NTIA Space record data form – TotumSat-1L Hosted Payload On LOFT YAM-3 Spacecraft

Prepared to support (Ground Station) Endpoint Experimental License Modification
Application 0044-EX-CM-2022

NTIA requires the following data for space related experiments using government shared spectrum. For each transmit frequency, please provide the data for both ends of the transmit-receive link. Use Part A to describe the satellite to ground information. Part B is for all ground to space transmit links.

Part A: Space to Earth Downlink Data

Satellite Transmitter Data

Transmit Frequency: 9 Channels Center Frequency Chan 0 - 2478.5 MHz Chan 1 - 2475.0 MHz Chan 2 - 2472.5 MHz Chan 3 - 2471.0 MHz Chan 4 - 2459.5 MHZ Chan 5 - 2457.5 MHz Chan 6 - 2454.5 MHz Chan 7 - 2478.5 MHz Chan 8 - 2475.0 MHz
Satellite Name: TotumSat-1L

Data Field	**Data Answer**	**Description/Comments**

Transmit Power (PWR)	PWR = 1.0W	TRANSMIT POWER SUPPLIED TO THE ANTENNA INPUT TERMINAL, EXAMPLE, PWR01 W2 TRANSMIT POWER UNITS INCLUDE: W = WATT, K = KILOWATT, M = MEGAWATT
Necessary Bandwidth	500 kHz per channel	THE WIDTH OF FREQUENCY BAND WHICH IS JUST SUFFICIENT TO SUCCESSFULLY TRANSFER DATA. FORMULAS CAN BE FOUND IN ANNEX J OF THE NTIA MANUAL.
RF Emissions Data		2-SIDED EMISSION BANDWIDTH VALUES
-3 dB bandwidth	460kHz	
-20 dB bandwidth	1.23MHz	
-40 dB bandwidth	1.73 MHz	
-60 dB bandwidth	2.14 MHz	
Modulation Type	QPSK	THE METHOD USED TO SUPERIMPOSE DATA ON THE CARRIER, EXAMPLE, BPSK, QPSK, GMSK.

Data Rate	DMSS downlink optimizes to Spreading Factors (SF) of 4 to 512 and 2 symbols/bit **thus OTA data rate is:** **488-62,500 bits/sec** **Max 62,500 bits/sec**	INFORMATION DATA RATE
Forward Error Correction Coding	Is FEC used? Yes ☒ No ☐ FEC Type: Viterbi, FEC Rate: ½ rate ,	
Total Symbol Rate	DMSS Downlink uses SF 4-512 and 500KHz Chip rate thus **Symbol rate varies :** **976 -125,000 symbols/sec** **Max 125,000 symbols/sec**	DATA RATE COMBINED WITH FEC AND FRAME OVERHEAD RESULTING IN THE TOTAL SYMBOL RATE AT THE INPUTE TO THE SYMBOL MAPPER/MODULATOR.
Does transmitter have a beacon mode?	Yes ☒ No ☐	**DMSS transmits a 1 sec broadcast message on Chan 0 and 0.31 sec sync burst in each channel during the first 6.8 seconds of every 10 second frame.**
If transmitter has a beacon mode, can the beacon be commanded off?	Yes ☒ No ☐	**DMSS payload is powered off during unused orbits or orbital segments. And it can be turned off by ground command.**

Polarization (XAP)	XAP = R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Orientation (XAZ)	XAZ = EC	NB= NARROWBEAM EC = EARTH COVERAGE
Antenna Dimension (XAD)	ANTENNA= GAIN 7.3dB BEAMWIDTH = 70 Degrees XAD01 07.3G070B	(NTIA format (XAD), EXAMPLE, XAD01 16G030B)
Type of satellite (State = SP) (City = geo or non)	Type = NonGeostationary	Choose either: Geostationary or Nongeostationary
For Geostationary	N/A	IF ANY SATELLITES ARE GEOSTATIONARY, REPORT ITS LATITUDE AS 000000N (XLA AND/OR RLA) AND REPORT ITS LONGITUDE (XLG AND/OR RLG).

For Nongeostationary (Orbital Data)	INCLINATION ANGLE = 97.5 deg APOGEE IN KILOMETERS = 525 PERIGEE IN KILOMETERS = 525 ORBITAL PERIOD IN HOURS 1 AND FRACTIONS OF HOURS IN DECIMAL 0.59 THE NUMBER OF SATELLITES IN THE SYSTEM = 1 ORB97.5IN00525AP00525PE001.59H01NRT01	IF ANY SATELLITES ARE NONGEOSTATIONARY, REPORT ITS INCLINATION ANGLE, APOGEE IN KILOMETERS, PERIGEE IN KILOMETERS, ORBITAL PERIOD IN HOURS AND FRACTIONS OF HOURS IN DECIMAL, THE NUMBER OF SATELLITES IN THE SYSTEM, THEN T01, EXAMPLE, REM04 *ORB,98.0IN00510AP00510PE001.58H01NRT01, AND FOR SPACE-TO-SPACE COMMUNICATIONS WITH ANOTHER NONGEOSTATIONARY SATELLITE ADD AN ADDITIONAL *ORB FOR IT ENDING IN R01, EXAMPLE, REM05 *ORB,72.9IN03209AP00655PE013.46H01NRR01

Earth Station Data (Receiver) 101 total		
State (RSC)	RSC = Mobile, Continental US	
City Name (RAL)	RAL	
Latitude (DDMMSS)	Lat = 24.32.38 to 49.00.00	
Longitude (DDDMMSS)	Lon = -066.58.58 to -124.38.41	
Receive Antenna Polarization (RAP)	RAP = J	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Receive Antenna Orientation (RAZ)	RAZ01 V00	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN = 3 dB , BEAMWIDTH = 180 , AZIMUTHAL RANGE = 000-360 (Omni), THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS Mobile, < 3000 m THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS <10m RAD = 03G180B000-360A03000H010	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Receive Antenna Additional Information (For Parabolic Antennas)	ANTENNA DIAMETER N/A, ANTENNA EFFICIENCY N/A,	

Number of Satellite Contacts Supported Per Day	For any single endpoint device: Typical= 2, Maximum= 4 Total for 101 active endpoints: Typical < 200 Maximum = 400	
Expected Duration of Each Contact	10 minutes	AVERAGE DURATION OF EACH CONTACT
Supported Operations	Satellite Health and Status Data ☒ Mission Payload Data ☒	

FCC notes:

1. Use S-Note S945.
2. REM AGN, Cubesat, TotumSat-1L is an experiment mounted on a LOFT host satellite. It is not a free flying Cubesat.

Part B: Ground Stations, Earth to Space link data:

Earth Station Transmitter Data

Transmit Frequency: A total of 8 Chan 0 – 2478.50 MHz Chan 1 – 2475.00 MHz Chan 2 – 2472.50 MHz Chan 3 – 2471.00 MHz Chan 4 – 2459.50 MHz Chan 5 – 2457.50 MHz Chan 6 – 2454.50 MHz Chan 7 – 2477.50 MHz		
State (XSC)	XSC = mobile, continental US	
City Name (XAL)	XAL =	
Latitude (DDMMSS)	Lat = 24.32.38 to 49.00.00	
Longitude (DDDMMSS)	Lon = -066.58.58 to -124.38.41	

Transmit Power (PWR)	PWR = 0.2 W	TRANSMIT POWER SUPPLIED TO THE ANTENNA INPUT TERMINAL, EXAMPLE, PWR01 W2 TRANSMIT POWER UNITS INCLUDE: W = WATT, K = KILOWATT, M = MEGAWATT
Necessary Bandwidth	500 kHz	THE WIDTH OF FREQUENCY BAND WHICH IS JUST SUFFICIENT TO SUCCESSFULLY TRANSFER DATA. FORMULAS CAN BE FOUND IN ANNEX J OF THE NTIA MANUAL.
RF Emissions Data		2-SIDED EMISSION BANDWIDTH VALUES
-3 dB bandwidth	460kHz	
-20 dB bandwidth	1.23MHz	
-40 dB bandwidth	1.73 MHz	

-60 dB bandwidth	2.14 MHz	
Modulation Type	QPSK	THE METHOD USED TO SUPERIMPOSE DATA ON THE CARRIER, EXAMPLE, BPSK, QPSK, GMSK.
Data Rate	DMSS uplink uses Spreading Factors (SF) of 128-4096 and 2 symbols/bit thus **OTA data rate is 61- 1953 bits/sec** **1953 bits/sec maximum**	INFORMATION DATA RATE
Forward Error Correction Coding	Is FEC used? Yes ☒ No ☐ FEC Type: Viterbi, FEC Rate: ½ rate,	
Total Symbol Rate	DMSS uplink uses SF 128-4096 and 500KHz Chip rate thus **Symbol rate varies 122 -3906 symbols/sec** **3906 symbols/sec maximum**	DATA RATE COMBINED WITH FEC AND FRAME OVERHEAD RESULTING IN THE TOTAL SYMBOL RATE AT THE INPUTE TO THE SYMBOL MAPPER/MODULATOR.

Transmit Antenna Polarization (XAP)	XAP = J	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Transmit Antenna Orientation (XAZ)	XAZ01 V00	THE EARTH STATION Transmitter ANTENNA AZIMUTH (XAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, XAZ01 V00
Transmit Antenna Dimensions (XAD)	ANTENNA GAIN = 3 dB , BEAMWIDTH = 180 , AZIMUTHAL RANGE = 000-360 (Omni), THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS Mobile, < 3000 m maximum THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS <10m maximum XAD = 03G180B000-360A03000H010	EXAMPLE ASSUMING NONGEOSTATIONARY, XAD01 16G030B000-360A00357H006

Transmit Antenna Additional Information (For Parabolic Antennas)	ANTENNA DIAMETER_____, ANTENNA EFFICIENCY_____, N/A	
Number of Satellite Contacts Supported Per Day	For single or collocated endpoint devices: Typical= 2, Maximum= 4 For 100 active endpoints: Typical < 200 Maximum = 400	

Expected Duration of Each Contact	10 min	

Satellite Receive Specifications		
Receive Antenna Polarization (RAP)	RAP = R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Receive Antenna Orientation (RAZ)	RAZ = EC	NB= NARROWBEAM EC = EARTH COVERAGE
Receive Antenna Dimension (RAD)	ANTENNA GAIN = 7.3 dB BEAMWIDTH = 70deg RAD01 07.3G070B	(NTIA format (RAD), EXAMPLE, RAD01 16G030B)
Type of satellite (State = SP) City = G/No	Type = Nongeostationary	Choose either: Geostationary or Nongeostationary
For Geostationary Satellites	Longitude = N/A	IF ANY SATELLITES ARE GEOSTATIONARY, REPORT ITS LATITUDE AS 000000N (XLA AND/OR RLA) AND REPORT ITS LONGITUDE (XLG AND/OR RLG).
For Nongeostationary (Orbital Data)	INCLINATION ANGLE = 97.5 deg APOGEE IN KILOMETERS = 525 PERIGEE IN KILOMETERS = 525 ORBITAL PERIOD IN HOURS 1 AND FRACTIONS OF HOURS IN DECIMAL 0. THE NUMBER OF SATELLITES IN THE SYSTEM = 1 ORB,97.5IN00525AP00525PE001.59H01NRT01	IF ANY SATELLITES ARE NONGEOSTATIONARY, REPORT ITS INCLINATION ANGLE, APOGEE IN KILOMETERS, PERIGEE IN KILOMETERS, ORBITAL PERIOD IN HOURS AND FRACTIONS OF HOURS IN DECIMAL, THE NUMBER OF SATELLITES IN THE SYSTEM, THEN T01, EXAMPLE, REM04 *ORB,98.0IN00510AP00510PE001.58H01NRT01, AND FOR SPACE-TO-SPACE COMMUNICATIONS WITH ANOTHER NONGEOSTATIONARY SATELLITE ADD AN ADDITIONAL *ORB FOR IT ENDING IN R01, EXAMPLE, REM05 *ORB,72.9IN03209AP00655PE013.46H01NRR01

For SunSynchronous Nongeostationary Orbits	Mean Local Time of Ascending Node (MLTAN) = 02:05	MLTAN IS THE ANGLE BETWEEN AN ORBIT'S ASCENDING NODE AND THE MEAN SUN, OFTEN EXPRESSED AS UNIT OF TIME (HH:MM)