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November 14, 2006 ***Ex Parte Notice***

Marlene H. Dortch
Office of the Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: In the Matter of Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum in the Ku- and Extended Ku-Bands to the Vehicle Mounted Earth Station Satellite Service ("VMES") on a Shared Primary Basis and to Adopt Licensing and Service Rules for VMES Operations in the Ku- and Extended Ku-Bands, RM-11336

Dear Ms. Dortch:

On November 13, 2006, Tim Shroyer, Chief Technical Officer, General Dynamics C4 Systems, along with Jennifer McCarthy and the undersigned, counsel for General Dynamics Corporation (collectively, "General Dynamics"), met with John Giusti, Jim Ball, Kate Collins, Howard Griboff, Francis Gutierrez, Scott Kotler, and Paul Locke. Following this meeting, General Dynamics met with Lisa Cacciatore, Ron Chase, Kate Collins, Howard Griboff, Scott Kotler, Paul Locke, John Martin, James Miller, and Salomon Satche. During both meetings, the parties discussed the factual and legal issues, as well as the various technical parameters, described in the above-captioned Petition for Rulemaking filed by General Dynamics on May 24, 2006. Attached hereto are the presentations that were either distributed during the meetings or used to facilitate the discussions.

Should you have any questions regarding this matter, please do not hesitate to contact the undersigned.

Respectfully submitted,

/s/

McLean Sieverding
Counsel for General Dynamics Corporation

cc: John Giusti;
Jim Ball;
Lisa Cacciatore;
Ron Chase;
Kate Collins;
Howard Griboff;
Francis Gutierrez;
Scott Kotler;
Paul Locke;
John Martin;
James Miller; and
Salomon Satche

General Dynamics

VMES Petition for Rulemaking (RM-11336)

Filed May 24, 2006

Satcom-on-the-Move ™

- Satcom-on-the-Move (SOTM) is a system that mounts sub-meter antennas directly on combat vehicles
- Enables high-bandwidth voice, video, and data communications over satellite while the combat vehicle moves over rough terrain
- Provides crucial situational awareness to battlefield commanders maneuvering in combat conditions
  - Saves lives through real-time troop location capabilities

Temporary Authorizations

- General Dynamics has successfully operated SOTM pursuant to experimental and special temporary authority since 11/24/04
  - 11/24/04: Initial STA effective
  - 05/31/05: Experimental authority effective
  - 06/15/05: Experimental authority expanded to include additional remote location
  - 07/25/05: Experimental authority expanded to permit operations via additional satellites from all CONUS locations
  - 11/21/05: Experimental authority expanded to permit additional hubs and varying antenna sizes
- Experimental authorization expires 06/01/07

Toward Regular Licensing for Vehicle Mounted Earth Station (VMES) Operations

- 05/24/06: VMES Petition for Rulemaking filed
  - 05/31/06: Met with Commissioners' Legal Advisors and the International Bureau Front Office to discuss the Petition
  - 06/28/06: Met with the Office of Engineering and Technology to discuss key issues and concerns regarding VMES operations
- 07/20/06: Petition placed on Public Notice
- 08/21/06: Comments
- 09/05/06: Reply Comments

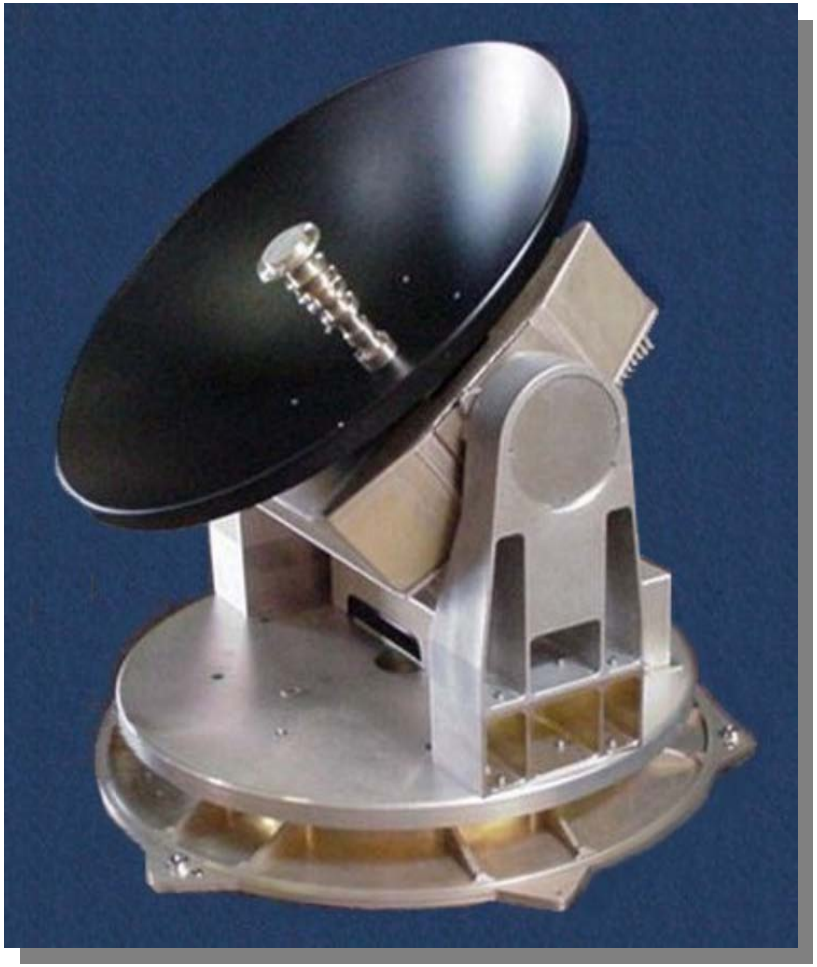
Broad Industry Consensus

- Commenters recognize that regularized licensing for VMES operations is necessary and would advance important U.S. interests
  - U.S. Military Needs: Required to meet the growing needs for extensive field testing and training with the VMES systems and technologies currently being utilized by the U.S. Military (domestically and abroad):
    - U.S. Army's Warfighter Information Network – Tactical (WIN-T) architecture
    - U.S. Marine Corps' Command and Control On-The-Move Network Digital Over-The-Horizon Relay (CONDOR)
  - Emergency Preparedness and First Responders: Required to enhance the capabilities of emergency response teams during natural disasters and other critical times of need
- Parties agree that the ESV Rules are the logical framework to apply

No Reason to Delay Regularized Licensing for VMES Operations

- ESV Rules: The Commission recently concluded a comprehensive study regarding mobile satellite operations in the Ku-band in the ESV proceeding
- The carefully prescribed ESV requirements ensure that existing operators in the band are adequately protected from harmful interference
- General Dynamics has proven, without question, that it can meet the operating Rules recently established in Part 25 governing ESVs for a slightly different class of earth station

The Commission Should Act Expeditiously on this Important Priority



Urgent Military Need

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Proven Operating Framework

Notice of Proposed Rulemaking

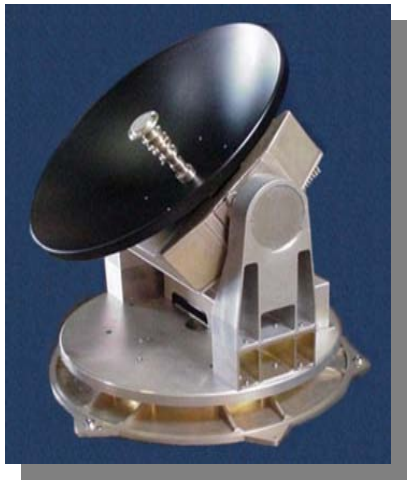
"Innovate…Integrate…Interoperate"

- "Terminals are smaller and easier to use; Data rates are higher; and Coverage areas are more dynamically defined. I encourage you to continue these efforts to innovate, to integrate, to interoperate -- and to rethink the ways that this unique sector can remain relevant, reliable, and innovative. For our part at the FCC, my colleagues and I are doing all that we can to help in meeting this challenge: I believe that it is the Commission's responsibility to ensure technological and competitive neutrality in competitive communications markets, including the satellite communications markets."
  - Remarks of FCC Chairman Kevin J. Martin to the Satellite Industry Association's Satellite Leadership Dinner (February 6, 2006)

GENERAL DYNAMICS

C4 Systems

Satcom-On-The-Move$_{TM}$ FCC Licensing Status



November 14, 2006

Description of Licensing Approach

General Dynamics Currently Operates Licensed SOTM$_{TM}$ Terminals

- Special Temporary Authorization Initially
- Experimental License Granted 21 Nov 2005
- Current License Has No Antenna Aperture Restrictions (Can Be Any Size)!

Government Users Desire Additional SOTM$_{TM}$ Antenna Types

- Smaller Apertures such as 20 and 18-Inch
- Even Smaller Apertures Are Desired By Users
- Larger Apertures such as 30-Inch Are Also Desired
- General Dynamics Is Producing Various Different Apertures

General Dynamics Understands the FCC's Licensing Constraints

- Combination of -14 dBW/4 kHz Input Power And Compliant Antenna Patterns With Tracking
  - This Approach Is Proven Effective for Earth Stations on Vessels
- This Approach Meets ITU Recommendations and Satellite Operator Requirements

General Dynamics Has Received a More Flexible SOTM$_{TM}$ License

- Precludes the Need for New Licenses For Every New Antenna Type
- Reduces Administrative Burden While Still Meeting Operational Requirements

Request for Specific Implementation

General Dynamics Complies With EIRP Density Requirements

- As Defined for Earth Stations on Vessels
- Including EIRP Density and Antenna Tracking Requirements

- EIRP Density Limits Are:

15 – 25log(θ) dBW/4kHz	for	$1.25° \leq \theta \leq 7.0°$
-6 dBW/4kHz	for	$7.0° < \theta \leq 9.2°$
18 – 25log(θ) dBW/4kHz	for	$9.2° < \theta \leq 48°$
-24 dBW/4kHz	for	$48° < \theta \leq 180°$

- Tracking Requirements Are:
  - Tracking Accuracy < 0.2 °
  - If Tracking Exceeds 0.5 °, Transmissions Cease
    - Until Tracking Error < 0.2°

General Dynamics Has Received A More General Authorization

- Specifically Without Antenna Aperture Limitation
- In All Cases, EIRP Density and Tracking Requirements Are Satisfied
- This Ensures Adjacent Satellite Interference Limits Are Always Observed

Explanation of Approach

Consider Representative SOTM$_{TM}$ Antenna Patterns

- Provided On The Following Slides, Isotropic Gain Is Illustrated
- Smaller Antennas Have Lower Gains and Wider 3dB Beamwidth
- FCC Regulation Curve from Section 25.209 Is Also Illustrated

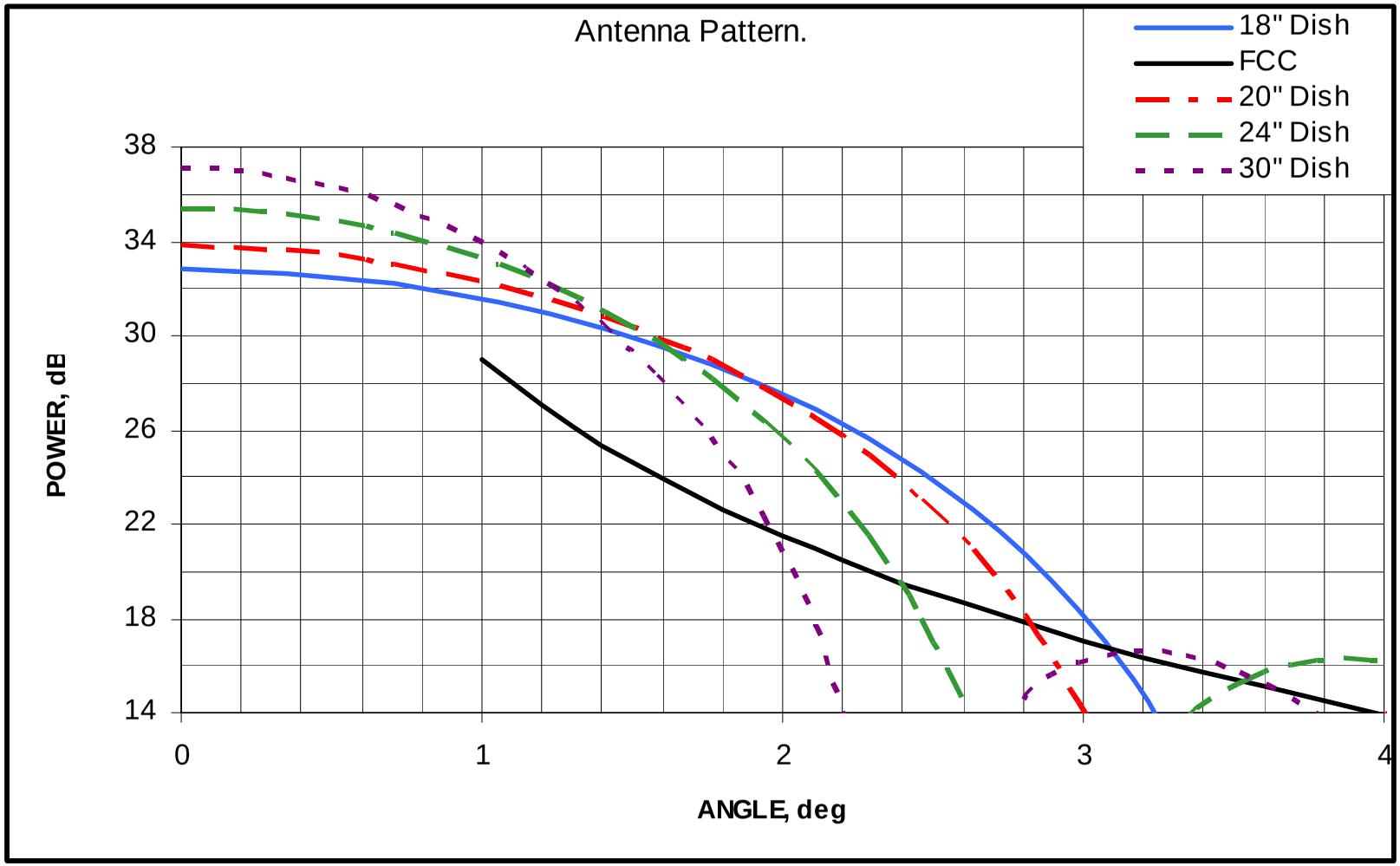
Input Power Density Is Reduced To Limit EIRP Density

- "Compliant" Antennas Routinely Licensed with – 14 dBW/4KHz Input Power Density
- Lower Input Power Densities Ensure Compliant EIRP Density, at All Angles
- Suitable Input Power Densities Include Antenna Pattern Excess of "Compliance" Plus Any Margin For Tracking Error
- EIRP Density Limits Are Achieved Through the Use Of Suitable Eb/No Modems
  - Can Include LDPC or Turbo-Code FEC, or Spread Spectrum In Extreme Cases

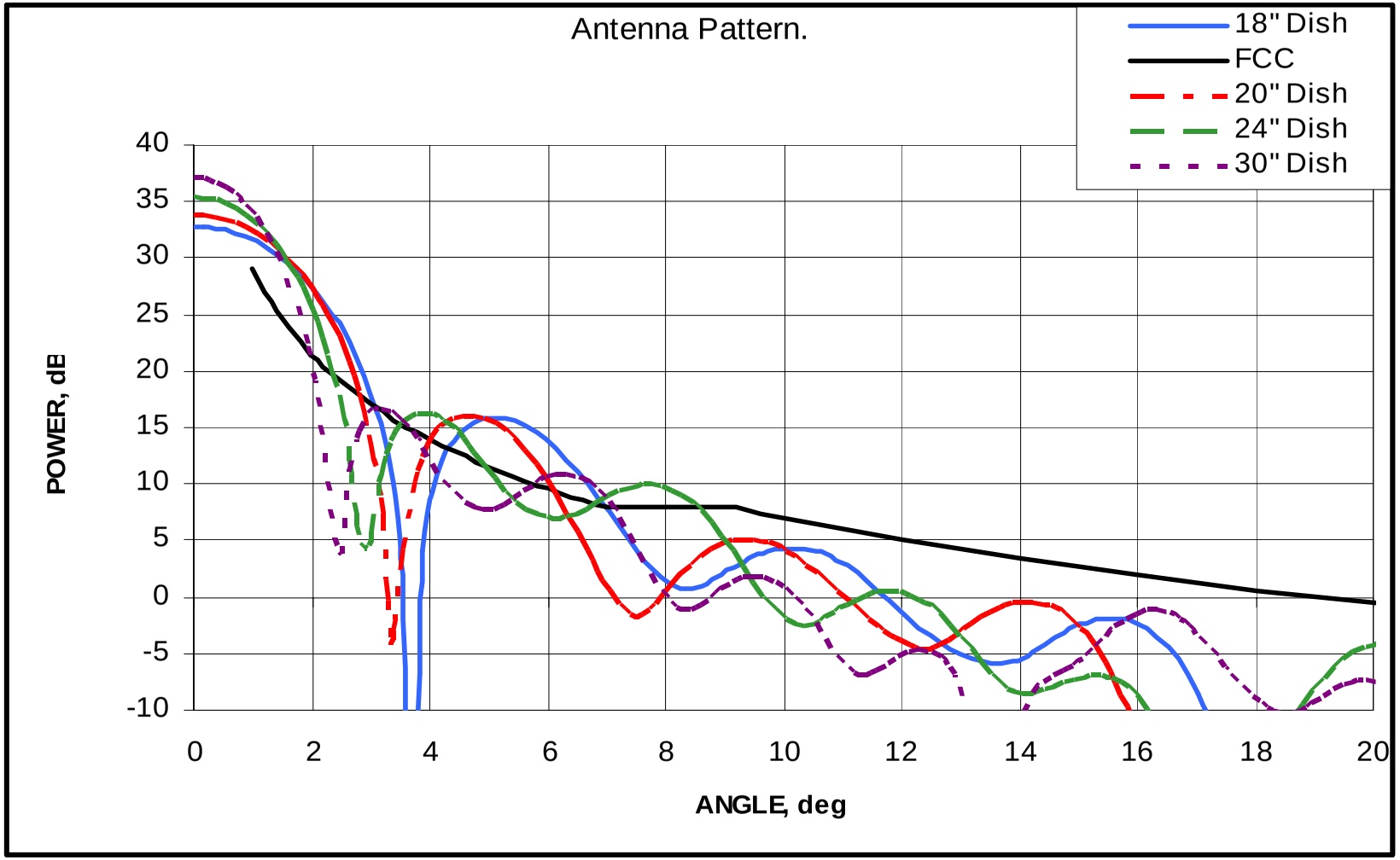
Representative EIRP Densities Are Illustrated on Following Slides

- EIRP Densities for 18, 20, 24, and 30-Inch Apertures Are Illustrated
- EIRP Density Limits For Earth Stations on Vessels Are Also Illustrated

SOTM Antenna Patterns – Close In



SOTM Antenna Patterns – Up to 20 Degrees



Proposed Compliance Approach

Input Power Density Is Reduced To Limit EIRP Density

- **In All Cases, EIRP Density Limits for Earth Stations On Vessels at Ku-Band Are Met**

EIRP Density Limits Are:

15 – 25log(θ) dBW/4kHz	for	$1.25° \leq \theta \leq 7.0°$
-6 dBW/4kHz	for	$7.0° < \theta \leq 9.2°$
18 – 25log(θ) dBW/4kHz	for	$9.2° < \theta \leq 48°$
-24 dBW/4kHz	for	$48° < \theta \leq 180°$

Tracking Requirements Are:

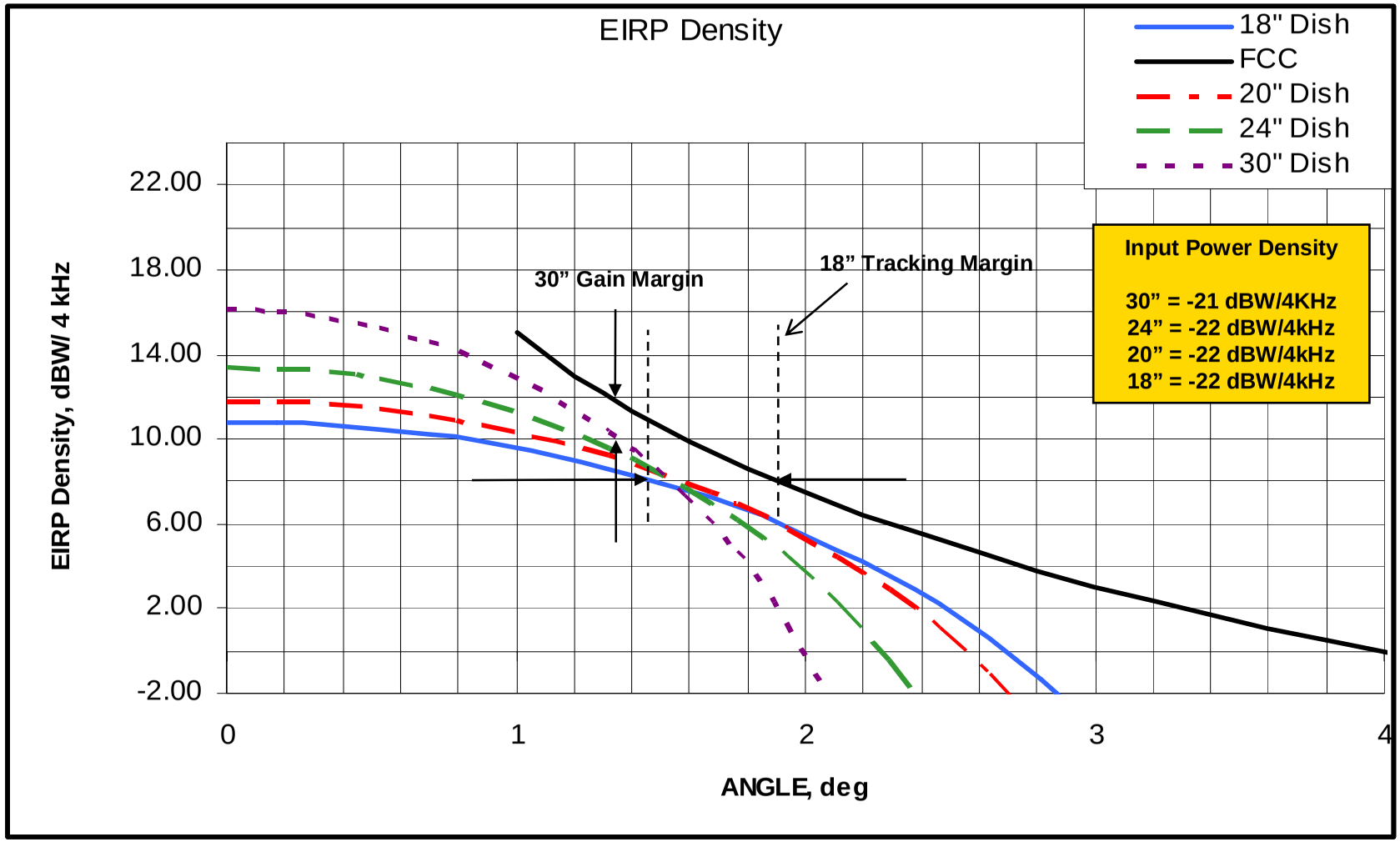
Tracking Accuracy < 0.2 °
If Tracking Exceeds 0.5 °, Transmissions Cease
Until Tracking Error < 0.2°

Specific Input Power Density Based On Antenna Gain Pattern

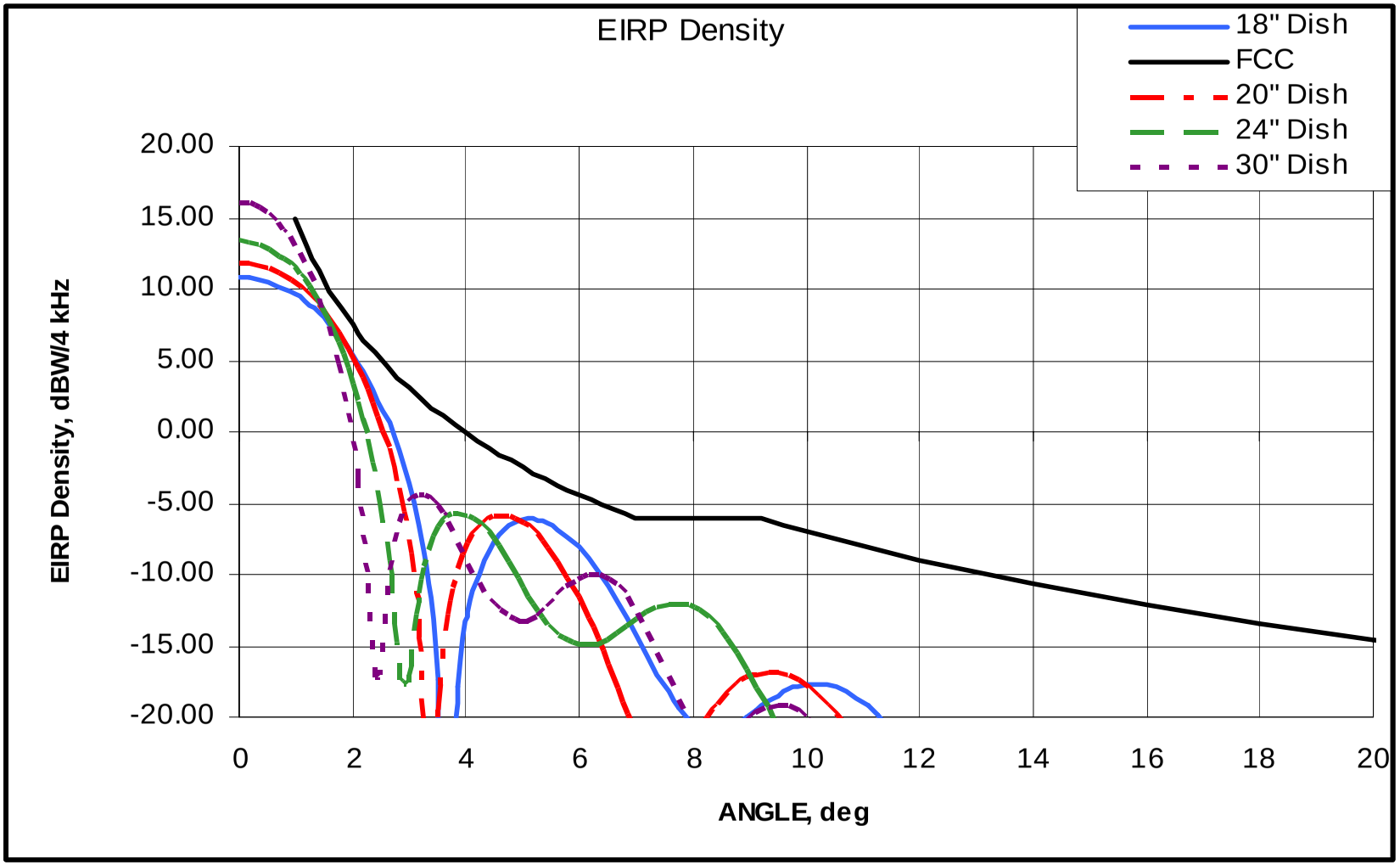
Resultant EIRP Densities Are Illustrated on Following Slides

- For 30-Inch Antenna – Input Power Density Limited to -21 dBW/4kHz
- For 24-Inch Antenna – Input Power Density Limited to -22 dBW/4kHz
- For 20-Inch Antenna – Input Power Density Limited to -22 dBW/4kHz
- For 18-Inch Antenna – Input Power Density Limited to -22 dBW/4kHz

Operating EIRP Density – Close In



Operating EIRP Density – Up to 20 Degrees



What Systems Make This Possible?

Spread Spectrum Modems Are Not Required!

- EIRP Density Is the Key Parameter, Achieved Through Signal Structure
- Modulation Types With Reasonable Eb/No Performance Are Fully Compliant
- Depends Upon Known Antenna Gain Performance and Known Tracking
- Link Analysis Has Been Done Using Various Modems and Satellites

CONUS Coverage FSS Ku-Band Satellites Are Compliant

- General Dynamics C4 Systems Is Currently Licensed for 7 Different Satellites
  - IA-5, IA-6, IA-6, IA-8, IS-707, Horizons 1, AMC-9
- In All Cases Within Beam, BPSK R-1/2 Turbo-Code Supports CONUS Operation
  - For 20-Inch Aperture Antennas and Larger

Operating Margin Is Limited But Available For Many Antennas

- In General, for Antennas 20-Inch in Size and Larger
- License Compliance Depends Upon Antenna Pattern, Tracking, and EIRP Density
- Small Apertures (less than 20-Inches) or Poor Tracking Must Generally Be Offset by Spread Spectrum or other EIRP Density Reduction Techniques

Flexibility Is Provided

- In General, Requirements Met With Antenna Tracking and “Good” FEC
  - EIRP Density On Orbital Arc Is the Limiting Factor Which Must Be Satisfied
  - Exceptionally Small Antennas Can Be Used, But May Require Spreading

Why Spread Spectrum Is Undesirable

Spread Spectrum Uses Significantly More Satellite Resources

- Spreading of 10 dB Uses 10 Times The Transponder Bandwidth!
  - 10 Times The Transponder Bandwidth Means 10 Times the Cost
- In Satellite Systems, Spread Spectrum Is Used Only to Limit EIRP Density
- Satellite Systems Do Not "Re-Use" Spectrum Efficiently
  - No Satellite Spread Spectrum System Can Overlay Very Many Carriers
  - All Systems Are Limited By Signal Cross-Correlation

Conventional FDMA/TDMA Modulation Is Preferable

- Significantly Greater Transponder Efficiency Is Provided
- Systems Can Be Interoperable With Currently Fielded Systems

Spread Spectrum Only Needed When Nothing Else Possible

- Current FCC Licensing Illustrates Spread Spectrum Not Required
  - For Antennas About 20-Inches and Larger
  - For All US Coverage FSS Ku-Band Satellite Transponders
- When Antenna Tracking Accuracy Is Not Good Enough To Meet EIRP Density

Systems Tested By General Dynamics C4 Systems

General Dynamics C4 Systems Is Testing Modem Systems

- Determining Current Modem System Performance As Well As Future Capabilities
- Tests Verify Compliance With FCC License Requirements
- Tests Include FDMA and TDMA Modem Systems

General Conclusions About FDMA Reached

- Low Eb/No FEC Coding Techniques Are Required
  - Latest Techniques, such as LDPC, provide Optimal Results
  - Good Turbo-Code FEC Provides Adequate Results, with Rate-1/2 or Better
- High Eb/No FEC Coding Requires Additional Measures
  - Spread Spectrum Required to Overcome High EIRP Density Requirements

Some TDMA Systems Are Compliant As Fielded

- TDMA Systems With “Good FEC” Meet EIRP Density Requirements
- For Example, Even DVB-RCS Systems Fully Meets EIRP Density Requirements
- DVB-S2 Standard Includes Even Better FEC Standards, Now Being Implemented
  - DVB-S2, As Endorsed by DISA, includes Adaptive LDPC Coding, Reducing Eb/No

Each System Must Be Separately Considered

- In General, “Good FEC” Precludes the Need for Spread Spectrum
  - Additional Testing Still Underway
  - Issues Like Frequency And Time Tracking Must Also Be Considered

Conclusion

Our Approach Meets FCC EIRP Regulatory Requirements By Limiting EIRP Density Toward Adjacent Satellites

- In All Cases, For All Modulation Types
- Depends Upon Known Antenna Gain Performance and Known Tracking

On-Axis EIRP Density Is Also Limited

- But Still Provides Useful Satellite Communications Link Performance

Operating Margin Is Provided

- For Antenna Gain Pattern Deviations
- For Antenna Tracking Accuracy Better Than 0.5 Degrees

Future System Enhancements Are Permitted

- Flexibly Supports Future Requirements
  - Improved Modem Waveform Performance
  - Various Generic Antenna Enhancements

This Approach Satisfies ITU Requirements

- FCC EIRP Density Limits are 14 dB More Stringent Than ITU Standards