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EX PARTE OR LATE FILED

October 10, 1996

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, DC 20554

RECEIVED
OCT 10 1996
Federal Communications Commission
Office of Secretary

Re: Ex parte presentation in RM-8811, ET Docket
No. 95-183, RM-8553, PP Docket No. 93-253,
ET Docket No. 94-124, RM-8308

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules and regulations, Motorola Satellite Communications, Inc. ("Motorola") hereby reports that an ex parte presentation was made on September 26, 1996 by representatives of Motorola to the following:

- Karl Kensinger International Bureau
- John Williams Office of Plans and Policy
- Ronald Netro Wireless Telecommunications Bureau
- Steve Sharkey Office of Engineering and Technology
- Michael Marcus Office of Engineering and Technology
- Joe Heaps Office of Engineering and Technology
- Harry Ng International Bureau

In that presentation, the Motorola representatives presented and discussed the attached document. They also discussed Motorola's position in the above-captioned proceedings, as that position has been set forth in Motorola's pleadings in these proceedings. Specifically, the Motorola representatives analyzed the spectrum needs of satellite systems in the frequencies implicated in these proceedings.

Handwritten signature: *W. F. Caton*
Printed name: W. F. CATON

Mr. William F. Caton
October 10, 1996
Page 2

Three originals and three copies of this letter are being submitted for inclusion in the above-referenced dockets.

Sincerely,

A handwritten signature in black ink, appearing to read "Pantelis Michalopoulos". The signature is fluid and cursive, with a large initial "P" and "M".

Pantelis Michalopoulos
Attorney for Motorola Satellite
Communications, Inc.

Attachment

cc: Mr. Karl Kensinger
Mr. John Williams
Mr. Ronald Netro
Mr. Steve Sharkey
Mr. Michael Marcus
Mr. Joe Heaps
Mr. Harry Ng



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The M-Star System

**A Global Network of Non-Geostationary Communications
Satellites Providing Broadband Services
in the 40 GHz Band**

Filed 4 September 1996 by:

Motorola Satellite Systems, Inc.



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Agenda

- **System Description**
- **Business Plan**
- **Spectrum Requirements**
- **Sharing Analysis - Fixed Systems**
- **Sharing With Other Systems**
- **Sharing Rules**
- **Summary**



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M-Star System Description

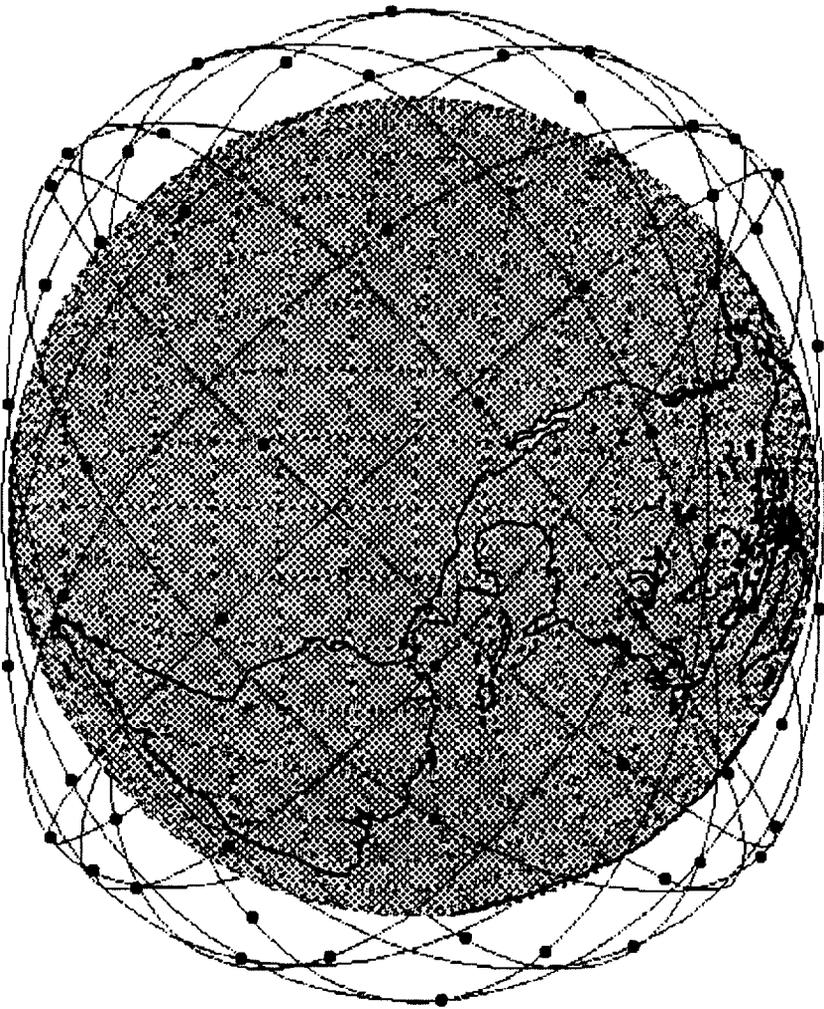
- Non-GSO Global satellite system comprising 72 satellites.
- Real-time wide-band information transfer
 - ⇒ Voice, Data, Digital Video, and Audio.
 - ⇒ Covering protocols such as ISDN, Frame Relay, X.25, TCP/IP, ATM, FDDI, and OC-1.
- Data rates from 2.048 Mbps to 51.84 Mbps.



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M-Star



Number of Planes:	12
Satellites per Plane:	6
Inclination:	47°
Altitude:	1350 km
Argument of Perigee:	0°
Eccentricity:	0.0013
Plane Spacing at Equator:	30°
Plane Phasing:	+25°
Minimum elevation Angle:	22°
Orbit Period:	6761 seconds



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M-Star Communications

Parameter Description	WAG/E-1 Specification	HBR Specification
Modulation Format	QPSK	QPSK
Coding	Convolutional Concatenated With Reed Solomon	Convolutional Concatenated With Reed Solomon
Target Bit Error Rate	10^{-6}	10^{-9}
Data Rates (information)	2.048 Mbps	51.84 Mbps
Downlink Bandwidth	3 GHz	3 GHz
Uplink Bandwidth	3 GHz	3 GHz
Eb/No requirement	2.2 dB.	2.7 dB
Ground Station RF Power Amplifier	up to 7.9 W for E-1 Terminals	up to 46.2 W for MTSO Terminals to Cell Site
Ground Terminal Aperture (m)	0.66	up to 79.5 W for HBR Terminals
Ground Terminal Figure of Merit G/T	19.3 dB/K	1.5
		26.4 dB/K



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Business Plan

M-Star will provide

- **Competitively priced regional and global communication**
- **Ready to use broadband infrastructure by 2000**
 - ⇒ **Lower total cost than global fiber networks**
 - ⇒ **Less time to build than a global fiber network**
- **Enhanced competition in telecommunication markets**

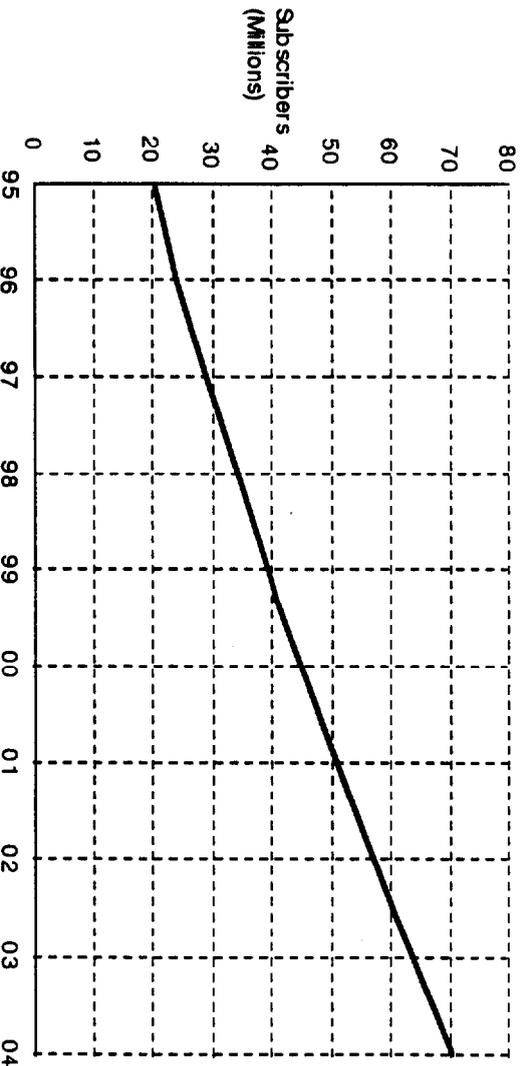


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Market & Demand for Services

- Third generation wireless services will include several advanced forms of voice and data communications transmitted from pocket sized telephones, wireless facsimile machines and other portable devices



The growth of wireless subscribers forecasted by the Yankee Group (Reference: "PCS: The Implementation Phase", the Yankee Group, February 1995).



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Market & Demand for Services

- M-Star provides for the interconnection between backhauls
- M-Star provides for LAN - LAN direct connections
- M-Star provides for small services connectivity or an aggregate of service providers (E-1)



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M-Star Spectrum Plan

- **Service Links:**
 - 37.5 - 40.5 GHz (Space-to-Earth)
 - 47.2 - 50.2 GHz (Earth-to-Space)
- **Inter-Satellite Links:**
 - 59.0 - 64.0 GHz
- **TT&C Links will operate in the service link band**
 - ⇒ Launch and emergency operations in FSS band below 18 GHz



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M-Star Satellite Capacity

- **Traffic Capacity**

⇒ **The distribution of end users will create high peak demands on the system. These peak demands are a key determinant of the overall spectrum requirements.**

⇒ **High peak traffic demands are managed by the use of a LEO Constellation, a versatile satellite payload and an antenna designed to create relative small beam coverage areas in the satellite coverage footprint.**

⇒ **A single space vehicle will support as many as 1800 E-1 links and 16 OC-1 links.**



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M-Star Typical Spectrum Requirements

- **Town & Small City**
 - ⇒ 250 E-1 links/town
 - ⇒ 25 E-1 links/transponder
 - ⇒ 1 OC-1 link/town
 - ⇒ 90 MHz/transponder
 - ⇒ 990 MHz per town

- **Large City**
 - ⇒ 450 E-1 links/city
 - ⇒ 25 E-1 links/transponder
 - ⇒ 15 OC-1 links/city
 - ⇒ 90 MHz/transponder
 - ⇒ 2970 MHz/city

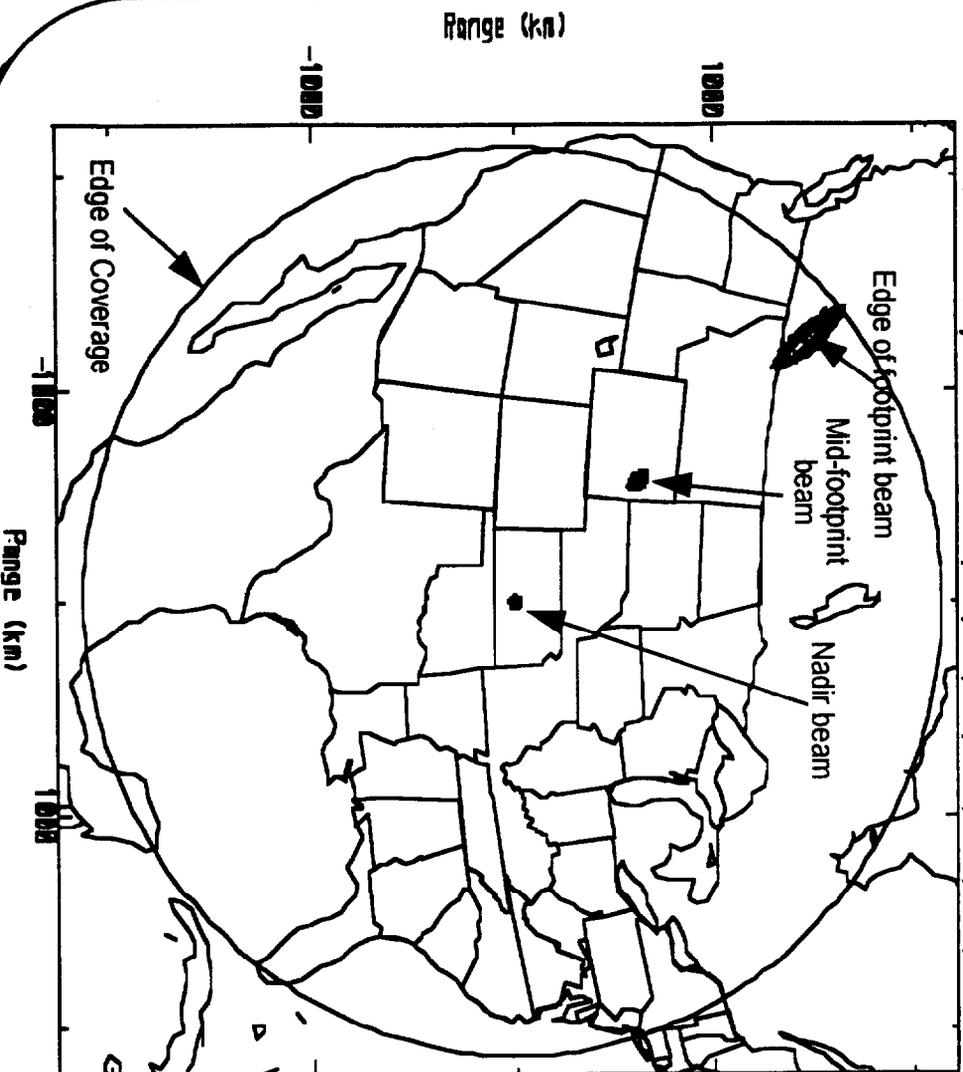


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M-Star Satellite Footprint

SV at 1350 km; Contours at -2, -4, -6, -8, -10, -14, -18, -22 dB



QPSK Modulation, Convolutional Coding concatenated with R/S

E1 Links

BER 10⁻⁶
 Eb/No 2.2 dB
 Rate 2.048 Mbps
 BW 3 GHz
 Xmit Antenna 0.66 m 7.9 W
 Rx Antenna G/T=19.3 dB/K

OC-1 Links

BER 10⁻⁹
 Eb/No 2.7 dB
 Rate 51.84 Mbps
 BW 3 GHz
 Xmit Antenna 1.5 m 46.2 to 79.5 W
 Rx Antenna G/T=26.4 dB/K



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Sharing with Fixed Service

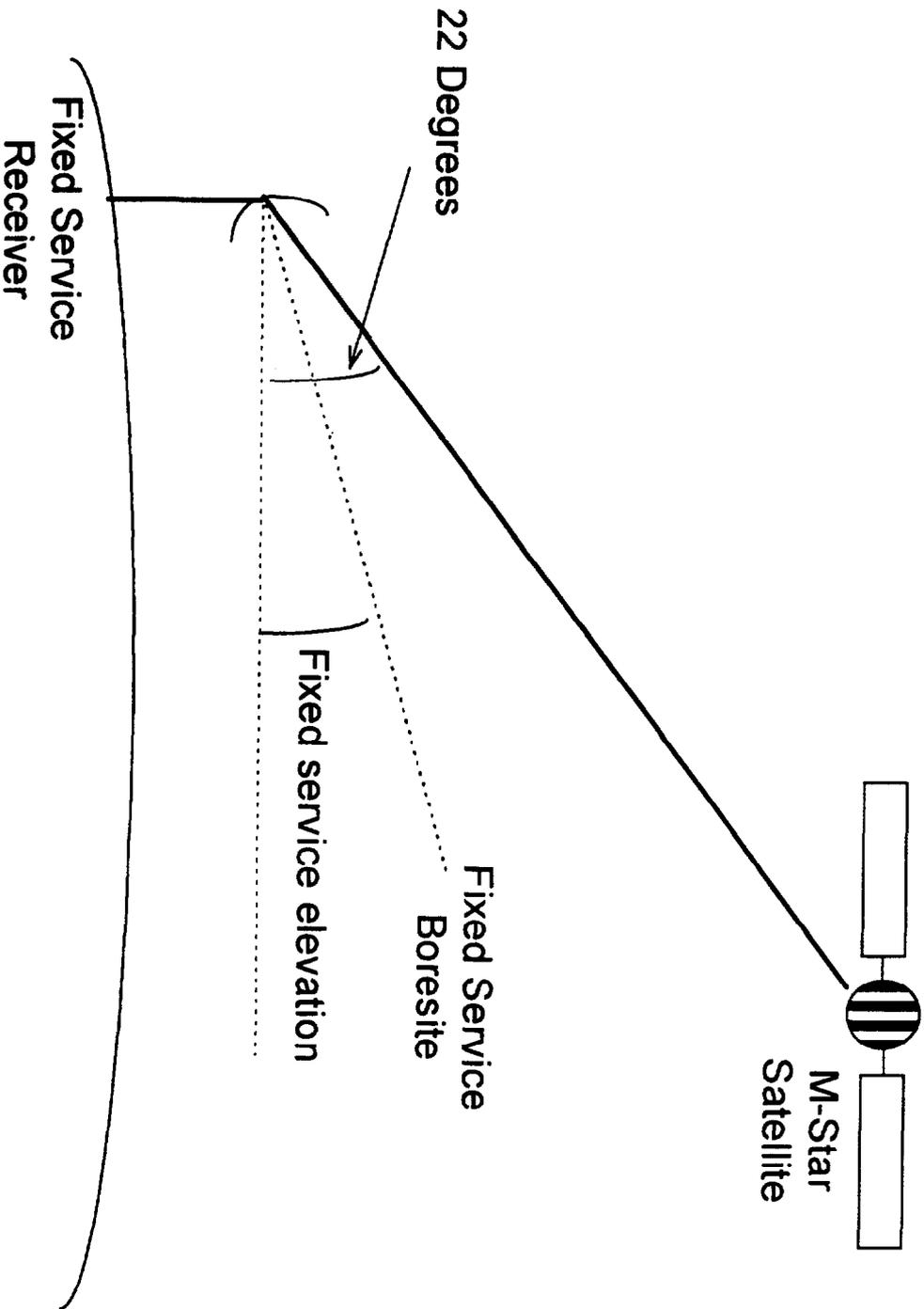
- **M-Star into Fixed Service**
 - ⇒ 37.5 - 40.5 GHz band (Sharing with Satellites).
 - ⇒ 47.2 - 50.2 GHz band (Sharing with Earth Stations).
- **Fixed Service interference into M-Star**
 - ⇒ 37.5 - 40.5 GHz band (Sharing with Earth Stations).
 - ⇒ 47.2 - 50.2 GHz band (Sharing with Satellites).



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Geometry of M-Star Downlink
into Fixed Service at 40 GHz





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M-Star Satellites into FS (37.5 - 40.5 GHz)

- M-Star is below 47 CFR 25.208(c) PFD limits
- Downlink calculations show that the peak Io/
No interference level experienced by the
Fixed Service is -14.2 dB.
- M-Star downlink can share without
coordination.



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Analysis Details of M-Star
Downlink into Fixed Service
at 40 GHz

PEAK IMPACT OF M-STAR DOWNLINK

FS Elevation Angle (deg)	Cell Site	OC-1 (MTSO)	OC-1 (Server)
	Io/No (dB)	Io/No (dB)	Io/No (dB)
0	-44.9	-40.2	-42.7
5	-42.1	-37.4	-39.9
10	-38.4	-33.6	-36.1
15	-32.5	-27.8	-30.3
20	-18.9	-14.2	-16.7

M-STAR TRANSMITTER PARAMETERS (Cell Site)

Power Radiated	W	0.02
Output losses	dB	1.50
Carrier frequency	GHz	40
Information rate	Mbps	10.24
Pwr spectral density	dBW/Hz	-88.59
Antenna boresite gain	dBi	40.60
Off boresite angle	deg	0
Off boresite gain	dBi	40.60
EIRP (boresite)	dBW	22.11
EIRPSD (off boresite)	dBW/Hz	-47.99

CHANNEL PARAMETERS

Distance	km	2585.9
Total absorption	dB	1.80
Spreading loss	dB	192.74

FS RECEIVER PARAMETERS

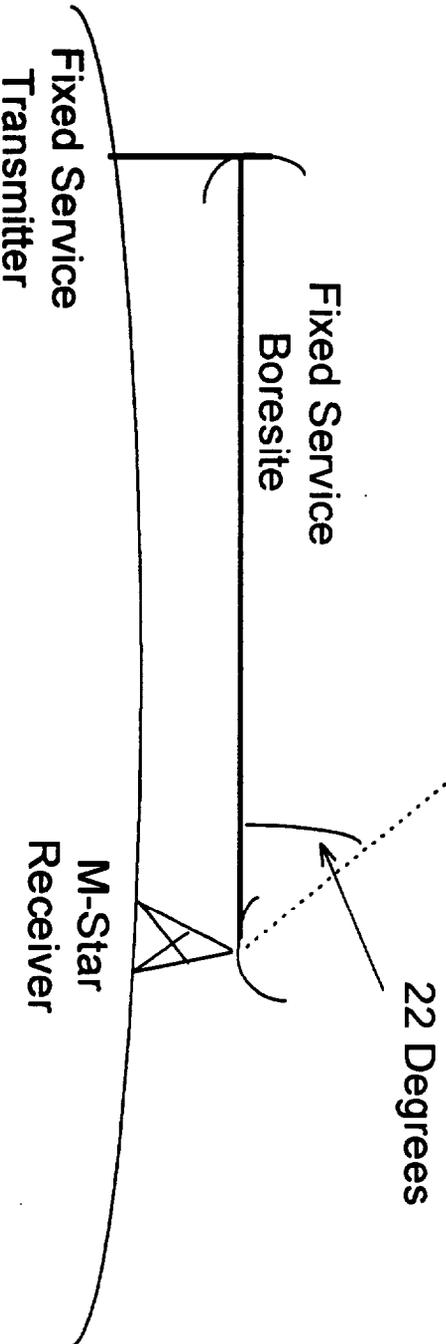
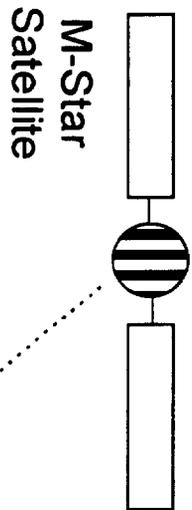
System temperature	K	1000
No	dBW/Hz	-198.60
Off boresite angle	degrees	2
Antenna diameter	m	0.66
Antenna boresite gain	dBi	46.60
Off boresight gain	dBi	25.03
Io	dBW/Hz	-217.50
Io/No	dB	-18.90



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Geometry of Fixed Service
into M-Star Downlink at 40 GHz





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FS into M-Star Earth Stations (37.5 - 40.5 GHz)

- M-Star will accept interference from the Fixed Service located 1 km away at the level of $10/N_0 = -13$ dB.
- Sharing Rules:

EIRP Limits:

For Fixed Service transmitters with clear air EIRP density less than -28.4 dBW/MHz no coordination required. Fixed Service can exceed this limit by means of adaptive power control only to the extent where link propagation attenuation exceeds the clear air value due to precipitation.

Higher power terminals need to be coordinated.



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Analysis Details of Fixed
Service into M-Star Downlink
at 40 GHz

FS RECEIVER

Receiver Noise Temp	deg	1000		
No	dBW/Hz		-198.60	
Reqd Co/No	dB		8.00	
Margin	dB		6.00	
Rx antenna gain	dBi		46.59	
Max tx EIRP	W	0.05	dbW	-13.01
Channel NBW	MHz	5		
	MHz	20		

BizTel Inc.
(File No.: 4228-CF-P/L-24)

FS CHANNEL

Frequency	GHz	40		
Tx-Rx distance	km	7.36		7.36
Spreading loss	dB		141.82	141.82
Atmos. Absorption	dB/km	0.13	0.96	0.96
T total propagation loss	dB		142.77	142.77

5 MHz Channel
20 MHz Channel

FSS CHANNEL

Tx-Rx distance	km	1		
Spreading loss	dB		124.48	124.48
Atmos. Absorption	dB/km	0.13	0.13	0.13
Total path loss	dB		124.61	124.61

5 MHz Channel
20 MHz Channel

FS TRANSMITTER

Reqd EIRP dens	dBW/Hz		-88.42		-88.42
Reqd EIRP	dBW/channel		-21.43		-15.41
Tx antenna gain	dBi		46.59		46.59
Reqd Power dens	dBW/Hz		-135.01		-135.01

FSS RECEIVER

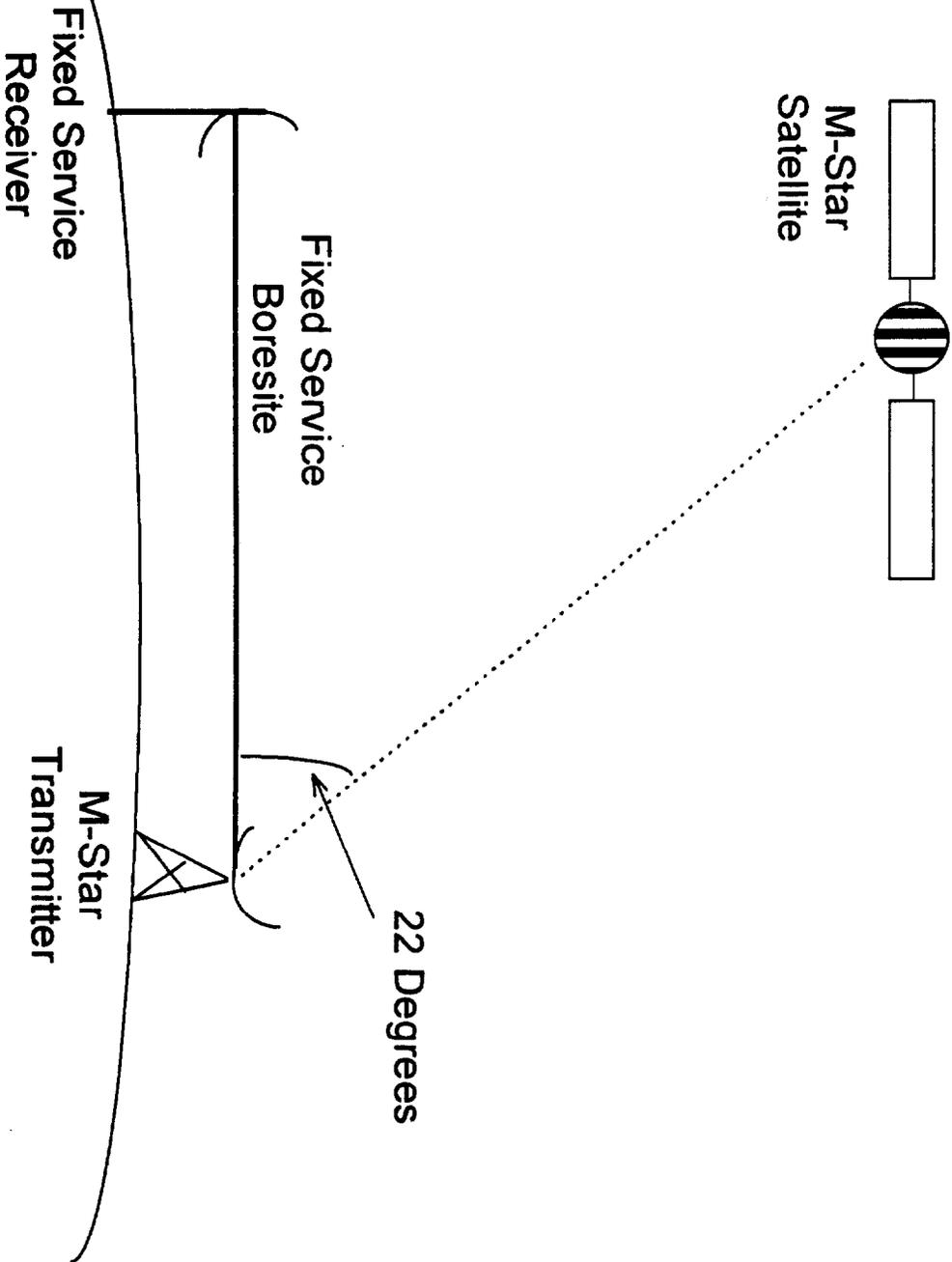
Rec. Noise Temp.	K	503		
No	dBW/Hz		-201.58	-201.58
Rx antenna gain	dBi		-1.56	-1.56
Io	dBW/Hz		-214.59	-214.59
Io/No	dB		-13.01	-13.01



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Geometry of M-Star Earth Station
into Fixed Service at 50 GHz





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M-Star Earth Stations into FS (47.2 - 50.2 GHz)

- M-Star is below EIRP limits of 47 CFR 25.204(b)
- Maximum required separation distance for lo/No to be below -13 dB (5% rise in noise floor) is 69.2 km for Fixed Service main beam interactions.
- Coordination with Fixed Service will be required.



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Analysis Details of M-Star
Uplink into Fixed Service
at 50 GHz

SEPARATION DISTANCE OF M-STAR UPLINK TO ACHIEVE I_o/N_o = -13 dB

FS Azimuth Angle (deg)	Cell Site	OC-1	OC-1
	Distance (km)	(MTSO) Distance (km)	(Server) Distance (km)
0	67.0	59.5	69.2
2.5	23.0	18.1	24.5
5	14.4	10.7	15.5
10	8.1	5.7	8.9
45	1.7	1.1	1.9

M-STAR TRANSMITTER PARAMETERS (Cell Site)

Power Radiated	W	1.5
Output losses	dB	0.50
Carrier frequency	GHz	50
Information rate	Mbps	10.24
Pwr spectral density	dBW/Hz	-68.84
Antenna boresite gain	dBi	49.30
Off boresite angle	deg	22
Off boresite gain	dBi	-1.56
EIRP (boresite)	dBW	50.56
EIRP/PSD (off boresite)	dBW/Hz	-70.40

CHANNEL PARAMETERS

Distance	km	67.00
Total absorption (0.4 dB/km)	dB	26.80
Spreading loss	dB	162.94

FS RECEIVER PARAMETERS

System temperature	K	1000
No	dBW/Hz	-198.60
Off boresite angle	degrees	0
Antenna diameter	m	0.66
Antenna boresite gain	dBi	48.53
Off boresight gain	dBi	48.53
I _o	dBW/Hz	-211.61
I _o /N _o	dB	-13.01



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Geometry of Fixed Service into
M-Star Uplink at 50 GHz

