December 9, 2008

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

RE: L-3 Communications "License for operation of broadband transmit and receive Ku band, mobile, data earth station"
File Number SES-LIC-20070322-00396
Call Sign E060390
Notice of Ex Parte Presentation

Dear Ms. Dortch:

On December 9, 2008, Paul Moller of Intellicom, Frank Cipolla of L-3 Datron, and Mark Cusano of L-3 Linkabit, met with Scott Kotler, Stephen Duall, Andrea Kelly and others at the FCC to provide a briefing on various technical aspect related to the license application[1]. This notice is being provided electronically via the FCC's Electronic Comments Filing System. The issues discussed in the meeting are reflected in the attached written presentation.

Please feel free to contact the undersigned with any questions regarding this submission.

Regards,

Paul Moller
Consultant/Agent to L-3 Communications
VP, Intellicom Technologies, Inc.
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cc: Scott.Kotler@fcc.gov
Andrea.Kelly@fcc.gov

[1] This proceeding has been designated "permit-but-disclose" for purposes of the Commission's ***exparte*** rules. ***See*** Public Notice, Report No. SES-01063 (August 26, 2008).

CERTIFICATE OF SERVICE

I, Paul E. Moller, herby certify that on December 9, 2008, I served a true copy of the foregoing "Notice of ***Ex Parte*** Presentation" to ViaSat by email upon the following:

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NCW Satcom-On-The Move
Briefing to the FCC
December 2008

Ex-parte
Permit-But-Disclose
Briefing

Meeting Objectives

- Brief FCC on technical attributes of license application
- Review filing vs. precedent
- Review public notice comments and responses
- Seek
  - feedback on the completeness of the application
  - status from FCC on this application
  - advice on next steps
  - FCC related rulemakings

Topics

- Introduction
- Filing Objectives
- Public Notice Comments
- Technical Briefing
- Conclusions

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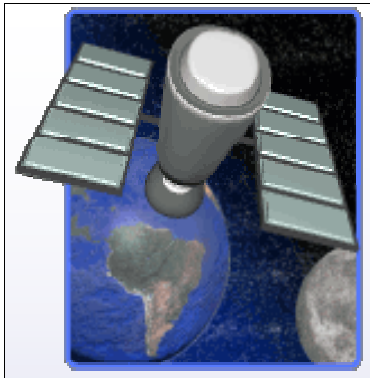

Intellicom Technologies

- **Systems Engineering**
  - Concept and Requirements Development
- **Engineering/Project Management**
- **Development**
  - Hardware Design and Implementation
  - Supplier Selection and Management
  - Network Management Design and Development
- **Integration, Verification, Qualification**
- **Deployment, Training, Support**
- **FCC Licensing**

- Intellicom staff typically have over **20 years of highly relevant Satcom industry experience** from such programs as Iridium, Teledesic, Spaceway, Milsatcom, VSAT, Satcom on the Move, UAV, Aircraft and MUOS.

- Worldwide Spacecraft and Ground systems experience

Intellicom Technologies is representing L3 in obtaining FCC licenses

L3 Communications

- **Linkabit Division**
  - specializes in the development, manufacture and support of information products for military and commercial uses
  - products include bandwidth-efficient satellite and line-of-sight voice, data and control modems; radios; complete terminals and antenna systems.
  - Early developers (1980's) of **satcom modems** and **viterbi codecs**
  - Provides the modem and **network management** for the system to be licensed

- **Datron Division**
  - serves customers worldwide with **fixed site and mobile antennas** for telemetry, TT&C, satellite communications, and RSS ground stations.
  - proven **airborne products** are used for commercial as well as military applications.
  - **Communications-on-the-Move (COTM) systems** serve the evolving Ku/Ka-band mobile communication markets
  - **state-of-the-art satellite tracking systems** meet the toughest environmental and reliability requirements
  - Provides the antenna, tracking system, and RF for the system to be licensed

SOTM Users

- Satellite News Gathering
- Special Events
- Homeland Security
  - Border Patrol
  - Emergency Communications
- US Forces – Marines, Navy, Army, Air Force
- Special Operations

Topics

- Introduction
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Filing Objective

Seeking a permanent FCC license for a Sub-Meter Satcom-On-The-Move (SOTM) earth station consisting of:

- L3/Linkabit MPM-1000 Modem and Modem Controller Assembly
- L3/Datron FSS-4180 Antenna Assembly (18", -LP, -LC)

- Ku Band (14-14.5 GHz, 11.7-12.2 GHz)
- All CONUS Mobile Operation
- Satellites (Points of Communication)
  - Filed:
    - AMC -2, 5, 9, Intelsat – IA7, IA8
  - Future Modification:
    - AMC -1, 2, 5, 6, 15, 21
    - Intelsat - G16, 17, 26, 27, 28, IS2, H1, H2
    - Telesat/Loral – Telstar 14
    - Sat GE - 23

History

- L3 has been developing and verifying operation of this earth station for well over **4 years** and has been developing satellite earth station antennas and modem equipment for well over **25 years**.

- The L3 earth station technology has been favorably critiqued by SES Americom, Intelsat, SES New Skies, and Echostar and all have provided affidavits stating this.

Experimental License

- Granted June 3, 2005 (call sign WD2XSJ)
- L3 has been performing development and verification testing of the earth station for almost 3 years
- Development and verification activities have improved the product and have helped to achieve customer and satellite operator confidence

Affidavits

Filed:

- SES, Intelsat acknowledge that the use of the L3 non-conforming antennas will not cause unacceptable interference into adjacent satellites in accordance with the FCC's 2-degree spacing policy

Available to be Filed:

- SES, Intelsat, Echostar, Telesat/Loral

Precedent

Raysat, DA-08-401A1 (Feb 15, 2008)	L-3 Filing
CONUS, Mobile operation on vehicles	CONUS, Mobile operation on vehicles
Ku Band – secondary basis (tx, rx)	Ku Band – secondary basis (tx, rx)
Non-compliant antenna 2.4 dB excess gain 25.220(c)(1) – reduce spectral density 25.220(c)(1) – satellite operator affidavit	Non-compliant 17.4”x12” antenna (11.4 dB excess gain) Does not meet gain requirement of 25.209, 212 25.220(c)(1) – reduce spectral density 25.220(c)(1) – satellite operator affidavit
SCPC FDMA, BPSK R1/3 FEC 518KG7W	MF-TDMA, Spread Spectrum, 10LogN, where N=1 45K0G7D, 71K7G7D, 1M43G7D, 11M5G7D Turbo codes
0.5 degree error, 100 ms mute, 3-axis gyro, receive power measurements No Transmit without signal lock	0.2 degree error, Beacon tracking, GPS and Inertial Navigation Mute within 100 mS on loss of signal or pointing error, positive power/frequency control from hub
400 mobile earth stations (METs), LMSS	Single station – communicating with hub
Grant based on existing regulatory requirements and precedent. Non-Routine	Grant requested on existing regulatory requirements and precedent. Waiver requested for sub-meter antenna and for table of allocations (11.7-12.2 GHz)
Coordination, Affidavits	Coordination, Affidavits from SES and Intelsat
Data Logging – every 20 minutes, maintained for 1 year	Can be provided if requested.
Coordination with NASA and White Sands, Space Research, Radio Observatory	Non-operational areas defined.

EIRP Spectral Density

Figure 2 shows the typical EIRP spectral density that can be achieved by lowering the Power Spectral Density into the antenna. The combined result of the antenna and the reduced PSD of the transmitted carrier can provide an EIRP spectral density that meets the intent of FCC 25.209 and the ITU recommendation, ITU-R S.728-1.

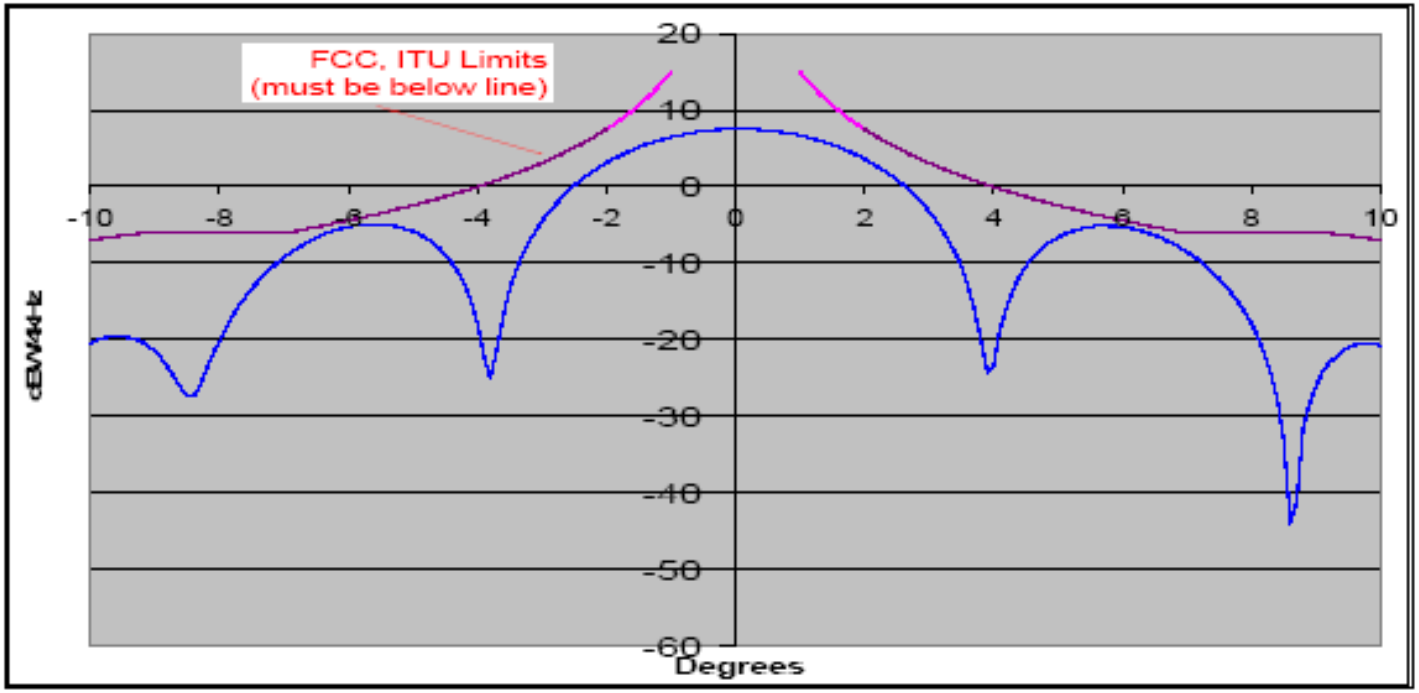

Figure 2 – EIRP Spectral Density

Topics

- Introduction
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Topics

- Public Notice Comments
  - Antenna
  - Multiple Access
  - Network Operation
  - Locational

No Issue With Antenna

"ViaSat has used and tested the L-3 Datron antenna and raises no issue with respect to the antenna's performance" and "ViaSat's operations using this antenna employed a modem that had a spread spectrum waveform with a very low power density, which greatly reduces the potential for interference due to antenna mispointing".

This is the approach that L3 has proposed. The Direct Sequence spreading factor is adjusted to ensure that the maximum EIRP density is not exceeded.

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Multiple Access….

"L3 Titan accounts for the relative rotation of the antenna, but does not appear to allocate any excess gain for multiple access methods"

- L3's correction for relative rotation of the antenna demonstrates the attention to detail and the use of conservative engineering methods.
- Margins for multiple access methods are appropriate for a CDMA network but are not relevant to our application which is a TDMA system.

…Multiple Access

- Per the filed document 20060920M01V10pm_TECH_BRIEF.doc:
  - "While spread spectrum is used as a method to reduce transmit power spectral density, it is NOT USED as a multiple access scheme".
  - Since CDMA is not used, the management of the EIRP spectral density of each station is sufficient.

- A CDMA based network, such as ViaSat's, requires additional reduction of 10*Log(N) below a single carrier or station EIRP density, where N is the number of accesses. Our system does not require a reduction of this type.

In our system N=1, 1oLogN=0

Topics

- Public Notice Comments
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  - Locational

Network Operation

"ViaSat is concerned about the potential for interference if this terminal were operated within an Network"

- The license application is for operation of a **single earth** station and not a Blanket VSAT network. It is not appropriate to dismiss this application for something that has not been requested.
- We are more than happy to deal with the networking aspects in the planned Blanket VSAT license application.

Network Operation

"I. The Application Does Not Provide A Technical Basis For Assessing The Interference Potential Of The Terminal If Operated Within A Network."

- The license application is for operation of a **single earth station** and not a Blanket VSAT network. It is not justified to dismiss this application for something that has not been requested.
- The application provides extensive technical information regarding antenna patterns, pointing angle analysis, modulation, maximum power spectral density relative to FCC 25.209, and corrections for relative rotation to the geostationary arc. This information is substantial for a single earth station.
- In fact **Intelsat and SES have provided a signed affidavit stating that they are in agreement with the operational practices.**
- Whether for a single earth station or a network, **the maximum power spectral density will not be exceeded.**
- **Additional technical information on the network management techniques will not change the key performance metric which is the maximum EIRP spectral density.**

Networking Aspects

"The commission should review the networking aspects of L3 Titan's proposed modem before it is employed in a Network"

L3 is willing to accept a condition for this single earth station license to limit the terminal from operating within a network of similarly non-conforming terminals. L3 Titan will file additional information in a future filing for VSAT or networked operations.

Potential Interference

- "*ViaSat is concerned about the potential for interference if this terminal were operated within a network.*"

- **A signed affidavit of satellite operators provides credibility that operation of this earth station is acceptable with regards to interference.**
- The potential victim of interference is not represented by ViaSat but instead by the satellite operators.
- L3 has filed an affidavit with the license application signed by the satellite operators, **Intelsat** and **SES Americom,** stating that they are satisfied with the technology and operational methods planned.
- In addition, L3 has been registered for operation on **SES New Skies** Satellites.

Topics

- Public Notice Comments
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Locational Record Keeping

"the Commission should include as a condition to any grant of authority a requirement to maintain records of the location of the mobile terminal to enable other operators to assess any incidents of interference"

"II. The Commission Should Apply The Same Locational Record Keeping Requirements That Apply To Earth Station On Vessels."

- We are aware that the FCC is currently reviewing a requirement for network operators of mobile or "non-compliant" antennas to maintain records of the location. Should the FCC rule to require records for VSAT networks and/or for single earth stations, then the mechanisms specified by the FCC will be added to the system to ensure compliance.

- The license application is for operation of a single earth station and not a blanket VSAT network. The location and activities of a single earth station are not typically required by the FCC.

Locational Record-Keeping

"Locational Record-Keeping Requirements Should Apply to a Single Antenna"

Should the FCC rule to require records for VSAT networks and/or for single earth stations, then the mechanisms specified by the FCC will be added to the system to ensure compliance.

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Technical Brief

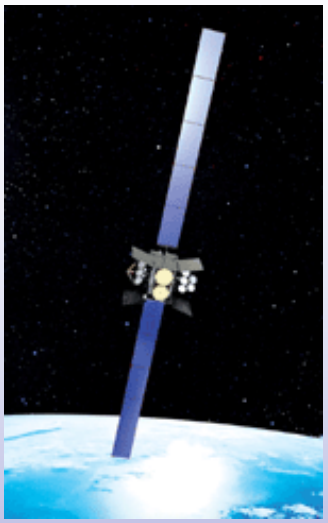
On-The-Move SATCOM Permanent Licensing

January 10, 2007

Document No. 20060920M01V10pm_TECH_BRIEF.doc

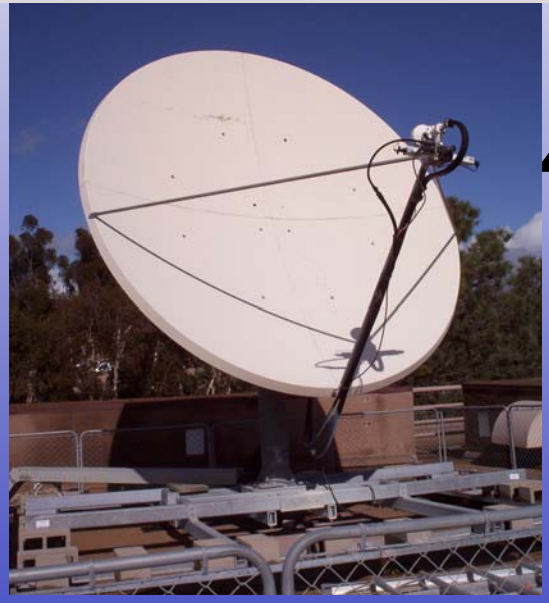
System Architecture

Asymmetrical System
- Desire small remote
- Hub size large enough to support remote

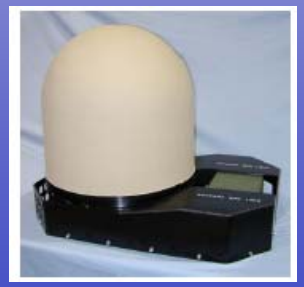


Satellite

HUB
Network Controller (NC)



SOTM REMOTE
Network Member (NM)



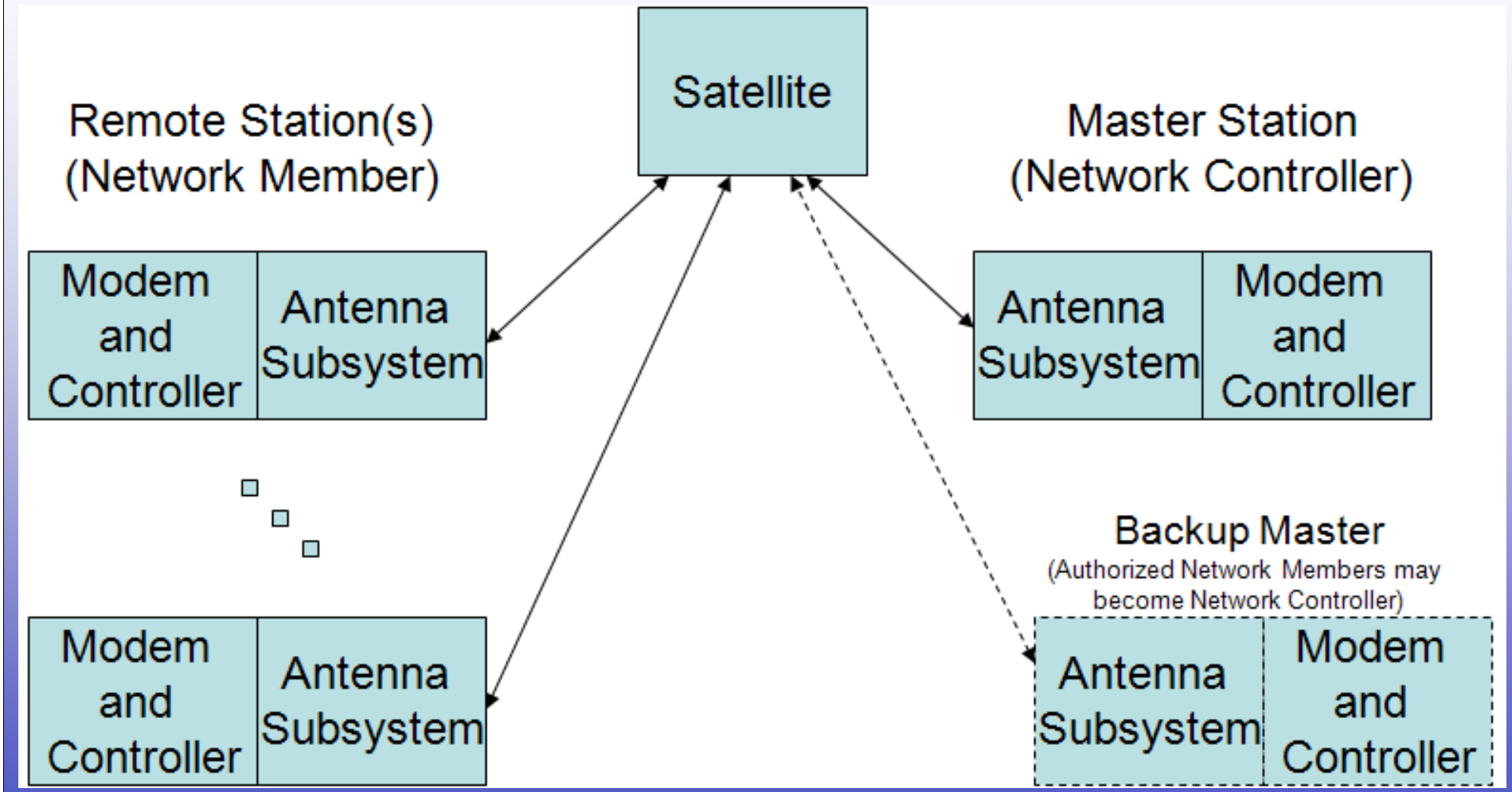
Hub (Network Controller)

1. Maintains control of all remote stations
2. Remotes shutdown if they do not receive the Forward Order Wire (FOW) carrier from the hub – like a system heartbeat
3. Hub provides all spectral assignments and ensures that allocated spectrum is not exceeded in bandwidth and power
4. Back-up hub(s) can take over control if primary hub fails

Topics

- Technical Briefing
  - Network - Multiple Access Scheme
  - SOTM Earth Terminal
  - Antenna Pattern
  - Antenna Pointing
  - Modulation and Spreading

Network Architecture



Network Entities

- **Network Controller (NC):**
  - provides resource management of leased space segment
  - continuously monitors and controls the Network Members
  - on-site 24x7 support or on-call rapid response
  - satellite space segment operations center shall be provided with the network operator's phone number for rapid fault resolution.

- **Network Members (NM):**
  - under continuous (remote) control and monitoring from the NC
  - can not transmit unless they receive the NC signaling channel

- **Geostationary Satellite:**
  - Space segment resources are leased from the available commercial satellite operators

- **Back-Up Network Controller:**
  - If the NC fails, all transmissions cease unless the failed NC recovers or a back-up pre-authorized terminal detects the failure and becomes the new NC

Access Scheme

- Multi-Frequency Time Division Multiple Access (MF-TDMA).
  - under control of the Network Controller
  - Resources are ASSIGNED (not contention based, not CDMA based)
- The Network Controller
  - provides real-time resource management through time slot, center frequency, and carrier bandwidth assignments to the Network Members via a common signaling channel
  - Assignments include Tx EIRP, modulation scheme, code rate, and DSSS spread factor
  - may assign multiple frequency slots for each burst time
- All stations can hop frequencies from burst to burst, but there will only be **one transmit carrier per frequency slot per time** building block.
- Spread spectrum is used as a method to reduce transmitted power spectral density, it is NOT USED as a multiple access scheme.

Topics

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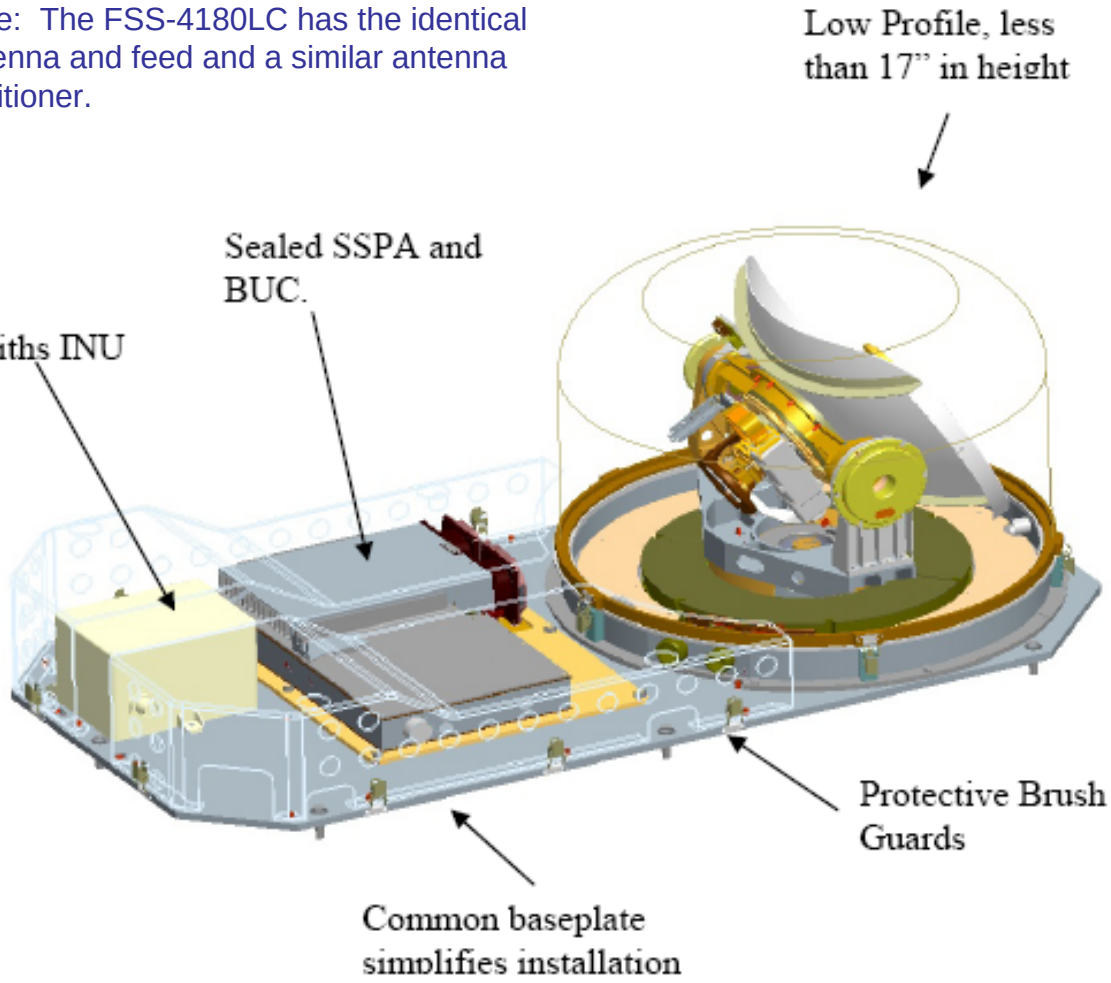
FSS-4180-LP Antenna

Note: The FSS-4180LC has the identical antenna and feed and a similar antenna positioner.



MPM-1000 Modem

Modem

& Network Management

Laptop

Topics

- Technical Briefing
  - Network - Multiple Access Scheme
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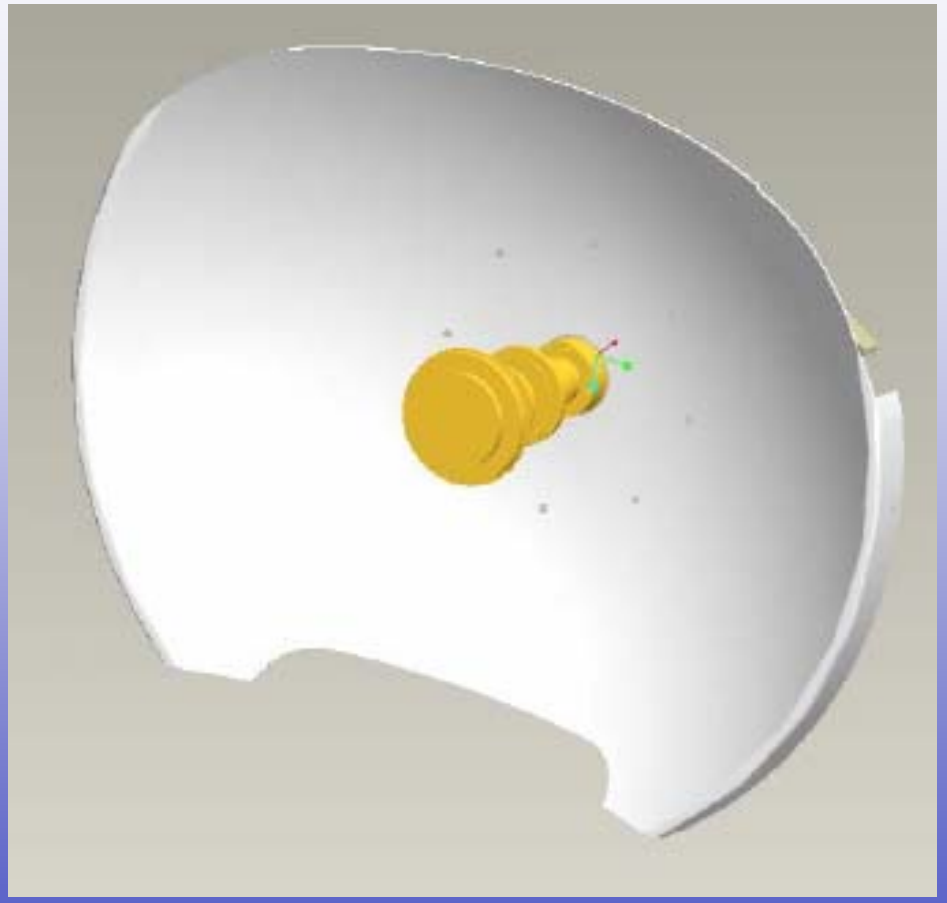
Antenna Reflector

- 17.4” x 12” (0.44m x 0.30m)
- elliptical in shape
- effective diameter (as if it were circular) of 0.36m

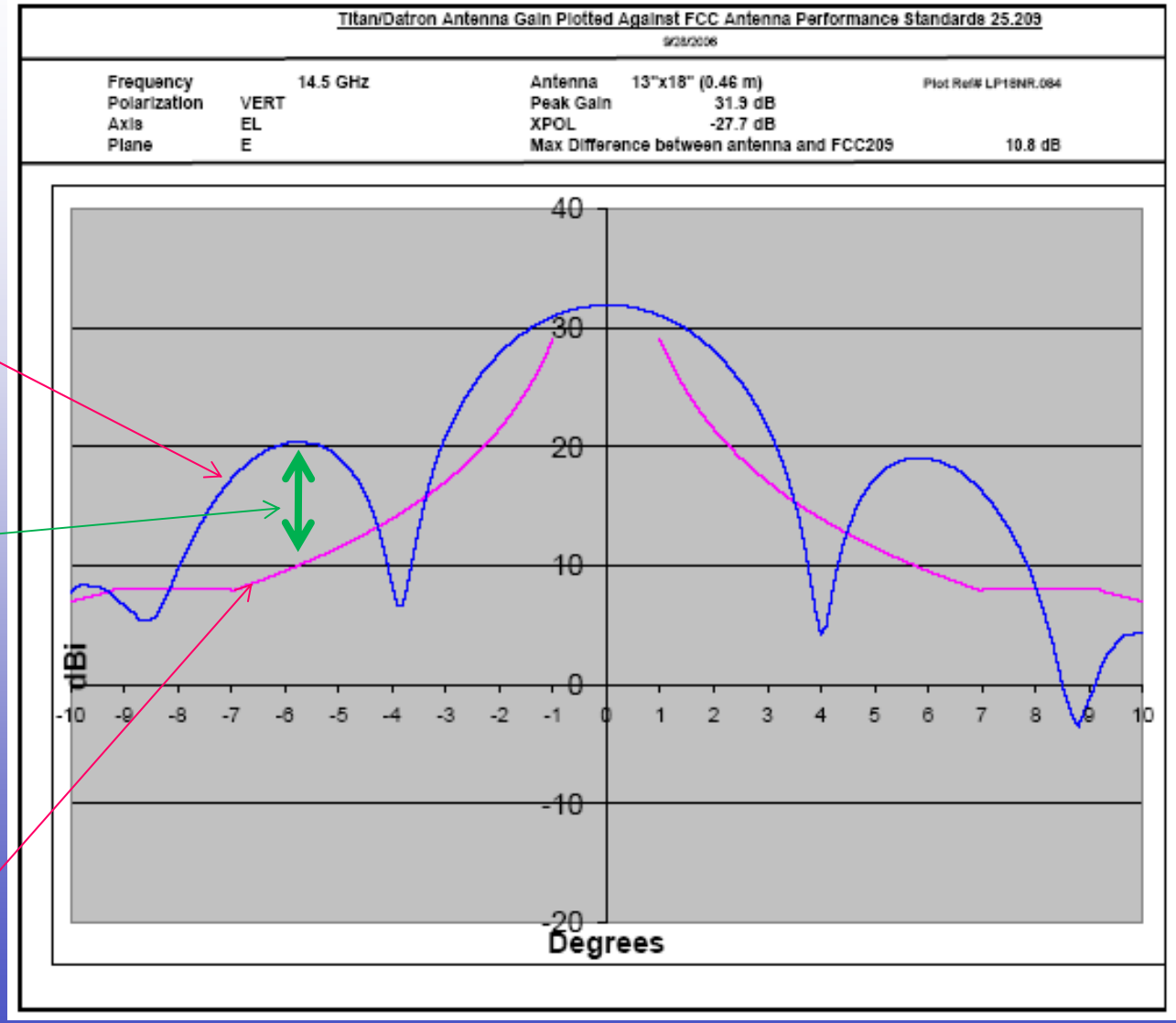


Antenna Pattern

FSS-4180-LP Pattern

Maximum Excess Gain

47CFR25.209



Maximum PSD into Antenna

Elevation Plane

FCC 25.209 compliant antenna	-14 dBW/4 kHz
maximum excess gain of the "non-compliant" antenna	11.3 dB
Maximum Power Spectral Density allowed into the "non-compliant" antenna	**-25.3 dBW/4 kHz**

Azimuth Plane

FCC 25.209 compliant antenna	-14 dBW/4 kHz
maximum excess gain of the "non-compliant" antenna	7.7 dB
Maximum Power Spectral Density allowed into the "non-compliant" antenna	**-21.7 dBW/4 kHz**

Relative Rotation

Depending on terminal/satellite locations, the antenna GEO arc cuts across antenna at different “relative rotation”. Maximum PSD into antenna depends on this “relative rotation”.

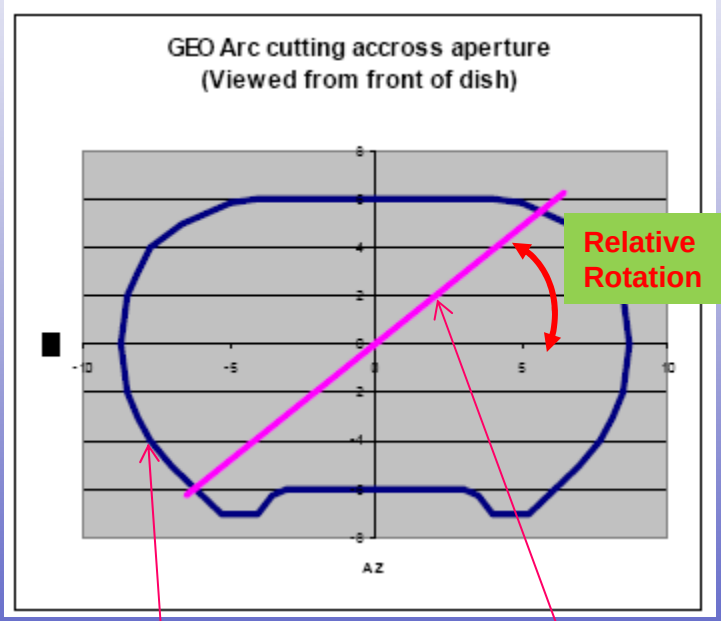


Table 8-1 Excess Gain and PSD vs. Relative Rotation (Note 1)

Relative Rotation Or Polarization (Degrees)	Increase in Excess Gain (dB)	Maximum Power Spectral Density allowed into the “non-compliant” antenna (dBW/4kHz)
0	0	-21.7
1 to 10	0.3	-22.0
11 to 20	0.9	-22.6
21 to 30	1.6	-23.3
31 to 40	2.2	-23.9
41 to 50	2.7	-24.4
51 to 60	3.1	-24.8
61 to 70	3.4	-25.1
71 to 80	3.5	-25.2
81 to 90	3.6	-25.3

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Advanced Antenna Positioner

Antenna Positioner

The L3/Datron Antenna Assembly controls pointing of the antenna through the use of advanced control systems utilizing:

- Kalman filters
- GPS
- inertial navigation
- signal tracking assistance
- beacon receiver
- and various sensors

This antenna pointing technology has been engineered over several years and has been verified in both lab and operational environments.

Pointing Errors

- **A = Antenna static errors** due to mechanical alignment of the feed, reflector, and its relation to the inertial navigation system. Typically this error is +/-0.2°, but this is +/-0.0° through the use of signal tracking assistance.

- **N = Navigational** system dynamic errors due to the motion of the inertial navigation system. Typically this error is +/-0.25°, but this is +/-0.0° through the use of signal tracking assistance.

- **S = Signal Tracking Assistance Errors –** A signal tracking mechanism will measure signal strength and peak the antenna signal strength using receive signal strength measurements resulting from dynamic motion or dithering. Tracking error is +/-0.1° and this eliminates Antenna Static errors (A) and Navigational errors (N).

- **D = Dynamic** pointing errors between the desired pointing angle and the antenna pointing while in motion. (+/-0.19°, 95%)

Pointing Errors

- **Total Error E** = expected value of the uncorrelated events (S, A, N, D)

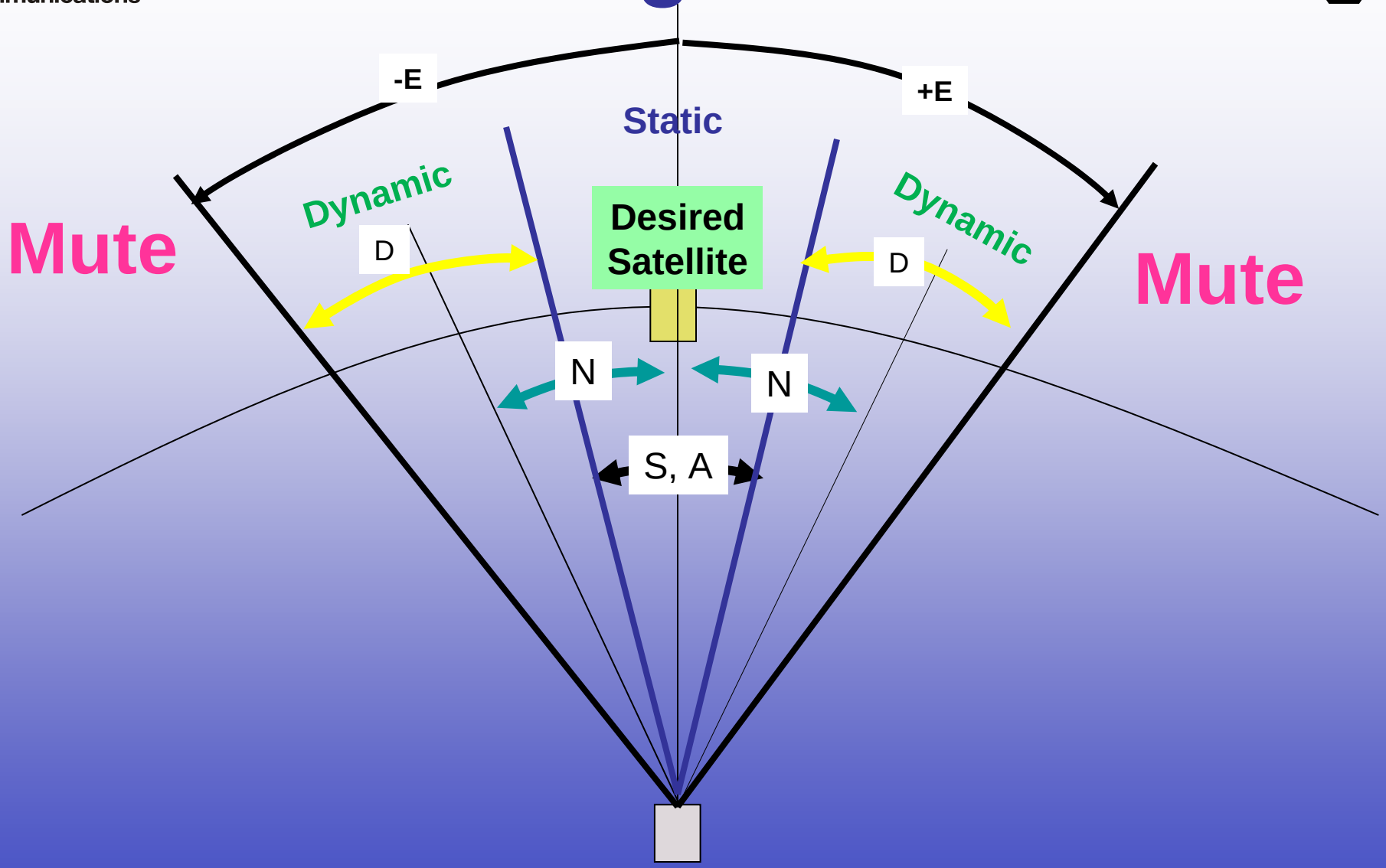
  = square root [$S^2 + A^2 + N^2 + D^2$]

  = square root [$(0.1)^2 + 0^2 + 0^2 + (0.19)^2$]

  = **+/-0.2°**

- Beyond +/-0.2° the transmitter is **muted in less than 100 mS** (similar to 47cfr25.222 requirements)

Pointing Error



Pointing Error Actions

Antenna/Vehicle are NOT in motion	**E<0.1°**, 100% of the time Transmitter is **Enabled**
Antenna/Vehicle are in motion (paved or dirt roads)	**E<0.2°** Transmitter is **Enabled**
Extreme Terrain Churchville B mobile vehicle conditions	**E<0.2°**, 95% of the time Transmitter is **Enabled**
Antenna/Vehicle are in motion	**E>0.2°** Transmitter is **MUTED**

Note: Churchville B mobile vehicle conditions are the anticipated most extreme operational conditions. Typically the operational environment will be less severe.

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MPM-1000

L3/Linkabit MPM-1000 Modem and Modem Controller Assembly

- Modulator
- Demodulator
- Turbo codec
- Stable clock, reference, and distribution
- Frequency conversion to/from IF
- Controller, configurable as a:
  - Network Member (NM), or
  - Network Controller (NC) (including resource manager)
- Ethernet Interface/Switch
- QOS manager
- Human Machine Interface

Modulation

- The Modem is capable of:
  - Modulation: BPSK (R ½), OQPSK (R ½, ¾)
  - Data Rates: 32 kbps to 3072 kbps per carrier
  - Coding: Turbo Coding
  - BPSK Direct Sequence Spreading: 1-16x
  - MF-TDMA (Multi-Frequency TDMA)
  - All spectrum assignments come from the Hub (Network Controller)

- If the station has an antenna less than 1m in diameter, then DSSS (direct sequence spread spectrum) BPSK is transmitted if required to keep the EIRP density within FCC limits.

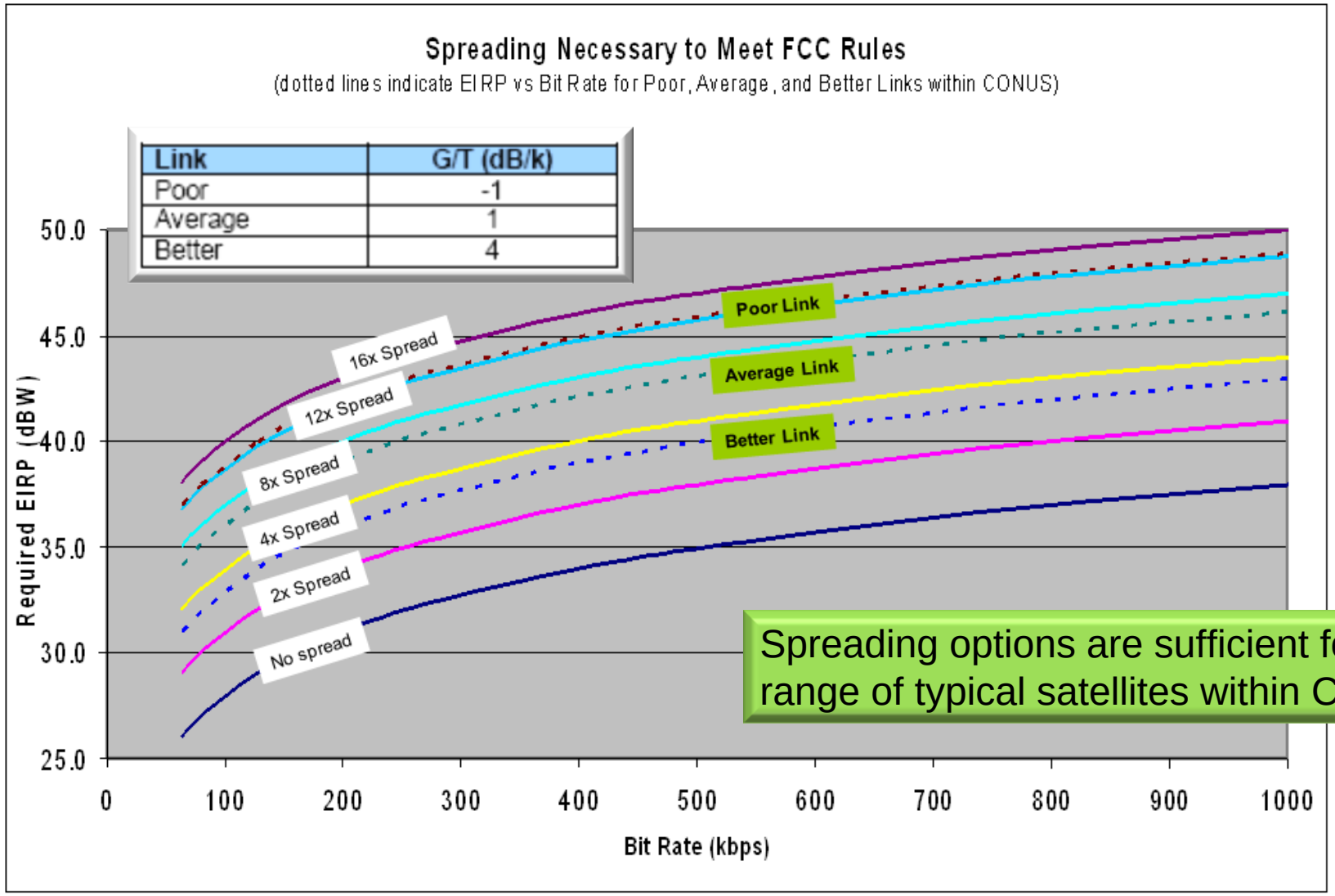
  - Typically DSSS BPSK, R ½ FEC will be utilized to ensure that the EIRP density meets FCC limits.

Carriers

Transmit Designator	Receive Designator	Emission	Emission BW (Hz)	Max. Allowed EIRP (dBW)	Bit Rate (BPSK)	Spreading
1T	1R	45K0G7D	45,000	20.7	32k	non-spread
2T	2R	717KG7D	717,000	32.7	32k	spread x16
3T	3R	1M43G7D	1,430,000	35.7	1024k	non-spread
not used	4R	22M9G7D	22,900,000	47.8	1024k	spread x16
5T	5R	11M5G7D	11,500,000	44.8	512k	spread x16

With the exception of the initial contention access channel (CROW), all carriers have unique (non-overlapping) time and frequency assignments. CDMA factors (10 LOG(N)) are not applicable to this system.

Spectral Spreading



Spreading options are sufficient for a range of typical satellites within CONUS

Power, Frequency, Timing Control

- Modems and frequency converters are phase locked to an accurate and stable 10 MHz reference
- If any converters loose lock, then their transmitter is muted
- HUB/Network Controller monitors and adjusts terminal power, frequency and timing accuracy

Contention Channel

- Contention Return Orderwire (CROW)
  - CROW time slots are identified by the Network Controller (NC) in the Forward Orderwire
  - CROW slots are only used by Network Members (NMs) for
    - initial network login
    - re-login following loss of downlink acquisition
  - NC assigns all subsequent Assigned ROW slots (AROWs) solely to each NM

- CROW Multiple Access
  - Transmission by multiple terminals within the same CROW time slot is minimized
  - Worst-case scenario occurs if the network is initially established with all NMs in listening mode followed by activation of the NC. In this scenario, multiple NMs may acquire the FOW Bulletin Board message at the same time and therefore attempt initial login in the same frame.
    - A similar scenario may occur if a catastrophic NC failure occurs without a graceful handover of network control

Contention Channel - Continued

- CROW Multiple Access - Continued
  - Network Planning is used to minimize the total transmit power spectral density in CROW time slots when multiple nodes contend during the same frame
    - A variable number of CROW time slots (0-7) can be configured per frame by the network planner
    - A variable CROW spread factor (x1 to x16) can be configured by the network planner (i.e. additional spreading beyond what it required for the small aperture nodes can be applied to accommodate the additive power caused by multiple node transmissions)

Contention Channel - Continued

- CROW Multiple Access - Continued
  - For initial login attempt, network members randomly select from the available CROW slots which produces a uniform distribution of contending terminals across the available number of slots
  - Following an initial login failure (eg. caused by collisions), terminals employ a random back-off algorithm to select subsequent frame for transmission
    - Maximum back-off frame count is initialized by the NC to 31 frames and is adjusted based on CROW arrival rate
  - collision event is **limited to**
    - **approximately 10% of a frame (a frame is 400mS) or 10 mS** since collision is detected and all stations attempt re-try at random time interval
    - Unusual occurrences of multiple logins due to network startup or failure

Topics

- Introduction
- Filing Objectives
- Public Notice Comments
- Technical Briefing
- Conclusions

Conclusions

- We respectfully request that the FCC grant a license for a single earth station.
- Recommendations or Actions