
Satellite Industry Update New System and Regulatory Issues

Presented to
National Spectrum Management Association

Spectrum Management 2014

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Agenda

- Broadband and Mobility FSS Systems
- Spectrum Issues
- ITU and WRC-15 Preparations
- Other Issues

FSS Mobility and Broadband Services

- ESAA R&O and Reconsideration in Circulation
- ESV Coordination Continues but slowly
- VMES
- ESOMPS
- Update on Broadband Services

ESAA 2ND R&O and Reconsideration

- FCC IB Docket 12-376
 - Original R&O Adopted December 20, 2012
 - NPRM and R&O for Aeronautical Earth Station operating in GSO **FSS Ku-band**
- FCC Recently released Second Report and Order and Order on Reconsideration (Doc No. FCC 14-45)
- Adopted: April 17, 2014, Released: April 18, 2014
- Regulatory parity by adopting a primary allocation for ESAA in the 14.0-14.5 GHz band.
- In addition, ESV, and VMES are authorize operations on a primary basis for all these applications in the 11.7-12.2 GHz and 14.0-14.5 GHz bands.

ESAA 2ND R&O and Reconsideration

- Definition of ESAA Terminal (25.103 & 25.227):
 - Defines ESAA terminal as Earth stations operating aboard aircraft that receive from and transmit to geostationary-orbit Fixed-Satellite Service space stations in § 25.227 of this part.”
 - All ESAA terminals operated in U.S. airspace, whether on U.S.-registered civil aircraft or non-U.S.-registered civil aircraft, must be licensed by the Commission. All ESAA terminals on U.S.-registered civil aircraft operating outside of U.S. airspace must be licensed by the Commission.
- Cessation of Emissions (25.227(b)(3)(i)):
 - ESAA terminal is self-monitoring and capable of shutting itself off automatically within 100 milliseconds if it exceeds the off-axis EIRP-density
 - The ESAA System NMC shall be capable of controlling aggregate emissions and cease transmission
- Pointing Error (25.227(b)(1)(iii)(A)):
 - Added language that the pointing error is within three sigma (σ) from the mean value, i.e., that there is a 0.997 probability the antenna maintains a pointing error within 0.2σ

Earth Stations Onboard Vessels (ESV)

- FCC Adopted new Rule Parts
 - §25.221 - C-band
 - §25.222 - Ku-Band
- 2nd Order on Reconsideration
 - Adopted July 17, 2012
 - Off-Axis EIRP restriction, same as VMES restriction
 - Antenna Pointing Error, also same as VMES
 - Also allows ESV to file ALSAT at Ku-band
- C-band ESVs continue to be coordinated at C-band
 - There are approximately 8-10 FCC C-band ESV licensees
 - US Navy has also been identified as C-band ESV operator
 - To date only 2-3 Operators have pursued frequency coordination
 - Many ESV operators claim to shut down C-band or switch to Ku-band when approaching coordination zones

Vehicle Mounted Earth Station (VMES)

- FCC VMES IB Docket 07-101
 - Initially Released July 2009
- FCC Adopted new Rule Part
 - §25.226 – **Ku-Band only**
 - Data Logging Required
 - Pointing Accuracy requirements modified slightly. Licensee must specify worst case non-interfering pointing accuracy
 - Coordination with NTIA NASA TDRSS and Radio Astronomy required
- VMES Order on Reconsideration Existing Issues
 - IB Docket 07-101, adopted January 4, 2013
 - Restricts aggregate off-axis EIRP to 1 dB below FCC limit
 - Antenna pointing error requirements, essentially unchanged
 - Human Exposure to Radiofrequency Radiation, requirement for cessation of emissions upon loss of signal
 - Allows for ALSAT licensing

Earth Stations on Mobile Platforms (ESOMPS)

- Developed by CEPT ECC, ECC Decision 13(AA)
- Deployment of mobile earth stations operating at Ka-band
 - 27.5-30.5 GHz transmit
 - 17.3-20.2 GHz receive
- Includes Ships, Land Vehicles, and Aircraft mounted earth stations
- Classified as Fixed Satellite Services
- Harmonizes the use of the band to allow free circulation and exemption from individual licensing while ensuring no harmful interference
- Possible template for how FCC will address mobility in the Ka-band
- In January, 2014, UK OFCOM has approved use of ESOMPS and is accepting applications

Updates on Broadband Ka-Band Systems

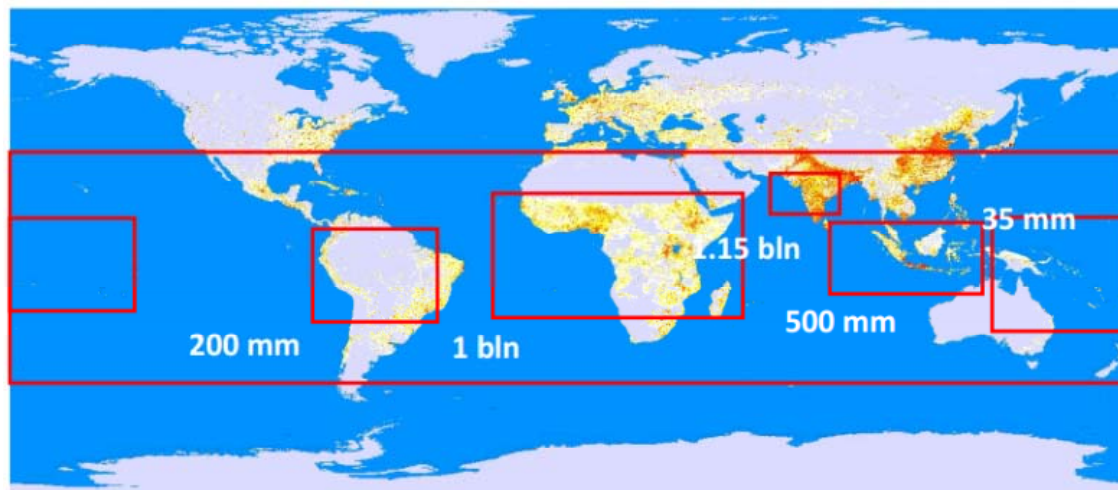
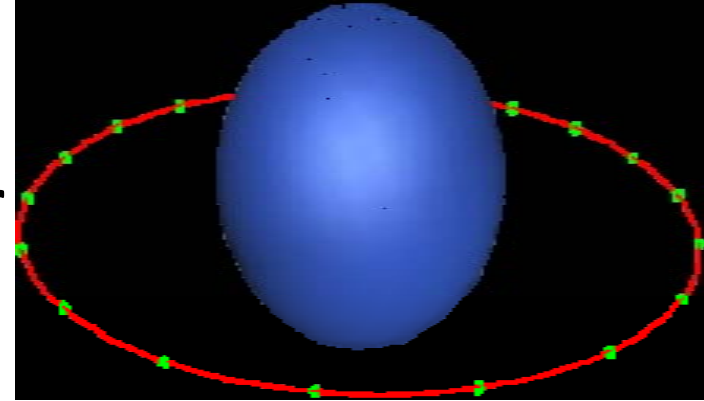
- ViaSat Exede
- Intelsat EPIC
- O3B
- Hughes Jupiter
- Inmarsat Global Express

ViaSat-1 Exede

- Exede Internet service from ViaSat, introduced Jan 2012 using ViaSat-1
- Located at 115.1° W.L.
- 72 Ka-band Spot Beams, 63 in U.S. and 9 in Canada
- In May, 2014 ViaSat launched their Business version of Exede 15 Mbps up/down
- Residential services offer 12 Mbps down, 3 Mbps up
- Data caps exist but there are late night free zones (LNFZ)
- Next generation ViaSat-2 is in design review, to be launched mid-2016

03b Networks, Ltd.

- Serving the Other 3 Billion People in emerging and less developed economies
- MEO constellation 8000km
- Coverage +/- 45 degrees of equator
- Ka-band Steerable Spot Beams
- Services
 - Expand cellular backhaul
 - Provide broadband IP connectivity

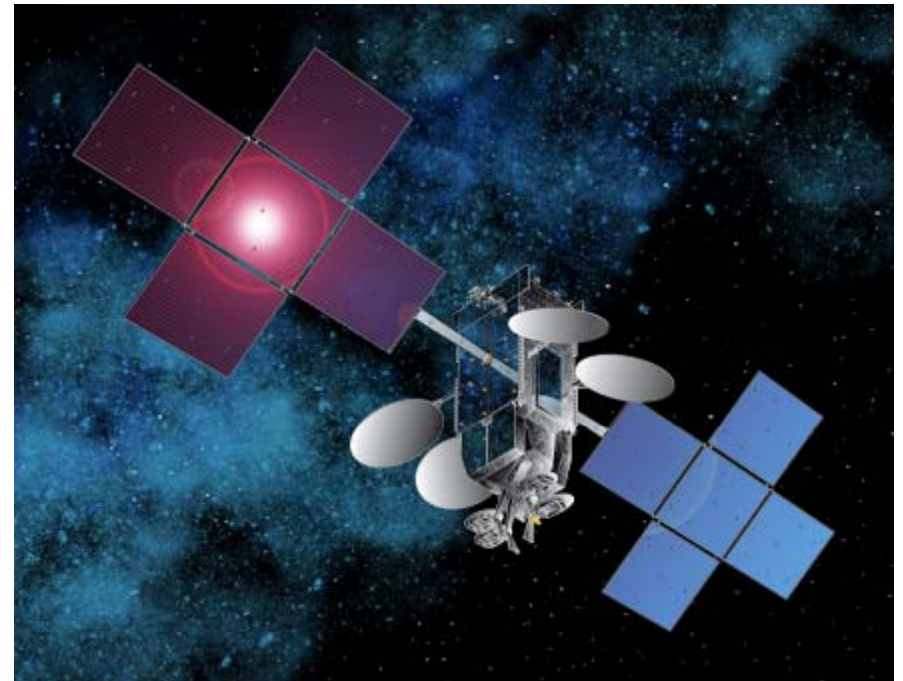


03b Networks, Ltd

- Launched first four satellites in June, 2013
- Launching additional four in June, 2014
- Final design calls for 16 satellites
- Viasat is manufacturing and delivering the gateway and larger customer equipment, 7.3m and 4.5m antennas respectively
- For our smaller customer antennas , 1.8m and 2.4m, General Dynamics systems will be used with a range of modems and hub management systems from Comtech, ViaSat and Gilat.
- Initial testing for high throughput and low latency is occurring

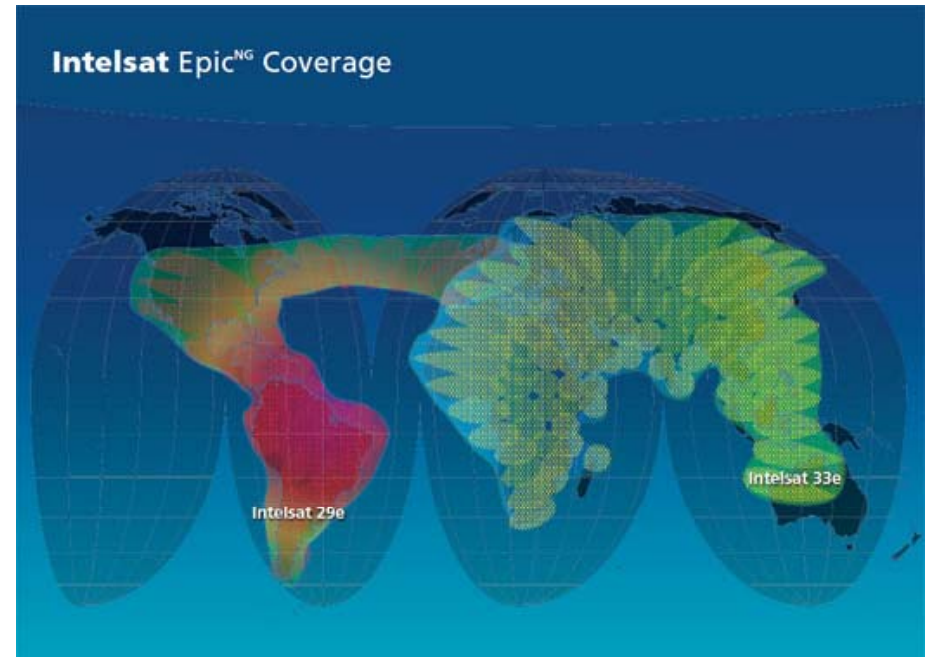
Hughes Jupiter 1

- EchoStar XVII, also known as Jupiter 1, is operated by Hughes Network Systems
- Launched in July 2012
- GEO Slot at 107.1° W.L.
- JUPITER will provide over 100 Gbps capacity at Ka-band using 60 spot beams
- Bent pipe architecture
- Jupiter 2 being built by SSL , 150 Gb capacity, 120 spot beam, launch mid-2016



Intelsat Epic^{NG}

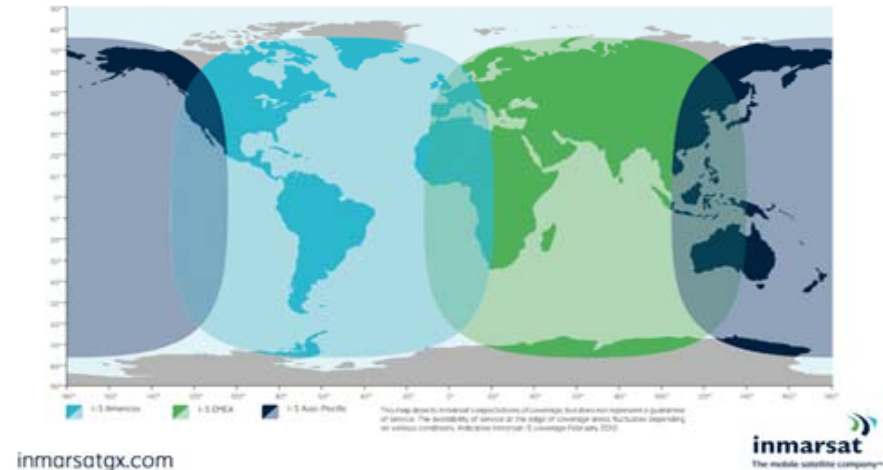
- The Intelsat Epic^{NG} platform utilizes C, Ku, and Ka-bands
- Two Intelsat Epic^{NG}-class satellites with expected in-service dates in 2015 and 2016
 - IS 29e serves the Americas and North Atlantic
 - IS33e in 2016 along with three more satellites to follow, total of 5 satellites
- Fully integrated with the Intelsat satellite and terrestrial infrastructure
- Expected throughput in the range of 25-60 Gbps
- Provides connectivity among multiple spot beams, including star and mesh, as well as loopback within the same user beam
- Open network allows for backward compatibility with existing networks



Inmarsat Global Xpress

- Worldwide wireless broadband network by Inmarsat
- Constellation of three Inmarsat-5 satellites
- 1st Satellite located at 62.7 EL, operational by July 2014
- 2 more satellites to launch in 2014, full constellation in 2015
- Offers high-speed inflight broadband services
- 89 small Ka-band beams capable of 60 Mbits/s download to 60 cm dish
- 6 steerable beams
- GX and VSAT Services
 - Download data rates of up to 50 Mbit/s

Indicative Inmarsat-5 coverage



Spectrum/Regulatory Issues

- FNPRM on Small Cell 3.5 GHz
- 2 GHz MSS NPRM/NOI – Globalstar
- NPRM on US Government Earth Station and Launch Spectrum
- 5 GHz – UNII Changes
- NPRM on 14 GHz ATG

FNPRM Small Cell 3.5 GHz

- **FCC GN Docket 12-354**
 - Released 4/23/2014
 - Comment 40 days from publication in FR
 - Reply Comments 60 days from FR
- **Proposes specific rules for Citizens Broadband Radio Service at 3.5 GHz (3550-3650 MHz)**
 - Promotes use of small cell technology
 - Promotes use of agile spectrum sharing technologies
- **SIA and other satellite users concerned about the proliferation of devices in adjacent band**

2 GHz MSS NPRM/NOI – Globalstar

- IB Docket No. 13-213, RM-11685, Released 11/1/2013
- Globalstar's petition for modified use of ATC in the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks;
- Low-power ATC in licensed spectrum at 2483.5-2495 MHz
- Use of adjacent 2473-2483.5 MHz band using technical rules for unlicensed operations in that band
- IEEE 802.11 standard Channel 14 (2474-2495 MHz (not allowed in US))
- Interference into existing BAS/BRS licensees, and unlicensed WiFi and Bluetooth users

Regulatory Parity

- NPRM on US Government Earth Station and Launch Spectrum
- FCC Newly released NPRM and NOI
 - ET Docket No. 13-115 , RM-11341, Released: May 9, 2013
- NPRM Seeks Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations
- NTIA requests that Federal Earth Stations it authorizes be allowed the same regulatory status as non-Federal earth stations in the same frequency bands (see following slides)

Regulatory Parity

- NPRM has Four Key Objectives:
 - Parity between Federal and non-Federal earth stations
 - FCC maintains oversight of the FSS
 - Ensure any new rules would not hinder or delay licensing and coordination
 - Establish procedures that ensure Federal and non-Federal earth station comply with FCC rules
- Frequency coordination issues are of concern

Regulatory Parity

Table 1: NTIA Requests Primary Status in 13.275 MHz of Non-Federal Spectrum			
Common Name	Frequency Band	Amount of Spectrum	Directional Indicator
C-band	3600-4200 MHz	600 MHz	space-to-Earth
	5850-6725 MHz	875 MHz	Earth-to-space
Ku-band	10.7-12.2 GHz	1,500 MHz	space-to-Earth
	12.7-13.25 GHz	550 MHz	Earth-to-space
	13.75-14.5 GHz	750 MHz	Earth-to-space
Ka-band	18.3-19.3 GHz	1,000 MHz	space-to-Earth
	19.7-20.2 GHz	500 MHz	space-to-Earth
	27.5-30.0 GHz	2,500 MHz	Earth-to-space
V-band	37.5-39.5 GHz	2,000 MHz	space-to-Earth
	47.2-50.2 GHz	3,000 MHz	Earth-to-space

5 GHz WiFi NPRM

- FCC NPRM allowing use of unlicensed WiFi devices at 5 GHz, 5.15-5.35 & 5.47-5.85 GHz
- In the Matter of Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band
 - ET Docket No. 13-49
 - Adopted: February 20, 2013, Released: February 20, 2013
- First Report and Order released April 1, 2014
- One of the items has expanded the limit of upper band to 5.85 GHz
- Satellite users have interference concerns regarding interference at 5.9 GHz

Qualcomm ATG – FCC NPRM

- Qualcomm proposes Air-Ground communications service on secondary basis in 14.0-14.5 GHz Band.
- Qualcomm Filed RM-11640
- FCC Releases NPRM on May 9, 2013
 - GN Docket 13-114
 - Adopted May 9, 2013
- Operation would be on secondary basis in 14 GHz band
- Coordination requirements similar to VMES, ESV, AESS
- Interference Issues mitigated using spatial diversity
 - Base Station pointed to the north
 - Aircraft stations oriented below the horizon of aircraft
 - Qualcomm provided analysis of non-interference operation with NGSO systems

ITU-R WRC-15 Preparation – IMT Spectrum Needs

- Leading up to the ITU WRC-15, the International Mobile Telecommunications industry is lobbying regulators to identify the C-band frequency band (3.4 – 4.2 GHz receive/downlink and 5.8-6.7 GHz transmit/uplink) for IMT services.
- ITU Study Group 5 has released Report ITU-R M.2290 detailing IMT spectrum requirements estimate.
- The ITU Report identified, by Radio Access Technique Groups (RATGs), the spectrum requirements as shown below:

Table 1 – Total spectrum requirements for both RATG 1 and RATG 2 in the year 2020

	Total spectrum requirements for RATG 1	Total spectrum requirements for RATG 2	Total spectrum requirements RATGs 1 and 2
Lower user density settings	440 MHz	900 MHz	1 340 MHz
Higher user density settings	540 MHz	1 420 MHz	1 960 MHz

ITU-R and WRC-15 Preparations

- Satellite Industry concerned with the potential for increased and excessive interference
- C-band satellite service providers are attempting to have their issues/concerns known and addressed
- February 13, 2014 some FSS Satellite service providers generated a report which reviewed the spectrum requirements for IMT
- Dispute over assumptions and traffic forecasts used in the ITU-R M.2290 report
- SG 5 asserts some traffic forecasts are as much as two orders of magnitude (>100) too high due unrealistic user density and amount of traffic per user
- Proposes JTG 4-5-6-7 experts review their findings and SG 5 report

Other

- In-Flight Mobile NPRM
- AT&T to Offer In-Flight Services

In-Flight Mobile NPRM

- FCC Considering NPRM to lift ban on in-flight GSM services
- WT Docket No. 13-301, Adopted 12/12/13
- Allow use of mobile wireless devices in-flight for email, texts, Internet use and voice services
- Harmonize regulations for operation of devices on airborne aircraft for all commercial mobile spectrum bands
- Authority to provide mobile communications services on airborne aircraft across to existing Part 87 aircraft licenses;
- Allow only if managed by an Airborne Access System certified by the Federal Aviation Administration
- Limit authorization aircraft at least 10,000 feet AGL

In-Flight Mobile NPRM

- Comments on impact of the proposal on public safety and national security, and issues related to the use of voice services onboard aircraft.
- If the Commission adopts the new rules, it will be the airlines' decision whether to permit the use of data, text and/or voice services while airborne.
- Bills have been introduced in both the House and Senate that would limit the use of voice services on flights.

Recent AT&T Announcement of ATG System

- AT&T to Offer In-Flight Wi-Fi using ATG
- With Honeywell International Inc., AT&T could begin offering the service in the continental U.S. as soon as late 2015
- Plan would be to use Wireless Communications Service at 2.3 GHz using 4G LTE Technology, adjacent to DARS bands
- AT&T has access to 5 MHz in each direction
- Getting full CONUS access for their towers is required.
- Plans for use of MSS satellite technologies, Inmarsat Global Express, for coverage filler and international flights
- Service would compete with Gogo service which uses a combination of ATG and FSS Satellite technologies

Conclusions

- FSS Broadband and Mobility continue to expand and are a primary focus of commercial satellite industry regulatory and technological developments
- Satellite industry is concerned about C-band, and other bands, spectrum access
 - 3.5 GHz Small Cells
 - IMT Requirements,
 - 5 GHz WiFi
 - Regulatory Parity issues