ECHOSTAR-15

ATTACHMENT A

Technical Information to Supplement Schedule S

A.1 Scope

This attachment contains the information required by §25.114(c) and other sections of the FCC Part 25 rules that cannot be captured by the Schedule S form.

A.2 General Description of Overall System Facilities, Operations and Services (§25.114(d)(1))

The ECHOSTAR-15 satellite will serve as in-orbit spare in the EchoStar fleet at 61.65° W.L., collocated with the ECHOSTAR-16, ECHOSTAR-12 and ECHOSTAR-3 satellites. The satellite will be operated using only TT&C frequencies located at the upper and lower 12 MHz guardbands of the ITU's Region 2 BSS Plan (Article 2A of Appendices 30 and 30A)[1]. EchoStar is not seeking authority to operate the communications payload of ECHOSTAR-15 while located at 61.65° W.L.

Primary TT&C functions will take place from EchoStar's earth station and satellite control facilities located in Cheyenne, WY and Gilbert, AZ.

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[1] The ITU Region 2 BSS Plan frequencies used for space operations functions (TT&C) are 12.2-12.212, 12.688-12.7, 17.3-17.312 and 17.788-17.8 GHz.

A.3 TT&C Characteristics
(§25.114(c)(4)(i) and §25.114(c)(9))

The information provided in this section complements that provided in the associated Schedule S submission.

The ECHOSTAR-15 TT&C subsystem provides for communications during transfer orbit and on-station operations, as well as during spacecraft emergencies. The TT&C subsystem operates in the 12 MHz guardbands for both uplink and downlink during all phases of the mission. The TT&C subsystem consists of 6 near omni-directional command antennas, 4 near omni-directional telemetry antennas, and 2 Ku-band communication antennas that can receive commands and transmit telemetry. TT&C operations will be conducted from EchoStar's Cheyenne, WY and Gilbert, AZ facilities. Other EchoStar TT&C facilities in Blackhawk, SD and Mt. Jackson, VA may be used in the event of an emergency or contingency requirement, subject to obtaining additional, appropriate FCC authorization in the future. The spacecraft is capable of operating at two command frequencies shown in Table A-1 below. During normal on-station and emergency operations at 61.65° W.L, command signals will be received by the near omni-directional antennas. The spacecraft is capable of operating at four transmit frequencies shown in Table A-1 below. During normal on-station and emergency operations at 61.65° W.L., the telemetry signals will be transmitted by the near omni-directional antennas.

A summary of the TT&C subsystem characteristics is given in Table A-1.

Table A-1: TT&C Performance Characteristics

Command Modulation	PCM/PSK
Command/Ranging Frequencies	17,791.5 MHz 17,793.5 MHz
Uplink Flux Density (Minimum)	Omni Rx antenna: > -83 dBW/m^2 (Command) -78 dBW/m^2 (Ranging) Comms Rx antenna: > -93 dBW/m^2 (Command) -87 dBW/m^2 (Ranging)
Satellite Receive Antenna Types and Modes of Operation	Omni antenna during transfer orbit and on-station emergencies for telecommand. Communications antenna during normal on-station operations for telecommand.

Polarization of Satellite Rx/Tx Antennas	RHCP for omni antenna RHCP for communications antenna
Peak Deviation (Command/Ranging)	± 400 kHz
Telemetry/Ranging Frequencies	12,692.0 MHz 12,693.0 MHz 12,694.5 MHz 12,698.5 MHz
Satellite Transmit Antenna Types and Modes of Operation	Omni antenna during transfer orbit, on-station emergencies and normal on-station operations for telemetry.
Maximum Downlink EIRP	15.2 dBW (Omni antenna) 18 dBW (Communications antenna)
Telemetry/Ranging Modulation Index: 1 sub-carrier 2 sub-carriers 3 sub-carriers	 1.0 ± 0.2 rad pk 0.7± 0.2 rad pk 0.58± 0.2 rad pk

A.4 Orbital Debris Mitigation Plan (§25.114(d)(14))

A.4.1 Debris Release Assessment (§25.144(d)(14)(i))

To protect the spacecraft from small body collisions, the design of the ECHOSTAR-15 spacecraft allows for individual faults without losing the entire spacecraft. All critical components (i.e., computers and control devices) have been built within the structure and shielded from external influences. Items that could not be built within the spacecraft nor shielded (such as antennas) are redundant and/or are able to withstand impact. The ECHOSTAR-15 spacecraft can be controlled through both the normal payload antenna and wide angle antennas. The likelihood of both being damaged during a small body collision is minimal. The wide angle antennas on this spacecraft are basically open waveguides that point towards the Earth (there is one set on each side of the spacecraft; either set could be used to successfully de-orbit the spacecraft). These wide angle antennas would continue to operate even if struck and bent.

Based on the above structural design and critical component redundancy, EchoStar believes this satellite has a limited probability of becoming a source of debris from small body collisions.

A.4.2 Accidental Explosion Assessment (§25.144(d)(14)(ii))

In order to ensure that the spacecraft does not explode on orbit the satellite controller takes specific precautions. All batteries and fuel tanks are monitored for pressure or temperature variations. Alarms in the Satellite Control Center ("SCC") inform controllers of any variations. Additionally, long term trending analysis will be performed to monitor for any unexpected trends.

Operationally, batteries are operated utilizing the manufacturer's automatic recharging scheme. Doing so ensures that charging terminates normally without building up additional heat. As this process occurs wholly within the spacecraft, it also affords protection from ground command link failures.

In order to protect the propulsion system, fuel tanks have been operated in a "blow down" mode. This means that at the completion of the orbit raising phase of the mission, the pressurant was isolated from the fuel system, thereby causing the pressure in the tanks to decrease over the life of the spacecraft. This also protects against a pressure valve failure causing the fuel tanks to become over pressurized.

In order to ensure that the spacecraft has no explosive risk after it has been successfully de-orbited, all stored energy onboard the spacecraft will be removed. Upon successful de-orbit of the spacecraft, all propulsion lines and latch valves will be vented and left open. All battery chargers will be turned off and batteries will be left in a permanent discharge state. These steps will ensure that no buildup of energy can occur resulting in an explosion in the years after the spacecraft is de-orbited.

Based on the above structural design and planned flight control precautions during and after the mission completion, EchoStar believes this satellite has a limited probability of becoming a source of debris from accidental explosions.

A.4.3 Safe Flight Profiles (§25.144(d)(14)(iii))

In considering current and planned satellites that may have a station-keeping volume that overlaps the ECHOSTAR-15 satellite, EchoStar has reviewed the lists of FCC-licensed satellite networks, as well as those that are currently under consideration by the FCC. In addition, non-U.S. networks for which a request for coordination has been published by the International Telecommunication Union ("ITU") within ±0.15° of 61.65° W.L. have been reviewed.

As already mentioned, the ECHOSTAR-16, ECHOSTAR-12 and ECHOSTAR-3 satellites operate at the nominal 61.65° W.L. orbital location, each having an east-west station-keeping tolerance of ±0.05°. These satellites are operated by EchoStar and can be internally coordinated to ensure their safe operation.

There are no pending applications before the Commission to use an orbital location within ±0.15° from 61.65° W.L. EchoStar is not aware of any satellite with an overlapping station-keeping volume with the ECHOSTAR-15 satellite and that is either in orbit or progressing towards launch pursuant to an ITU filing.

Based on the preceding, EchoStar seeks to locate and operate the ECHOSTAR-15 satellite at 61.65° W.L., with an east-west station-keeping tolerance of ±0.05°, in order to eliminate the possibility of any station-keeping volume overlap with the adjacent EchoStar satellites. EchoStar therefore concludes that physical coordination of the ECHOSTAR-15 satellite with another party is not required at the present time.

A.4.4 Post Mission Disposal Plan (§25.144(d)(14)(iv))

At the end of the operational life of the ECHOSTAR-15 satellite, EchoStar will maneuver the satellite to a disposal orbit with a minimum perigee of 330 km above the normal GSO operational orbit. This proposed disposal orbit altitude exceeds the minimum required by §25.283, which is calculated below.

The input data required for the calculation is as follows:

Total Solar Pressure Area "A" = 111 m^2

(includes area of solar array, satellite body and deployed antennas)

"M" = Dry Mass of Satellite = 2364 kg

"C_R" = Solar Pressure Radiation Coefficient (worst case) = 2

Using the formula given in §25.283, the Minimum Disposal Orbit Perigee Altitude is calculated as follows:

= 36,021 km + 1000 x C_R x A/M

= 36,021 km + 1000 x 2 x 111/2364

= 36,115 km

= 329 km above GSO (35,786 km)

Adequate margin has already been accounted for in the calculation of the designed disposal orbit of 330 km above GSO, which includes margin relative to the above calculation. Attaining the altitude of 330 km above the GSO orbit will require approximately 12 kg of propellant, which will be reserved, taking account of all fuel measurement uncertainties, to perform the final orbit raising maneuvers.

Propellant tracking is accomplished using a bookkeeping method. Using this method, the ground control station tracks the number of jet seconds utilized for station keeping, momentum control and other attitude control events. From the number of jet seconds, the amount of fuel used is determined. This process has been calibrated using data collected from thruster tests conducted on the ground and has been found to be accurate to within a few months of life on the spacecraft.

In addition to the bookkeeping method, a pressure, volume and temperature (PVT) test is done to support the findings of the bookkeeping method. Lastly, propellant depletion gauges allow for monitoring of the propellant through the telemetry.

A.5 Interference Analysis

The ECHOSTAR-15 satellite at 61.65° W.L. will operate under authority of the United States. The underlying Article 2A satellite network filing, USABSS-17, which has been recorded in the Master International Frequency Register (MIFR) at the nominal location of 61.5° W.L.

EchoStar is not seeking operating authority of the communications payload on ECHOSTAR-15. Accordingly, no interference analysis is provided for the operations of the communication payload.

The next adjacent satellites with potential TT&C frequency overlap with ECHOSTAR-15 are NIMIQ-5 (nominally located at 72.7° W.L., 11.1° away) and INTELSAT 805 (nominally located at 55.5° W.L., 6° away). Given this large orbital separation and the use of large earth stations for both command and telemetry, negligible interference will be received from them or caused by the ECHOSTAR-15 satellite.

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this application and that it is complete and accurate to the best of my knowledge and belief.

/s/ Zachary Rosenbaum
Zachary Rosenbaum
Senior Manager, Advanced Programs and Spectrum Management