FCC 312 Schedule S	FEDERAL COMMUNICATIONS COMMISSION SATELLITE SPACE STATION AUTHORIZATIONS (Technical and Operational Description)	Page 1: General, Frequency Bands, and GSO Orbit

S1. GENERAL INFORMATION Complete for all satellite applications.

a. Space Station or Satellite Network Name: MSAT-1		e. Estimated Date of Placement into Service: 6/2/1996	i Will the space station(s) operate on a Common Carrier Basis: N
b. Construction Commencement Date:		f. Estimated Lifetime of Satellite(s): 10 Years	j. Number of transponders offered on a common carrier basis:
c. Construction Completion Date:		g. Total Number of Transponders: 1	k. Total Common Carrier Transponder Bandwidth: MHz
d1. Est Launch Date Begin:	d2. Est Launch Date End: 4/20/1996	h. Total Transponder Bandwidth (no. transponders x Bandwidth) 29 MHz	l. Orbit Type: Mark all boxes that apply: [X] GSO [ ] NGSO

S2. OPERATING FREQUENCY BANDS Identify the frequency range and transmit/receive mode for all frequency bands in which this station will oper
Also indicate the nature of service(s) for each frequency band.

Frequency Band Limits				e. T/R Mode	f. Nature of Service(s): List all that apply to this band
Lower Frequency (_Hz)		Upper Frequency (_Hz)			
a. Numeric	b. Unit (K/M/G)	c. Numeric	d. Unit (K/M/G)		
1530	M	1559	M	T	Mobile-Satellite Service
1631.5	M	1660.5	M	R	Mobile-Satellite Service
13.0	G	13.25	G	R	Feeder Link for Mobile Satellite Service in FSS
11.701	G	11.701	G	T	Satellite Telemetry
11.70275	G	11.70275	G	T	Satellite Telemetry
14.0005	G	14.0005	G	R	Satellite Command
10.75	G	10.95	G	T	Feeder Link for Mobile Satellite Service in FSS
14.4495	G	14.4495	G	R	Satellite Command

S3. ORBITAL INFORMATION FOR GEOSTATIONARY SATELLITES ONLY:

a. Nominal Orbital Longitude (Degrees E/W): 106.5 W	b. Alternate Orbital Longitude (Degrees E/W):		c. Reason for orbital location selection: MSAT operates its feederlinks in the Appendix 30B Ku-band., and so operates at the 106.5 degrees W longitude orbital location that is a Canadian ITU Appendix 30B Ku-band longitude.
Longitudinal Tolerance or E/W Station-Keeping: d. Toward West: 0.05 Degrees e. Toward East: 0.05 Degrees	f. Inclination Excursion or N/S Station-Keeping Tolerance: 0.05 Degrees	Range of orbital are in which adequate service can be provided (Optional): Degrees E/W g. Westernmost: h. Easternmost:	
i. Reason for service are selection (Optional):			

FEDERAL COMMUNICATIONS COMMISSION **Page 2: NGSO Orbits**
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S4. ORBITAL INFORMATION FOR NON-GEOSTATIONARY SATELLITES ONLY

S4a. Total Number of Satellites in Network or System:

S4b. Total Number of Orbital Planes in Network or System:

S4c. Celestial Reference Body (Earth, Sun, Moon, etc.):

S4d. Orbit Epoch Date:

For each Orbital Plane Provide:

(e) Orbital Plane No.	(f) No. of Satellites in Plane	(g) Inclination Angle (degrees)	(h) Orbital Period (Seconds)	(i) Apogee (km)	(j) Perigee (km)	(k) Right Ascension of the Ascending Node (Deg.)	(l) Argument of Perigee (Degrees)	Active Service Arc Range (Degrees)		
								(m) Begin Angle	(n) End Angle	(o) Other

S5. INITIAL SATELLITE PHASE ANGLE For each satellite in each orbital plane, provide the intital phase angle.

(a) Orbital Plane No.	(b) Satellite Number	(c) Initial Phase Angle (Degrees)

NO NGSO DATA FILED

FEDERAL COMMUNICATIONS COMMISSION **Page 3: Service Areas**
SATELLITE SPACE STATION AUTHORIZATIONS
FCC Form 312 - Schedule S: (Technical and Operational Description)

S6. SERVICE AREA CHARACTERISTICS for each service area provide:

(a) Service Area ID	(b) Type of Associated Station (Earth or Space)	(c) Service Area Diagram File Name (GXT File)	(d) Service Area Description. Provide list of geographic areas (state postal codes or ITU 3-ltr codes), satellites or Figure No. of Service Area Diagram.
LA1	S	MSAT-106.5 N America	CONUS, Alaska, Canada and other as shown
LA2	S	MSAT-106.5 HI Svc Are	Hawaii
KU1	S	MSAT-1 Ku SA.gxt	Canada
OMNI	S	MSAT-1-OMNI-SA.gxt	GLOBAL

FEDERAL COMMUNICATIONS COMMISSION **Page 4: Antenna Beams**
SATELLITE SPACE STATION AUTHORIZATIONS
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S7. SPACE STATION ANTENNA BEAM CHARACTERISTICS For each antenna beam provide:

(a) Beam ID	(b) T/R Mode	Isotropic Antenna Gain		(e) Pointing Error (Degrees)	(f) Rotational Error (Degrees)	(g) Min. Cross-Polar Iso-lation (dB)	(h) Polar-ization Switch-able? (Y/N)	(i) Polarization Alignment Rel. Equatorial Plane (Degrees)	(j) Service Area ID	Transmit			Receive				
		(c) Peak (dBi)	(d) Edge (dBi)							(k) Input Losses (dB)	(l) Effective Output Power (W)	(m) Max. EIRP (dBW)	(n) System Noice Temp (k)	(o) G/T Max. Gain Pt. (db/K)	(p) Min. Saturation Flux Density (dBW/m2)	Input Attenuator (dB)	
																(q) Max. Value	(r) Step Size
LE1	T	34	28	0.12	0.2	20	N		LA1	1	500	57.3					
LR1	R	34	28	0.12	0.2	20	N		LA1				600	3.2		7.5	2.5
LE2	T	34	28	0.12	0.2	20	N		LA1	1	500	57.3					
LR2	R	34	28	0.12	0.2	20	N		LA1				600	3.2		7.5	2.5
LE3	T	34	28	0.12	0.2	20	N		LA1	1	500	57.3					
LR3	R	34	28	0.12	0.2	20	N		LA1				600	3.2		7.5	2.5
LE4	T	34	28	0.12	0.2	20	N		LA1	1	500	57.3					
LR4	R	34	28	0.12	0.2	20	N		LA1				600	3.2		7.5	2.5
LE5	T	30	24	0.12	0.2	20	N		LA1	1	500	57.3					
LR5	R	30	24	0.12	0.2	20	N		LA1				600	-0.8		7.5	2.5
LE6	T	30	24	0.12	0.2	20	N		LA2	1	500	57.3					
LR6	R	30	24	0.12	0.2	20	N		LA2				600	-0.8		7.5	2.5
KU1E	T	29.2	23.2	0.12	0.2	25	N	90	KU1	1	6	36.2					
KU1	R	29.2	23.2	0.12	0.2	25	N	0	KU1				600	-3.6		7.5	2.5
OMNI	T	2	2	0.12	0.2	20	N	90	OMNI	1	0.16	7.4					
OMNI	R	2	2	0.12	0.2	20	N	0	OMNI				600	-8		1	1

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S8. ANTENNA BEAM DIAGRAMS For each beam pattern provide the reference to the graphic image and numerical data:
Also provide the power flux density levels in each beam that result from the emission with the highest power flux density.

(a) Beam ID	(b) T/R Mode	(c) Co-or Cross Polar Mode ("C" or" X")	(d) GSO Ref. Orbital Longitude (Deg. E/W)	(e) NGSO Antenna Gain Contour Description (Figure/Table/ Exhibit)	(f) GSO Antenna Gain Contour Data (GXT File)	Max. Power Flux Density (dBW/M2/Hz) At Angle of Arrival above horizontal (for emission with highest PFD)				
						(g) 5 Deg	(h) 10 Deg	(i) 15 Deg	(j) 20 Deg	(k) 25 Deg
LE1	T	C	-106.5		MSAT-1-Tx-East.gxt	-134.2	-134	-133.9	-133.8	-133.7
LR1	R	C	-106.5		MSAT-1-Rx-East.gxt					
LE2	T	C	-106.5		MSAT-1-Tx-EC.gxt	-134.2	-134	-133.9	-133.8	-133.7
LR2	R	C	-106.5		MSAT-1-Rx-EC.gxt					
LE3	T	C	-106.5		MSAT-1-Tx-WC.gxt	-134.2	-134	-133.9	-133.8	-133.7
LR3	R	C	-106.5		MSAT-1-Rx-WC.gxt					
LE4	T	C	-106.5		MSAT-1-Tx-West.gxt	-134.2	-134	-133.9	-133.8	-133.7
LR4	R	C	-106.5		MSAT-1-Rx-West.gxt					
LE5	T	C	-106.5		MSAT-1-Tx-South.gxt	-134.2	-134	-133.9	-133.8	-133.7
LR5	R	C	-106.5		MSAT-1-Rx-South.gxt					
LE6	T	C	-106.5		MSAT-1-Tx-AkHi.gxt	-134.2	-134	-133.9	-133.8	-133.7
LR6	R	C	-106.5		MSAT-1-Rx-AkHi.gxt					
KU1E	T	C	-106.5		MSAT-1 Ku Tx.gxt	-159.6	-159.4	-159.3	-159.2	-159.1
KU1	R	C	-106.5		MSAT-1 Ku Rx.gxt					
OMNI	T	C	-106.5		MSAT-1 Omni-E.gxt	-209	-209	-209	-209	-209
OMNI	R	C	-106.5		MSAT-1 Omni-R.gxt					

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S9. SPACE STATION CHANNELS For each frequency channel provide:

(a) Channel No.	(B) Assigned Bandwidth (kHz)	(c) T/R Mode	(d) Center Frequency (MHz)	(e) Polarization (H, V, L, R)	(f) TTC or Comm Channel (T or C)
KUD	200000	T	10850	V	C
KUU	200000	R	13125	H	C
LD	29000	T	1544.5	R	C
LU	29000	R	1646.0	R	C
THG1	1000	T	11701	H	T
TOMN1	1000	T	11701	V	T
COMH	100	R	14000.5	H	T
COMNI	100	R	14449.5	V	T
THG2	1000	T	11702.75	H	T
TOMN2	1000	T	11702.75	V	T
BEAC1	1	T	10753.5	V	C
BEAC2	1	T	10751	V	C

S10. SPACE STATION TRANSPONDERS For each transponder provide:

(a) Transponder ID	(b) Transponder Gain (dB)	Receive Band		Transmit Band	
		(c) Channel No.	(d) Beam ID	(e) Channel No.	(f) Beam ID
FWD1	123.3	KUU	KU1R	LD	LE1
FWD2	123.3	KUU	KU1R	LD	LE2
FWD3	123.3	KUU	KU1R	LD	LE3
FWD4	123.3	KUU	KU1R	LD	LE4
FWD5	123.3	KUU	KU1R	LD	LE5
FWD6	123.3	KUU	KU1R	LD	LE6
RET1	122	LU	LR1	KUD	KU1E
RET2	122	LU	LR2	KUD	KU1E
RET3	122	LU	LR3	KUD	KU1E
RET4	122	LU	LR4	KUD	KU1E
RET5	122	LU	LR5	KUD	KU1E
RET6	122	LU	LR5	KUD	KU1E
CMDOM		COMNI	OMNIR		
CMDHG		COMHG	KU1R		
TELO1				TOMN1	OMNIE
TELO2				TOMN2	OMNIE
TELH1				THG1	KU1E
TELH2				THG2	KU1E
AFC1				BEAC1	KU1E
AFC2				BEAC2	KU1E

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S11. DIGITAL MODULATION PARAMETERS For each digital emission provide:

(a) Digital Mod. ID	(b) Emission Designator	(c) Assigned Bandwidth (kHz)	(d) No. of Phases	(e)Uncoded Data Rate (kbps)	(f) FEC Error Correction Coding Rate	(g) CDMA Processing Gain (dB)	(h) Total C/N Performance Objective (dB)	(i) Single Entry C/I Objective (dB)
CW1	1K00N	1	1				9.8	22
GCS	6K00G1D	6	4			0	9.9	22.1
MMS	5K00G1D	5	2	600	0.5	0	4.2	16.4
DATAF	270KG1D	300	4	270		0	4	16
DATA1	168KG1D	168	2	2.637			-5	7.2
DATA2	42K0G1D	42	2	2.637			-11	1.2
QPSKV	6K00G1D	6	4				9.9	22.1

FEDERAL COMMUNICATIONS COMMISSION **Page 8: Analog Modulation**
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S12. ANALOG MODULATION PARAMETERS For each analog emission provide:

(a) Analog Mod. ID	(b) Emission Designator	(c) Assigned Bandwidth (kHz)	(d) Signal Type	(e) Channels per Carrier	Multi-channel Telephony				(j) Video Standard NTSC, PAL, etc.	(k) Video Noise-Weighting (dB)	(l) Video and SCPC/FM Modulation Index	(m) SCPC/FM Compander, Preemphasis, and Noise Weighting (dB)	(n) Total C/N Performance Objective (dB)	(o) Single Entry C/I Objective (dB)
					(f) Ave. Companded Talker Level (dBm0)	(g) Bottom Baseband Freq. (MHz)	(h) Top Baseband Freq. (MHz)	(i) RMS Modulation Index						
TELE	138GX	100	PM	1									5	17
CMD	700KF9D	1000	SCPC/FM	1									25	17

FEDERAL COMMUNICATIONS COMMISSION **Page 9: Typical Emissions**
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S13. TYPICAL EMISSIONS For each planned type of emission provide:

Associated Transponder ID Range		Modulation ID		(e) Carriers per Transponder	(f) Carrier Spacing (kHz)	(g)Noise Budget Reference (Table No.)	(h) Energy Dispersal Bandwidth (kHz)	Receive Band (Assoc. Transmit Stn)			Transmit Band (This Space Station)			
(a) Start	(b) End	(c) Digital (Table S11)	(d) Analog (Table S12)					(i)Assoc. Stn. Max. Antenna Gain (dBi)	Assoc. Station Transmit Power (dBW)		EIRP (dBW)		(n) Max. Power Flux Density (dBW/m2/Hz)	(o)Assoc. Stn Rec. G/T (dB/K)
									(j) Min.	(k) Max.	(l) Min.	(m) Max.		
FWD1	FWD6	CW1		1		MSAT CW Carr		61	-7.5	-5.5	28	30	-132.5	-16
FWD1	FWD6	GCS		1		MSAT GCS EO		61	-5.5	-1.5	30	34	-130.3	-16
FWD1	FWD6	MMS		1		MSAT MMS Ca		61	-15.5	-11	20	24.5	-139	-20
FWD1	FWD6	DATAF		1		MSAT DATAF		61	5.5	9.5	41	45	-119.4	-10
RET1	RET6	CW1		1		MSAT CW Carr		8	3.5	9.5	3.1	9.1	-153.4	36.5
RET1	RET6	GCS		1		MSAT GCS EO		8	5	12.5	6.5	12.1	-152.2	36.5
RET1	RET6	MMS		1		MSAT MMS Ca		4	-4.5	1.5	-8.9	-2.9	-166.4	36.5
RET1	RET6	DATAF		1		MSAT DATAF		14	18.3	24.4	23.9	30	-153.1	36.5
CMDOM	CMDOM		CMD	1		Telemetry and		59.5	24.5	27.5				
CMDHG	CMDHG		CMD	1		Telemetry and		59.5	9.5	12.5				
TELO1	TELO2		TELEM	1		Telemetry and					7.5	7.5	-156.4	35
TELH1	TELH2		TELEM	1		Telemetry and					17.5	17.5	-146.4	35
AFC1	AFC2	CW1		1		MSAT Beacon					10	10	-152.5	36
FWD1	FWD6	DATA1		1		MSAT DATA1		61	-5.5	-1.5	30	34	-144.7	-25.3
FWD1	FWD6	DATA2		1		MSAT DATA2		61	-7.5	-3.5	28	32	-140.7	-25.3
FWD1	FWD6	QPSKV		1		MSAT QPSK V		61	-7.5	-4.5	28	31	-131.7	-16
RET1	RET6	DATA1		1		MSAT DATA1		3	4.52	8.52	-0.88	3.12	-175.6	36.5
RET1	RET6	DATA2		1		MSAT DATA2		3	4.52	8.52	-0.88	3.12	-169.6	36.5
RET1	RET6	QPSKV		1		MSAT QPSK V		8	5	9.2	4.6	8.8	-155.5	36.5

S14. Is the space station(s) controlled and monitored remotely? If Yes, provide the location and telephone number of the TT and C control point(s): Yes

Remote Control (TT C) Location(s):

S14a: Street Address: 1601 Telesat Court			
S14b. City: Ottawa	S14c. County:	S14d. State/Country	S14e. Zip Code: K1B 1B9
S14f. Telephone Number: 888-835-3728 x3315	S14g. Call Sign of Control Station (if appropriate):		

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S15. SPACECRAFT PHYSICAL CHARACTERISTICS:

S15a: Mass of spacecraft without fuel (kg): 1326	Spacecraft Dimensions (meters)	Probability of Survival to End of Life (0.0 - 1.0)
S15b. Mass of fuel and disposables at launch (kg): 1670		
S15c. Mass of spacecraft and fuel at launch (kg): 2996	S15f. Length (m): 69	S15i. Payload: 0.904
S15d. Mass of fuel, in orbit, at beginning of life (kg): 1666	S15g. Width (m): 53	S15j. Bus: 0.906
S15e. Deployed Area of Solar Array (square meters): 32.9	S15h. Height (m): 69	S15k. Total: 0.819

S16. SPACECRAFT ELECTRICAL CHARACTERISTICS:

Spacecraft Subsystem	Electrical Power (Watts) At Beginning of Life		Electrical Power (Watts) At End of Life	
	At Equinox	At Solstice	At Equinox	At Solstice
Payload (Watts):	(a): 2516	(f): 2516	(k): 2535	(p): 2535
Bus (Watts):	(b): 718	(g): 475	(l): 718	(q): 475
Total (Watts):	(c): 3234	(h): 3234	(m) 3234	(r): 3234
Solar Array (Watts):	(d): 4073	(i): 3695	(n): 3357	(s): 3126
Depth of Battery Discharge (%):	(e) 72.1 %	(j) 0 %	(o) 72.1 %	(t) 6 %

S17. CERTIFICATIONS:

a. Are the power flux density limits of § 25.208 met?:	[X] YES	[ ] NO	[ ] N/A
b. Are the appropriate service area coverage requirements of § 25.143(b)(ii) and (iii), or § 25.145(c)(1) and (2) met?	[X] YES	[ ] NO	[ ] N/A
c. Are the frequency tolerances of § 25.202(e) and the out-of-band emission limits of § 25.202(f)(1), (2) and (3) met?	[X] YES	[ ] NO	[ ] N/A

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.