

## Schedules

**SCHEDULE S**, along with Main Form 312, is to be completed when:

- Applying for a license of a New Space Station,
- Amending a pending space station application,
- Applying for a license for a Replacement Satellite,
- Applying for a Modification of a granted space station license, other than modifications filed for fleet management purposes under Section 25.118(e) of the Commission's rules, or when
- Filing a Letter of Intent to Use Non-U.S. Licensed Satellite(s) to Provide Service in the United States.

### **SPECIFIC INSTRUCTIONS FOR SCHEDULE S Technical and Operational Description of Space Station(s)**

#### **PURPOSE OF FILING**

Schedule S is used for all space station filings that do not involve Assignments of License or Transfers of Control. Schedule S and the Main Form must be completed when filing for licenses for all new space stations, all amendments to pending space station applications, all modifications to existing space station authorizations, and all letters of intent to use non-U.S. licensed satellites to provide service in the United States. Schedule S collects most technical and operational information relevant to the space station.

Note that Schedule S does not collect all of the information required by the Commission's rules with respect to space station applications. In addition to the information required in this form, the space station applicant is required to provide all the information specified in Section 25.114 of the Commission's rules, 47 C.F.R. § 25.114. This information, as well as any other information that the applicant wishes to provide in connect with the application may be attached as exhibits to the application. The provision of all data elements on Schedule S is required for all space station filings, unless otherwise specified.

#### **S1. GENERAL INFORMATION**

Items S1a-S1i should be completed by all applicants. These items identify the satellite(s), its construction and launch schedule, its transponder and bandwidth capacity, its common carrier status, and whether it operates in the GSO or NGSO orbit(s). If a satellite constellation consists of both GSO and NGSO satellites, mark both check boxes in item S1i. The dates in items S1b-S1e may be provided either in terms of a date (month/day/year) or in terms of the number of months after an authorization is received.

Item S1d (Estimated launch date) should be provided as a range of dates (beginning and ending dates) for NGSO networks.

#### **S2. OPERATING FREQUENCY BANDS**

Items S2a-S2f identify the frequency bands and radio services (nature of service) in which the satellite(s) will operate. Please make separate row entries for each frequency band. For example, a satellite operating in the 13.75-14.5 GHz range should be entered as one row for 13.75-14.0 GHz and a second row for 14.0-14.5 GHz. Also make separate row entries when the nature of service or transmit/receive mode changes between adjacent frequency bands.

Items S2a-S2d, frequency range, should be identified according to accepted ITU methodology. Frequencies less than or equal to 10.0 GHz should be specified in Megahertz, while frequencies above 10.0 GHz should be specified in Gigahertz. Standard unit symbols (Items S2b and S2d) are: “K” = kilohertz, “M” = megahertz, and “G” = gigahertz.

Item S2e, T/R Mode, indicates whether the satellite transmits or receives in this frequency band. Identified transmit bands with “T” and receive bands with “R”. When a satellite both transmits and receives in the same frequency band (Inter-Satellite Service, ISS), identify the band with “T/R”.

Item S2f, Nature of Service: Identify all radio services (nature of service) that will be used by the satellite(s) in each frequency band. Abbreviations or codes may be used such as FSS for Fixed-Satellite Service, MSS for Mobile-Satellite Service, BSS for Broadcasting-Satellite Service, etc. Select the Nature of Service Codes from the following list.

<u>Code</u>	<u>Nature of Service</u>	<u>Description</u>
<u>Fixed Satellite Service</u>		
FSS	-	Fixed Satellite Service
DTH	-	Direct to Home in the Fixed Satellite Service
FBSS	-	Feeder Link for Broadcasting Satellite Service in FSS
FMSS	-	Feeder Link for Mobile Satellite Service in FSS
<u>Mobile-Satellite Service</u>		
AMSS	-	Aeronautical Mobile-Satellite Service
LMSS	-	Land Mobile-Satellite Service
MMSS	-	Maritime Mobile-Satellite Service
MSS	-	Mobile-Satellite Service
MSXA	-	Mobile-Satellite, Except Aeronautical Mobile-Satellite
<u>Broadcasting Satellite Service</u>		
BSSV	-	Broadcasting Satellite Service - Video
BSSD	-	Broadcasting Satellite Service - Data
BSSS	-	Broadcasting Satellite Service - Sound
DARS	-	Satellite Digital Audio Radio Service
<u>Radio Navigation Satellite Service</u>		
ARNS	-	Aeronautical Radio Navigation Satellite Service
MRNS	-	Maritime Radio Navigation Satellite Service
RNSS	-	Radio Navigation Satellite Service
<u>Non-specific Satellite Services</u>		
AMAS	-	Amateur Satellite Service
EESS	-	Earth Exploration Satellite Service
METS	-	Meteorological Satellite Service
RDSS	-	Radio Determination Satellite Service
RLSS	-	Radio Location Satellite Service
RAS	-	Radio Astronomy Service
SFTS	-	Standard Frequency and Time Signal Satellite Service
SOS	-	Space Operation Service
SRS	-	Space Research Service
ISS	-	Inter-Satellite Service
OTHR	-	Other Satellite Service (please specify)

### **S3. ORBITAL INFORMATION FOR GEOSTATIONARY SATELLITES ONLY**

Items S3a-S3i should be completed only when the application involves GSO satellites. This section should be skipped if the application only involves NGSO satellites. These items collect information about the GSO orbital location(s), station-keeping tolerances, and service arc. The provision of the service arc and its selection reason are optional for the Fixed-Satellite Service.

#### **S4. ORBITAL INFORMATION FOR NON-GEOSTATIONARY SATELLITES**

Items S4a-S4o should be completed only when the application involves NGSO satellites. This section should be skipped if the application only involves GSO satellites. These items collect information about the NGSO satellite constellation. Items S4a-S4d apply to the entire NGSO satellite constellation and are provided only once for the constellation. Items S4e-S4o apply to each orbital plane that composes the NGSO constellation and one row must be provided for each orbital plane composing the NGSO constellation.

Item S4d is the date of the orbit epoch. This is the date to which all of the orbital parameters (items S4g-S4l) are referenced.

Items S4m-S4o, Active Service Arc Range, is the range of phase angles within the orbit over which the satellite(s) actively provide(s) communication. Items S4m and S4n should be used when the satellite(s) is(are) active in a single range of phase angles (i.e. 0°-360° or 0°-90°). When the satellite(s) is(are) active over multiple ranges, item S4o should reference an exhibit that describes or lists the active service arcs. For example, satellites might be active only in the 0°-90° and 180°-270° ranges of phase angle.

#### **S5. INITIAL SATELLITE PHASE ANGLE**

Items S5a-S5c should be completed only when the application involves NGSO satellites. This section should be skipped if the application only involves GSO satellites. These items collect information about the phasing of the satellites within each orbital plane of the NGSO satellite constellation.

Table S5 will contain a row for each satellite that composes the NGSO satellite constellation. For each satellite within each orbital plane of the NGSO satellite constellation, identify the initial phase angle within its orbital plane. For example, orbital plane “1” might contain three (3) evenly spaced satellites. In this case, table S5 would include three rows with the following data to describe plane “1”. Row 1: 1, 1, 0°; Row 2: 1, 2, 120°; and Row 3: 1, 3, 240°. Note that item S5a, Orbital Plane No., refers to the orbital plane(s) identified in item S4e above and must have been previously defined in item S4e.

#### **S6. SERVICE AREA CHARACTERISTICS**

Items S6a-S6d should be completed for both GSO and NGSO satellite systems. These items collect information about the service area(s) that will be served by the satellite system. Each service area must be assigned a unique “Service Area ID” (item S6a) which will be referenced in Table S7.

Items S6c and S6d: These items describe or map the service area. Service areas can be defined as a list of known geographic areas, such as U.S. state postal codes (NY, CA, etc.) or ITU 3-letter geographic codes (USA, CAN, MEX, etc.). Service areas can also be defined as a closed contour plotted on a map. The ITU has defined a computer file format (GXT format) for the collection of graphical data in electronic form. This file format includes a methodology for the specification of service area diagrams in Annex C to Attachment 2 of ITU Circular Letter CR/58. *See ITU Circular Letter CR/58, “Notification of frequency assignments to stations in the space radiocommunications services on electronic media”, 21 October 1996.* The provision of each

service area in the form of a GXT file is permitted for both GSO and NGSO satellites. Item S6c must reference the electronic file containing the service area definition for each service area.

## **S7. SPACE STATION ANTENNA BEAM CHARACTERISTICS**

Items S7a-S7r should be completed for both GSO and NGSO satellite systems. These items collect information about the antenna beam characteristics for each antenna beam used by the satellite system. Each antenna beam must be assigned a unique “Beam ID” (item S7a) which will be referenced in Tables S8 (item S8a) and S10 (items S10d and S10f). Depending upon whether the beam is used for transmission or reception (item S7b, T/R Mode = “T” or “R”), the transmit data (items S7k-S7m) or the receive data (items S7n-S7r) should be provided.

Item S7c, Peak Isotropic Antenna Gain, is the maximum antenna gain resulting from all conditions of beam pointing.

Item S7i, Polarization Alignment Rel. Equatorial Plane, applies only to linearly polarized beams and should be left blank for circularly polarized beams.

Item S7j, Service Area ID, identifies the service area that the beam covers. Identify the service area using the unique service area ID created in table S6 (item S6a).

Item S7l, Effective Transmit Output Power, is the effective power delivered to the antenna after all input losses (item S7k) have been deducted.

## **S8. ANTENNA BEAM DIAGRAMS**

Items S8a-S8l should be completed for both GSO and NGSO satellite systems. These items collect information about the antenna beam coverage diagram for each antenna beam used by the satellite system. These diagrams are sometimes referred to as “footprints” and are generally provided in the form of a beam coverage map or two-dimensional graph. Each antenna beam will have a co-polarized coverage pattern (item S8c = “C”) and a cross-polarized coverage pattern (item S8c = “X”). Provide both co- and cross-polarized patterns for each antenna beam.

Item S8a, Beam ID, identifies the antenna beam to which the coverage patterns belong. Identify the beam by using the unique Beam ID created in table S7 (item S7a).

Item S8e, NGSO Antenna Gain Contour Description, is provided only for NGSO satellite systems. Provide the figure, table, or exhibit number that depicts or describes the antenna gain coverage contour diagram. NGSO antenna gain diagrams may also be described in equation form. The provision of an exhibit in electronic form that describes the antenna gain contour is required for all NGSO satellite systems.

Item S8f, GSO Antenna Gain Contour Data, is provided only for GSO satellite systems. The antenna gain contour data shall be provided in electronic form as a computer data file in the ITU GXT file format. Item S8f should reference the electronic file containing the antenna diagram definition in GXT format for each GSO antenna beam. The ITU has defined a computer file format (GXT format) for the collection of graphical data in electronic form. This file format includes a methodology for the specification of antenna gain contour diagrams for GSO satellites in Annex D to Attachment 2 of ITU Circular Letter CR/58. *See ITU Circular Letter CR/58, “Notification of frequency assignments to stations in the space radiocommunications services on electronic media”, 21 October 1996.*

Items S8g-S8l, Max. Power Flux Density (PFD): For all co-polarized transmitting beams, provide the maximum PFD on the earth's surface for 5°, 10°, 15°, 20°, and 25° angles of arrival above horizontal. The angle of arrival above the horizontal is equivalent to the earth station elevation angle. Use the emission with the highest PFD and assume a uniform spatial density across the bandwidth for all modulations. The PFD at each angle of arrival is to be provided in dB(W/m<sup>2</sup>) in either a 4 kHz or 1 MHz reference bandwidth. The selection of the reference bandwidth depends upon the appropriate FCC Rules that apply to the subject frequency band, radio service, and type of satellite orbit. See §25.208 for the applicable PFD limits.

## **S9. SPACE STATION CHANNELS**

Items S9a-S9f should be completed for both GSO and NGSO satellite systems. These items collect information about the channel frequencies used by the satellite system. Each channel frequency must be assigned a unique "Channel No." (item S9a) which will be referenced in Table S10 (items S10c and S10e).

Item S9f: Indicate whether the channel serves to provide TT&C (item S9f = "T") functions or communications (item S9f = "C") functions.

## **S10. SPACE STATION TRANSPONDERS**

Items S10a-S10f should be completed for both GSO and NGSO satellite systems. These items collect information about the transponder strapping used by the satellite system. Each transponder must be assigned a unique "Transponder ID" (item S10a) which will be referenced in Table S13 (items S13a and S13b). Provide both receive and transmit information on simple frequency changing transponders. Provide either receive or transmit information for half-links such as those used for TT&C functions, on-board processing, and inter-satellite links.

Item S10c and S10e, Receive and Transmit Channel Nos., identify the frequency channels associated with each transponder. Identify the channels by using the unique Channel Nos. created in table S9 (item S9a).

Item S10d and S10f, Receive and Transmit Beam IDs, identify the antenna beams associated with each transponder. Identify the beams by using the unique Beam IDs created in table S7 (item S7a).

## **S11. DIGITAL MODULATION PARAMETERS**

Items S11a-S11i should be completed for both GSO and NGSO satellite systems. These items collect information about the digital modulation parameters used by the satellite system. Each digital modulation scheme must be assigned a unique "Digital Modulation ID" (item S11a) which will be referenced in Table S13 (item S13c).

Item S11h, Total C/N Performance Objective, is the minimum C/N ratio required to provide the minimum acceptable performance based solely upon modulation considerations. It does not include link-related degradations or margins. It is the minimum C/N ratio where a bit error rate of 10<sup>-7</sup> is achievable.

Item S11i, Single Entry C/I Objective, is the required C/I ratio from a single source of interference that is required for the communications link to meet its overall performance objectives.

## **S12. ANALOG MODULATION PARAMETERS**

Items S12a-S12o should be completed for both GSO and NGSO satellite systems. These items collect information about the analog modulation parameters used by the satellite system. Each analog modulation scheme must be assigned a unique “Analog Modulation ID” (item S12a) which will be referenced in Table S13 (item S13d).

Item S12n, Total C/N Performance Objective, is the minimum C/N ratio required to provide the minimum acceptable performance based solely upon modulation considerations. It does not include link-related degradations or margins.

Item S12o, Single Entry C/I Objective, is the required C/I ratio from a single source of interference that is required for the communications link to meet its overall performance objectives.

### **S13. TYPICAL EMISSIONS**

Items S13a-S13p should be completed for both GSO and NGSO satellite systems. These items collect information about the communication link parameters used by the satellite system. For each set of contiguous transponders with common link parameters, identify the starting (item S13a) and ending (item S13b) transponder IDs using the unique transponder IDs created in table S10 (item S10a).

Items S13c-S13d: Identify either the digital (item S13c) or analog (item S13d) modulation ID from table S11 (item S11a) or table S12 (item S12a), as appropriate, using the unique modulation IDs created in tables S11 and S12.

Item S13g: Provide the reference to the table or exhibit number that details the link noise budget for the link.

Items S13i, S13j, S13k, and S13p: These items provide the antenna gain, transmit powers, and G/T ratio for the station with which this space station communicates. These parameters are for the associated earth station or, in the case of inter-satellite links, the associated space station.

Items S13l-S13o: These items provide the eirp and maximum power flux density for the subject space station. The maximum power flux density (PFD) (items S13n and S13o) are the maximum value for the emission under all angles of arrival and all conditions of beam pointing. The PFD is to be provided in dB(W/m<sup>2</sup>) (item S13n) in either a 4 kHz or 1 MHz reference bandwidth (item S13o). The selection of the reference bandwidth depends upon the appropriate FCC Rules that apply to the subject frequency band, radio service, and type of satellite orbit. See §25.208 for the applicable PFD limits.

### **S14. REMOTE CONTROL (TT&C) LOCATION(S)**

Items S14a-S14g should be completed for both GSO and NGSO satellite systems. These items collect information about the location(s) of the earth station(s) that provide TT&C services for the satellite system. Provide the earth station’s call sign (item S14g) if the earth station is licensed by the U.S.

### **S15. SPACECRAFT PHYSICAL CHARACTERISTICS**

Items S15a-S15k should be completed for both GSO and NGSO satellite systems. These items collect information about the physical size (mass and dimensions) of the spacecraft and the probability of it surviving to its projected end of life.

### **S16. SPACECRAFT ELECTRICAL CHARACTERISTICS**

Items S16a-S16t should be completed for both GSO and NGSO satellite systems. These items collect information about the electrical power characteristics of the spacecraft.

**S17. CERTIFICATIONS**

Items S17a-S17c should be completed for both GSO and NGSO satellite systems. These items certify compliance with particular technical rules relevant to space stations. See 47 C.F.R. Part 25.

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