Mobile Satellite Service (MSS) System Characterization

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A number of mobile satellite service (MSS) systems have been proposed to provide data and telephony services in the 2 GHz regime. All of the systems except for the Boeing MSS system are being developed to provide services to mobile users having handheld devices. The Boeing MSS system is being developed to provide communications, navigation, and surveillance services for global avionics, commonly referred to as Aeronautical Mobile-Satellite (Route) Services. Thus, for the Boeing MSS system, the user terminal is located on an aircraft.

In some cases, the systems proposed are extensions to existing designs originally proposed in the 1.6 GHz band. The service link uplink/downlink frequency ranges are nominally 1980 to 2025 MHz and 2160 to 2200 MHz, respectively. Table 1 provides representative MSS system characteristics that could be used in performing MSS/FS interference evaluations. In some cases, specific values are still being finalized. Thus, the specific MSS system operator should be contacted prior to performing a final evaluation.

As shown in Table 1, the proposed MSS systems comprise a wide spectrum of constellation designs, including both geostationary satellite orbit (GSO) and non-GSO configurations. In the case of the Ellipso 2G system, elliptical orbits have been proposed.

All of the MSS system employ multiple beam-type antennas having up to several hundred beams. The antenna polarizations used are all either right- or left-hand circular. Finally, a variety of multiple access schemes have been proposed including time division multiple access (TDMA), code division multiple access (CDMA), frequency division multiple access (FDMA) and multiple combinations.

Table 1: Representative Mobile Satellite Service (MSS) System Characteristics

Category	Parameters	Iridium (Macrocell)	Globalstar (GS-2)	ICO	Boeing (Note 2)
Constellation	Orbit	Circular	Circular	Circular	Circular
	Inclination	98.8°	54° for NGSO	45°	53°
	# Satellites	96	64 NGSO; 4 GSO – preferably 80° W, 10°E, 100° E and 170°W	10 to 12	16
	# Planes	8	8 for NGSO	2	16
	Satellite Separation	30°		60° for 12 satellite configuration; 72° for 10 sat configuration	N/A
	Altitude (Km)	850 (nom)	1420 for NGSO, 35750 (nom) for GSO	10,355	20,181
Space Station Design	Antenna Type	Multiple Beam Antenna	Multiple Beam Antenna	Multiple Beam Antenna	Multiple Beam Antenna
	# Beams	228	NGSO: 96 GSO: 64	163	37
	Maximum EIRP/Beam (dBW)	Data: 22.1; Voice: 29.6	NGSO: 40 GSO: 50.8	55.4 – 58.1	ATN: 28.8 TIS: 46.4
	Polarization	RHCP	LHCP	RHCP	RHCP and LHCP
User Terminal Design (Note 3)	Antenna Type	Non-Directional	Non-Directional	Non-Directional	Non-Directional
	Receive G/T (dB/ °K)	-24.8	-24.5 (derived)	-23.8	ATN: -17.55 (derived) TIS: -19.3
S-E Service Link Parameters	Access Scheme	Data: CDMA/FDMA Voice: TDMA/FDMA	CDMA/FDMA & TDMA/FDMA	TDMA/FDMA	ATN: CDMA TIS: TDMA/FDMA
	Frequency (GHz)	Uplink: 1.990 – 2.025 Dnlink: 2.165 – 2.200	Uplink: 1.990 – 2.025 Dnlink: 2.165 – 2.200	Uplink: 1.985 – 2.015 Dnlink: 2.170 – 2.200	Uplink: 1.990 – 1.99825 Dnlink: 2.170 – 2.17825
	Modulation	QPSK	QPSK	QPSK	ATN: Same as IS-95A TIS: QPSK

Table 2.2-1 (Continued): Representative Mobile Satellite Service (MSS) System Characteristics

Category	Parameters	MCHI (Ellipso 2G)	Constellation II	CELSAT	TMI (CANSAT-M3)
Constellation	Orbit	Circular and Elliptical	Circular	Circular	Circular
	Inclination	(Note 1)	62° for 7 planes of 5 satellites each, Equatorial for 1 plane of 11 satellites	GSO	GSO
	# Satellites	26	46	1 (Initial) 3 (Total - Future); #1: 90° - 100° W, #2: 65° - 75° W, #3: 110° - 120° W	1; 106° - 112° W with 106.5° W preferred
	# Planes	5 (4 elliptical and 1 circular)	8	1	1
	Satellite Separation	(Note 1)		Longitudinal spread > 21°	N/A
	Altitude (Km)	(Note 1)	2035 for 62° planes, 1965 for equatorial plane	35,750 (nom)	35,750 (nom)
Space Station Design	Antenna Type	Multiple Beam Antenna	Multiple Beam Antenna	Multiple Beam Antenna	Multiple Beam Antenna
	# Beams	127	32	480	72
	Maximum EIRP/Beam (dBW)	2.5 MHz spread: 39.48 5.0 MHz spread: 42.49 10 MHz spread: 44.33	34.2 to 41.4 (derived)	53 (nom)	32 to 44
	Polarization	Circular	RHCP	RHCP	RHCP
User Terminal Design	Antenna Type	Non-Directional	Non-Directional	Non-Directional	Non-Directional
	Receive G/T (dB/ °K)	Handheld: -25.4 Transportable: -14.0	-22.1	-26	-10 to -24
S-E Service Link Parameters	Access Scheme	FDMA/CDMA	CDMA	CDMA & TDMA	CDMA & SCPC/FDMA
	Frequency (GHz)	Uplink: 1.990 – 2.025 Dnlink: 2.165 – 2.200	Uplink: 1.980 – 2.025 Dnlink: 2.165 – 2.200	Uplink: 1.990 – 2.025 Dnlink: 2.165 – 2.200	Uplink: 1.990 – 2.025 Dnlink: 2.160 – 2.200
	Modulation	Data: BPSK Spread: QPSK & Offset QPSK	Offset QPSK		QPSK

Table 2.2-1 (Concluded): Representative Mobile Satellite Service (MSS) System Characteristics

Category	Parameters	Inmarsat (Horizons)
Constellation	Orbit	Circular
	Inclination	GSO
	# Satellites	4; #1: 20° E, #2: 110° E, #3: 170° W, #4: 90° W
	# Planes	1
	Satellite Separation	Function of which satellites considered
	Altitude (Km)	35,750 (nom)
Space Station Design	Antenna Type	Multiple Beam Antenna
	# Beams	100 to 200
	Maximum EIRP/Beam (dBW)	66
	Polarization	
User Terminal Design	Antenna Type	Non-Directional
	Receive G/T (dB/ °K)	12
S-E Service Link Parameters	Access Scheme	TDMA
	Frequency (GHz)	Uplink: 1.980 – 2.025 Dnlink: 2.160 – 2.200
	Modulation	

(1)

Borealis – 2G	Concordia – 2G
3 planes (all Elliptical)	2 planes (1 Elliptical and 1 Circular)
5 satellites/plane	5 satellites in elliptical plane; 6 satellites in circular plane
Elliptical (Apog: 7513.4 Km, Perig: 674.3 Km; Inc: 116.6°)	Elliptical (Apog: 7975.7 Km, Perig: 4285.6 Km; Inc: Equatorial) Circular (Alt: 7747.3 Km)
Spacing: 72°	Spacing: 72° (Elliptical), 60° (Circular)

(2) The Boeing MSS system will be used for the provision of communications, navigation, and surveillance services for global avionics commonly referred to as Aeronautical Mobile-Satellite (Route) Services. In this context, ATN refers to the Aeronautical Telecommunications Network and TIS refers to Traffic Information Services. ATN supports two-way communications while TIS is only a one-way, ground-to-satellite-aircraft broadcast link.

(3) The user terminal for the Boeing MSS system is an aircraft terminal.