Request for Special Temporary Authority

The National Telecommunications and Information Administration ("NTIA") has authorized the National Aeronautics and Space Administration ("NASA") to conduct experiments with the Technical Educational Satellite -6 ("TechEdSat-6") low earth orbit nanosatellite. A copy of that authorization is attached hereto.[1]

NASA will operate an Iridium satellite phone that it will host on TechEdSat-6. The satellite phone will transmit from TechEdSat-6 to space stations in Iridium's "Big LEO" constellation.[2] The transmissions are part of an experiment that, among other goals, will utilize Iridium's constellation as a tracking and data relay satellite ("TDRS") for nanosatellites.

Iridium hereby requests special temporary authority ("STA") commencing on November 20, 2017, in connection with the experiment, to transmit from its space stations to TechEdSat-6 in the 1618.725–1626.5 MHz band. The technical characteristics of these transmissions will be identical to the technical characteristic of Iridium's already-licensed space station transmissions in the 1618.725–1626.5 MHz band.[3]

Iridium's space station constellation is licensed under Call Sign S2110. Because Iridium will be operating under the requested STA in accordance with the parameters of its license, no operating parameters, other than effective radiated power, were used in the form that this exhibit accompanies. The only change from Iridium's licensed operations is that Iridium will be adding the TechEdSat-6 as a point of communication. Iridium's space station license does not cover intersatellite communications in the 1618.725–1626.5 MHz band.

It is anticipated that TechEdSat-6 will be in orbit for a maximum of thirty (30) days. However, because of current uncertainty as to when the experiment will begin, Iridium is seeking authority herein to cover the period shown in the STA form.

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[1] As explained in a letter from NASA that also is attached, although the NASA authorization only refers to TechEdSat-5, it also covers satellites, including TechEdSat-6, that have the same parameters and technical characteristics as TechEdSat-5.

[2] The Form 442 that this narrative accompanies states that two satellite phone units will be used. This statement reflects the fact that there will be a primary unit and a back-up unit. But only a single unit will be operational at any given time.

[3] Iridium's constellation is comprised of 66 satellites, any one of which may be used as part of the experiment at any point in time.

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, CA 94035-1000

October 31, 2017

Reply to Attn of: IO/233-17

Maureen C. McLaughlin
Vice President Public Policy, Iridium
1750 Tysons Boulevard
Suite 1400, McLean VA 22102

As delegated to me by the NASA National Spectrum Manager, I am providing this letter in support of a Federal Communications Commission (FCC) application filed by Iridium for experimental special temporary authority for their satellites to communicate with the NASA Technical Educational Satellite 6 (TechEdSat-6) low earth orbit nanosatellite. The National Telecommunications and Information Administration (NTIA) supports the use of TechEdSat nanosatellites to communicate with Iridium's satellites. Although NTIA spectrum certification SPS-22152/1 acknowledges the use of a previously launched TechEdSat satellite for this purpose (TechEdSat-5), I hereby confirm the certification also covers all near future TechEdSat satellites, including TechEdSat-6, operating under the same parameters and technical characteristics as TechEdSat-5. Iridium remains responsible for securing separate FCC authorizations for its satellites to communicate with TechEdSat nanosatellites.

If you have any questions or require additional clarification on this, please feel free to contact me at (650) 604-1415, or William.K.Notley@nasa.gov.

Sincerely,

William K. Notley
Ames Research Center Spectrum Manager

Cc:
John E. Zuzek/GRC 142:248
William D. Horne/HQ:7Y59
Catherine C. Sham/JSC 44:212
Marcus S. Murbach/ARC/RD 202-1
Hopkins, Justin/ARC/IO 233-17

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035-1000

Reply to IO:233-17

January 4, 2017

TO: Marcus S. Murbach, TechEdSat-5 Project Manager

FROM: William K. Notley, Center Spectrum Manager

SUBJECT: National Telecommunication and Information Administration (NTIA) Stage 2 Certification of Spectrum Support for TechEdSat-5

Subject and attached approved NTIA Stage 2 for TechEdSat-5 is provided for your retention and proof to anyone requiring it for launch and operation of your RF payloads per the allowances and limitations specified in the certification and the EL-CID application submitted for it (i.e., upon satisfaction of item 5 in Section 3 of the certification by Iridium with FCC). This NTIA spectrum certification is provided for use by your organization per all the applicable conditions cited within it. Please review the entirety of it and let me or my Alternate, Justin Hopkins, know if you have any questions. You are required to sign for it upon completion of a briefing my office will conduct with you in which we will review all the conditions and references cited in the certification. Specific to adherence to the references not explained in the certification for Sections 8.3.32 and 8.3.40 of the NTIA Manual, the following applies:

- Section 8.2.32 of the NTIA Manual, Control of Emissions from Space Stations: The use of frequencies by space stations will be authorized only in those cases where such stations are equipped so as to ensure the ability to turn on or to provide immediate cessation of emissions by telecommand.

- Section 8.2.40 of the NTIA Manual, Space Research in Bands other than those Allocated to the Space Research Service: In carrying out space developmental responsibilities, it is necessary and desirable that NASA conduct research by and on space techniques, especially in bands allocated to the various space services. Thus NASA may find it necessary to propose satellite research in various federal and non-federal bands. In general, assignments to space research space and earth stations will be experimental, i.e., on a non-interference basis to operational systems in accordance with the Table of Frequency Allocations.

This NTIA certification is non-transferable for temporary or permanent use by any other Ames organization or non-NASA entity, without prior authorization by the Ames RF Spectrum Manager. Without compromise, they may not be transferred to a non-federal entity.

If you have any spectrum related questions any time prior to, during or after your project concludes, please contact Justin or I.

William K. Notley

Concurrence:

I have thoroughly read this letter, the attached approved NTIA Stage 2 certification, received the briefing from the Center Spectrum Office, and satisfied all my inquiries in order to ensure as the official representative of my organization, the RF payloads on TechEdSat-5 will be used in absolute accordance with the NTIA Stage 2 certification, NTIA Manual of Regulations, and NASA Radio Frequency (RF) Spectrum Management Guidelines (NPR 2570.1)

Signature

1-5-2017
Date

cc:
ARC/IO – Justin Hopkins

SPS-22120/1
FOR AGENDA Ref. SPS-21887/2

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington D.C. 20230

DATE: November 30, 2016

MEMORANDUM

TO: Stephen J. Butcher
Chairperson, Spectrum Planning Subcommittee

FROM: Ben Tadesse Tadesse Binyam Digitally signed by Tadesse Binyam Date: 2016.11.30 16:34:27 -05'00'
Chief, Systems Review Branch

Brian W. Costello BRIAN COSTELLO
Assessment Author, Systems Review Branch

SUBJECT: NTIA Preliminary Assessment of the NASA's Technical Education Satellite 5 (TechEdSat-5) Mission, Stage 2

INTRODUCTION

This memorandum presents the results of the NTIA preliminary assessment of the NASA's request for Stage 2 (experimental stage) review of the Technical Education Satellite-5 (TechEdSat-5) Mission. The TechEdSat-5 will perform a flight experiment using a "modulated Exo-Brake" to permit a stable, controlled, and targeted de-orbit maneuver by means of a "warping" drag device. The data collected from this mission will eventually lead to future systems that permit small payloads to be retrieved from other orbital platforms (such as the International Space Station (ISS)). A Global Positioning System (GPS) receiver and advanced nano-satellite communication suite will permit positional information as well as a simple uplink capability to command the nano-satellite. The system features also include an Iridium transceiver which utilizes the Iridium satellite network as a Tracking and Data Relay Satellite (TDRS) for nano-satellites, Industrial, Scientific and Medical (ISM) band Wi-Fi transmitter for video/telemetry downlink, and low powered onboard 2.4-GHz sensors. The TechEdSat-5 is being developed through a partnership between NASA's Ames Research Center (ARC) and San Jose State University. This system will operate in the space research service. The estimated initial cost of this system is $100,000.

The TechEdSat-5 will send the 2.4-GHz telemetry data to the Wallops Flight Facility (WFF) earth station at Wallops Island, VA. NASA indicated that the TechEdSat-5 is a short duration experiment and will last for less than one month. The satellite will transmit for about 15 minutes per orbit when in line-of-sight of the WFF earth station and only after receiving commands via the Iridium link to initiate the downlink transmission.

Table 1 below summarizes this system's proposed spectrum requirements.

Table 1: TechEdSat-5's Proposed Spectrum Requirements

Requested Frequency Bands (MHz)	Requested Emission Designators	Mean Power (W)	Requested Stage 4 Station Class Symbol
1618.725-1626.5 (space-to-space)	41K7Q7W	1	EH
2457* (space-to-Earth)	2M40F1D	0.72	

* = Part 15 Device

Spectrum support issues/certification are discussed hereinafter. References to the NTIA Manual are for September 2015 Revision of the May 2013 Edition.

Table 2: Preliminary Assessment Findings

ISSUES	FINDINGS	REMARKS
Data Adequacy	Y ☒ N ☐ Adequate per Chapter 10 of the NTIA Manual:	Submitted to SPS for review in December 2016. The updated EL-CID submission (SPS-21887/2 –Date: November 22, 2016) replaced the original submission (SPS-21887/1 –Date: July 29, 2016). NASA requested that this unique space research mission be certified for experimental operation under Section 8.2.40 of the NTIA Manual. NASA also requested that this review and certification be expedited as the launch is planned for November 2016. NASA requested that this system operates with station class symbol EH. NASA stated that the TechEdSat-5 will perform a flight experiment for the extremely short operating duration of this mission. Per phone (via relay service) conversation with NASA, NASA agreed that the Stage 2 station class symbol is XT and the system will not be developed for operational use. NASA plans to use the frequency 2457 MHz for downlink. NASA provided the Federal Communications Commission (FCC) ID: UQ2AWUS036H for use of the band 2412-2462 MHz). The document of the FCC's grant of equipment authorization showed FCC Rule Part 15C (part of non-licensed (Part 15) device). It is noted that Section 10.3.7 of the NTIA Manual states "Federal policy for non-licensed devices is covered in Parts 7.8 and 7.9 and such devices will normally not be considered for the purpose of this review procedure." However, the assessment author recommended this preliminary assessment not to address the frequency 2457 MHz. Per phone (via relay service) conversation with NASA, NASA indicated that the TechEdSat-5 has a capability to transmit the signals to the nano-satellites for commanding and receive the signals from the nano-satellites in the frequency range 1618.725-1626.5 MHz. NASA will submit a waiver request to the Space System Subcommittee (SSS) instead of providing the advanced publication and notification to the ITU Radiocommuication Bureau because of the extremely short operating duration of this mission.

Table 2: Findings (Continuation)

ISSUES	FINDINGS	REMARKS
Allocations Conformance	Allocation Compliance: Federal Allocations Operations in the Space Research Service in the Space-to-Space Frequency Range 1618.725-1626.5 MHz: **1613.8-1626.5 MHz** Y N ☐ ☒	The frequency range 1618.725-1626.5 MHz falls within one federal allocation band 1613.8-1626.5 MHz that is not allocated for space research service. However, Section 8.2.40 of the NTIA Manual authorizes NASA to conduct space research in the bands other than those allocated to the space research service. NASA must conduct operations on unprotected and noninterference basis to authorized users of the band.
Spectrum Standards	Section 5.2.1 of the NTIA Manual applies: FREQUENCY TOLERANCE COMPLIANCE: Transmitter: Y N ☒ ☐	Frequency Tolerance System: Input Data: Transmitter: 3 ppm (max.). NTIA Requirement: 20 ppm
	Section 5.6 of the NTIA Manual applies. The NASA did not provide the transmitter data (-3 dB, -20 dB, -40 dB, and -60 dB bandwidth, harmonic levels, and spurious level).	NASA provided the FCC ID: Q639602 for use of the band 1616-1626.5 MHz and emission designator 41K7Q7W (FCC Rule Part 25). A document of the FCC's grant of equipment authorization showed this FCC ID.
Radiation Hazard	For the operations at the frequency range 1618.725-1626.5 MHz, this system is expected to generate power densities in excess of recommended criteria at distances up to 1 meter from the antenna in the mainbeam.	CRITERIA: 10 mW/cm^2 criterion of 29 CFR 1910.97 and the ANSI standard C95.1-1982 criterion of 5 mW/cm^2. Input data used: Average Power: 1 W Frequency Range: 1618.725-1626.5 MHz Antenna Gain: 5 dBi
Applicable Policy	Section 3.3.1.2 of the NTIA Manual applies. NASA will submit a waiver request to the SSS instead of providing the advanced publication and notification to the ITU Radiocommuication Bureau because of the extremely short operating duration of this mission. NASA indicated that the TechEdSat-5 is a short duration experiment and will last for less than one month. Section 8.2.17 of the NTIA Manual applies. NASA should take the full operational responsibility of the federally sponsored TechEdSat-5.	Section 3.3.1.2 of the NTIA Manual specifies guidance for requesting exemption from submitting space system information to the Radiocommunication Bureau if the intended use is for a short period of time less than 12 months. Section 8.2.17 of the NTIA Manual requires federal stations to be able to exercise effective control, supervision, and responsibility over the radio equipment.

Table 2: Findings (Continuation)

ISSUES	FINDINGS	REMARKS
Applicable Policy	Section 8.2.32 of the NTIA Manual applies. NASA conformed via phone conversation (via relay service) with NASA has a full capability to turn on or to provide immediate cessation of emission by telecommand when conducting experiments with this system. Control link will be managed by Iridium network. Section 8.2.40 of the NTIA Manual applies. NASA requested that this unique space research mission be certified for experimental operation under Section 8.2.40 of the NTIA Manual. Section 8.2.55 of the NTIA Manual does not apply. The system will not be developed for operational (Stage 4) use. NASA did not provide the measurements of the emission levels (in units of dBW) generated in the frequency band used by the Navstar Global Positioning System. Section 10.3.7.40 of the NTIA Manual applies. NASA plans to use the frequency 2457 MHz for downlink. NASA provided the Federal Communications Commission (FCC) ID: UQ2AWUS036H for use of the band 2412-2462 MHz). The document of the FCC's grant of equipment authorization showed FCC Rule Part 15C (part of non-licensed (Part 15) device).	Section 8.32 of the NTIA Manual specifies space stations will be authorized only in those cases where such stations are equipped so as to ensure the ability to turn on or to provide immediate cessation of emission by telecommand. Section 8.2.40 of the NTIA Manual allows NASA to conduct space research in bands other than those allocated to the space research service on a noninterference basis. Section 8.2.55 of the NTIA Manual states "Federal agencies requesting Stage 4 Spectrum Certification for systems operating in the 390-413 MHz, and 960-1710 MHz frequency bands must provide measurements of the emission levels generated in the frequency bands used by the Navstar Global Positioning System.....". Section 10.3.7 of the NTIA Manual states "Federal policy for non-licensed devices is covered in Parts 7.8 and 7.9 and such devices will normally not be considered for the purpose of this review procedure. Plans or proposals to operate non-licensed devices in space, however, shall be submitted to the SPS for record (this information should be submitted via a short memorandum and include the frequency bands, Part 15 FCC ID number if applicable, and how the equipment will be used). Agencies can request that information on a non-licensed device, regardless of whether it is to be used in a terrestrial application or in space, shall include a justification for SPS consideration of such a device."
EMC	NASA should be aware that operations using the band 1618.725-1626.5 MHz should be conducted on a noninterference basis to operational systems in accordance with the National Table of Frequency Allocations. NASA must coordinate the TechEdSat-5's operations in the band 1618.725-1626.5 MHz with the authorized users using this band to ensure that these out-of-band operations do not interference with duly authorized federal and non-federal users of the band 1613.8-1626.5 MHz. The coordination with the FCC is required to ensure compatibility. NASA should be aware that due to nonconformance of this system with out-of-band emissions, harmonic levels, and spurious level standards (due to lack of data) specified in Section 5.6 of the NTIA Manual.	

CONCLUSION:

Spectrum resources adequate to support the subject system are expected to be available in accordance with conditions delineated in the attached draft certification:

FORM NTIA-44 (3/91)	U.S. DEPARTMENT OF COMMERCE NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION	Classification	Control Number
	CERTIFICATION OF SPECTRUM SUPPORT	**UNCLASSIFIED**	Doc. 43133/1 SPS-22152/1

Recipient Agency	System	Stage of Review
NASA	**Technical Education Satellite-5 (TechEdSat-5) Mission**	2 – Experimental

Section 1: OPERATING CHARACTERISTICS FOR WHICH SUPPORT IS CERTIFIED

Frequency (MHz)	Emission	Mean Power (W)	Station Class (Stage 2)	Transmit Locations	Receive Locations
1618.725 - 1626.5	41K7Q7W	1	XT	Space	Space

Section 2: SOURCE DOCUMENTS

Docket Number	Description of Document	Dated
SPS-21887/2 SPS-22120/1	NASA Request for Stage 2 System Review NTIA Preliminary Assessment	November 22, 2016 November 30, 2016

Section 3: SPECTRUM PLANNING SUBCOMMITTEE (SPS) RECOMMENDATIONS

The SPS reviewed this system under the provisions of Chapter 10 of the NTIA Manual, noting that this system will not advance to Stage 4, and recommends that:

1. NTIA certify Stage 2 spectrum support for the Technical Education Satellite-5 (TechEdSat-5) Mission as specified in Section 1.
2. NASA be aware that operations of this system are limited for a duration of 3-6 months from the date of frequency assignment.
3. NASA be aware that operations of this system using the frequency band 1618.725 - 1626.5 MHz in the space research service are to be conducted on an unprotected, noninterference basis in accordance with Section 8.2.40 of the NTIA Manual.
4. NASA ensure that this system is equipped with the ability to turn on or to provide immediate cessation of emission by telecommand in accordance with Section 8.2.32 of the NTIA Manual.
5. NASA be aware that coordination with Iridium is required for use of the frequency band 1618.725 - 1626.500 MHz, and that operation of this system is contingent upon Iridium successfully obtaining authorization from the FCC.
6. NASA submit a request that NTIA waive the ITU international registration requirement to the Space Systems Subcommittee (SSS) in accordance with Section 3.3.1.2 of the NTIA Manual.
7. NASA protect personnel from radiation levels that exceed generally accepted exposure criteria.

Name/Title of Recommending Official	Signature	Date
Binyam Tadesse SPS Vice Chairperson		DEC 14 2016

Section 4: NTIA CERTIFICATION

The Office of Spectrum Management concurs with the SPS recommendations in Section 3.

This office certifies Stage 2 spectrum support for this system.

Name/Title of Certifying Official	Signature	Date
Peter A. Tenhula Deputy Associate Administrator		DEC 14 2016

Downgrading Instructions	Classification	Distribution
	UNCLASSIFIED	IRAC, SPS, FAS