W/Hz)	-54	dB(W/Hz)
OOB Supression	0	dB	-70	dB
Antenna Horizon Gain	-10	dB	-10	dB
In-Band EIRP	-64	dB(W/Hz)	-134	dB(W/Hz)
Green Bank, VLA Objective	-221	dB(W/m^2/Hz)	-221	dB(W/m^2/Hz)
Wavelength @ 14.5 GHz	0.02	m	0.02	m
Isotropic Collecting Area	3.4E-05	m^2	3.4E-05	m^2
Isotropic Collecting Area	-44.7	dB(m^2)	-44.7	dB(m^2)
Green Bank, VLA Objective	-265.7	dB(W/Hz)	-265.7	dB(W/Hz)
Required Prop Loss to meet GB/VLA Obj	-201.7	dB	-131.7	dB
VLBA Objective	-189	dB(W/m^2/Hz)	-189	dB(W/m^2/Hz)
VLBA Objective	-233.7	dB(W/Hz)	-233.7	dB(W/Hz)
Required Prop Loss to meet VLBA Obj	-169.7	dB	-99.7	dB

Based upon the required propagation loss to meet in-band and out-of-band objectives, the following page summarizes the coordination distances required based upon various propagation scenarios using the ITS irregular terrain model.

Frequency 14.5 GHz

ITM AREA MODE PROPAGATION SIMULATIONS FOR THE GREEN BANK TELESCOPE

Input Parameters					Environmental Parameters					Statistical Parameters			Distance to Meet Green Bank Propagation Loss Requirements (Green=FSL; Red=ITM)	
Antenna Heights (m)			Site Criteria					Conduc Gnd			Reliability			
Tx	Rx	Pol	Tx	Rx	dH (m)	Surf Refr (N)	Epsilon Gnd	S/m	Climate	Mode of Variability	%	Confidence	In-Band (202 dB)	OOB (132 dB)
2	139.6	V	Random	Random	10	301	15	0.001	Continental Temperate	Mobile	1	50	218.8	?
2	139.6	H	Random	Random	10	301	15	0.001	Continental Temperate	Mobile	1	50	218.8	?
2	139.6	V	Random	Very Careful	10	301	15	0.001	Continental Temperate	Mobile	1	50	218.8	?
2	139.6	V	Careful	Very Careful	10	301	15	0.001	Continental Temperate	Mobile	1	50	221.8	?
2	139.6	V	Very Careful	Very Careful	10	301	15	0.001	Continental Temperate	Mobile	1	50	223.5	?
2	139.6	V	Careful	Careful	10	301	15	0.001	Continental Temperate	Mobile	1	50	221.8	?
2	139.6	V	Careful	Careful	90	301	15	0.001	Continental Temperate	Mobile	1	50	214.4	?
2	139.6	V	Careful	Careful	200	301	15	0.001	Continental Temperate	Mobile	1	50	147.6	?
2	139.6	V	Careful	Careful	200	301	15	0.001	Continental Temperate	Single	1	50	47.8	?
2	139.6	V	Careful	Careful	90	301	15	0.001	Continental Temperate	Single	1	50	68	?
2	139.6	V	Careful	Careful	90	301	15	0.001	Continental Temperate	Individual	1	50	143.2	?
2	139.6	V	Careful	Careful	200	301	15	0.001	Continental Temperate	Individual	1	50	64.9	?
2	139.6	V	Careful	Careful	200	301	15	0.001	Continental Temperate	Mobile	50	50	47.8	?
2	139.6	V	Careful	Careful	200	301	15	0.001	Continental Temperate	Mobile	99	50	28	?
2	139.6	V	Careful	Careful	90	301	15	0.001	Continental Temperate	Mobile	1	90	214.4	?

ITM AREA MODE PROPAGATION SIMULATIONS FOR THE VERY LARGE ARRAY

Input Parameters					Environmental Parameters					Statistical Parameters			Distance to Meet Very Large Array Propagation Loss Requirements (Green=FSL; Red=ITM)	
Antenna Heights (m)			Site Criteria					Conduc Gnd			Reliability			
Tx	Rx	Pol	Tx	Rx	dH (m)	Surf Refr (N)	Epsilon Gnd	S/m	Climate	Mode of Variability	%	Confidence	In-Band (202 dB)	OOB (132 dB)
2	40	V	Careful	Careful	30	301	15	0.001	Continental Temperate	Mobile	1	50	203.4	?
2	40	V	Careful	Careful	10	301	15	0.001	Continental Temperate	Mobile	1	50	203.4	?
2	40	V	Careful	Careful	90	301	15	0.001	Continental Temperate	Mobile	1	50	195.9	?

ITM AREA MODE PROPAGATION SIMULATIONS FOR THE VLBA SITES

Input Parameters					Environmental Parameters					Statistical Parameters			Distance to Meet Very Large Array Propagation Loss Requirements (Green=FSL; Red=ITM)	
Antenna Heights (m)			Site Criteria					Conduc Gnd			Reliability			
Tx	Rx	Pol	Tx	Rx	dH (m)	Surf Refr (N)	Epsilon Gnd	S/m	Climate	Mode of Variability	%	Confidence	In-Band (170 dB)	OOB (100 dB)
2	40	V	Careful	Careful	0	301	15	0.001	Continental Temperate	Mobile	1	50	44.1 (?)	0.2
2	40	V	Careful	Careful	0	301	15	0.001	Mar Temp Over Sea	Mobile	1	50	44.8 (?)	0.2
2	40	V	Careful	Careful	30	301	15	0.001	Continental Temperate	Mobile	1	50	60.7	0.2
2	40	V	Careful	Careful	90	301	15	0.001	Continental Temperate	Mobile	1	50	50.6	0.2