Satellite Industry Update
New Systems and Regulatory Issues

Presented to
National Spectrum Management Association

Spectrum Management 2013

Presented by
Ken Ryan, Skjei Telecom
May 14, 2013

Skjei TELECOM

Agenda

- Update on Some Existing Systems
- Broadband FSS Systems
- FSS Mobility
- Regulatory Update

Skjei TELECOM

Update on Some Existing Systems

- DARS
- LightSquared
- Big LEOS
- Little LEOS

Skjei TELECOM

DARS

- SiriusXM merger of Sirius Satellite and XM Radio completed in July 2008
- Services now operate over 2320-2345 MHz band
- Satellite Fleet:
  - Sirius originally employed a three (3) satellite HEO constellation
  - XM utilized GEO satellite operating at orbital slots 85° and 115° W.L.
  - Sirius migrating to all GEOs and will retire the HEOs within 2 years time, est.
- Currently there are nine Sirius XM satellites in orbit:
  - XM Band XM1 though XM5 (one is retired),
  - Sirius HIEO S1 through S3, and
  - Sirius Band GEO FM5. FM6 is awaiting launch
- SiriusXM in process of integrating technologies at their terrestrial repeater sites

Skjei TELECOM

Lightsquared – Brief Recap

- Lightsquared predecessor companies begin development of an ATC to combat urban canyon effects and improve performance
- Circa 2004 FCC essentially approved the ATC plan
- 2005 FCC even lessened restrictions on ATC buildout requirements
- 2009 GPS community voiced concerns over interference
- In 2011 various technical analyses indicate harmful interference may indeed occur
- February 2012 FCC withdraws approval of ATC plan
- Fall 2012 Lightsquared files new frequency plan

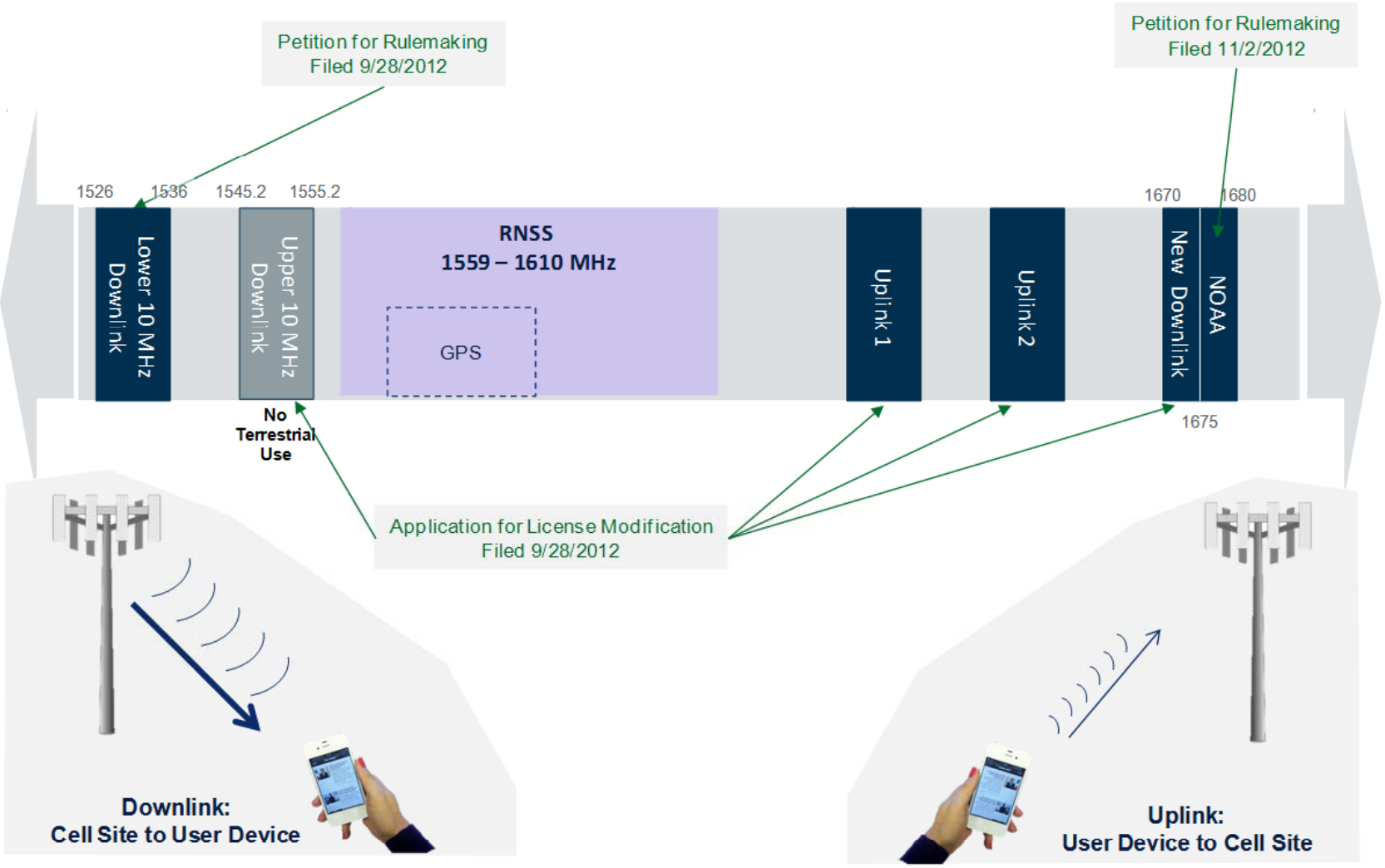
Skjei TELECOM

Lightsquared - Regulatory Status of New Plan

- LightSquared submitted 3 filings to FCC in late 2012 to begin process of modifying its terrestrial authorization
  - Application for License Modification to allow use of 1670-1680 with L-band uplinks, replacing L-band downlinks in upper 10 MHz
  - Petition for Rulemaking to add terrestrial service allocation to 1675-1680
  - Petition for Rulemaking to reexamine service rules for L-band downlinks in lower 10 MHz
- LightSquared's plan was placed on public notice by the FCC, with public comments received through early-January 2013
- In December 2012, the FCC confirmed that LightSquared's terrestrial buildout milestones were no longer applicable while the issues surrounding GPS were still pending
- On April 29, the FCC granted LightSquared temporary authority necessary to begin feasibility assessment of critical elements of its proposed solution, working with NOAA
  - Similar to sharing studies being conducted by Verizon and T-Mobile with DoD

Skjei TELECOM

Lightsquared



Big LEOS & Little LEOS

- Orbcomm
  - Continues to offer M2M global asset monitoring and messaging services from constellation of 29 LEO satellites
  - Recently, Oct. 7, 2012, the first SpaceX Falcon 9 launch of a prototype OG2 ORBCOMM satellite from Cape Canaveral failed to achieve proper orbit
- Big LEOs – Iridium
  - Sept 2009 Iridium Satellite LLC merged with a special purpose acquisition company
  - System extensively used by the DOD
- Big LEOs – Globalstar
  - In 2007 Globalstar launched eight additional first-generation spare satellites into space
  - Between 2010 and 2013, Globalstar launched 24 second-generation satellites in an effort to restore their system to full service
  - Plans for ATC component

Skjei TELECOM

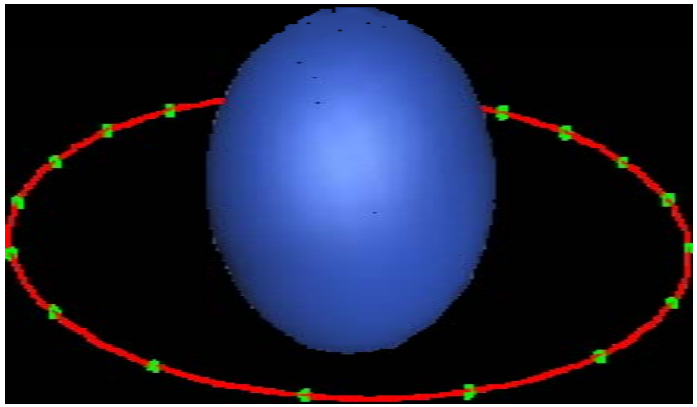
Broadband FSS Systems

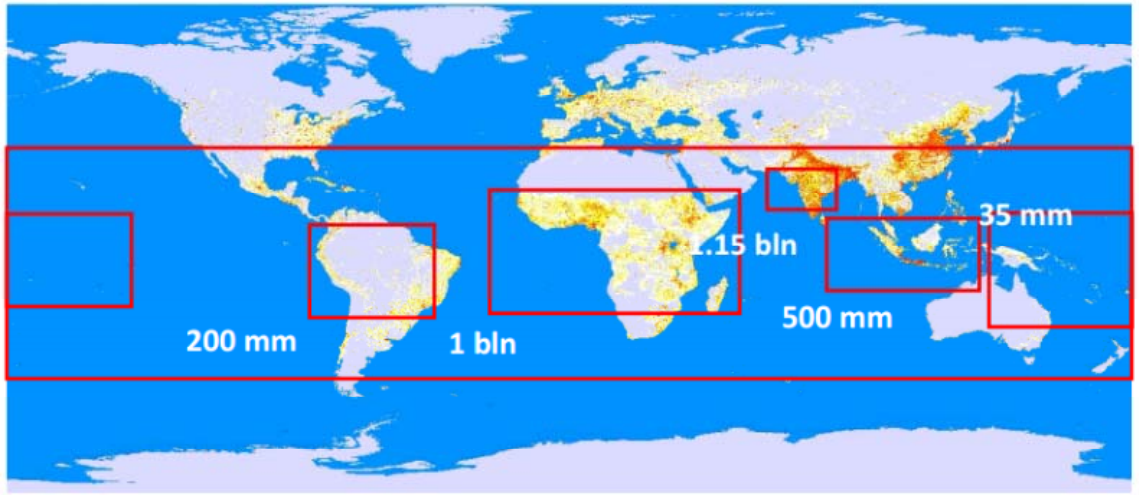
- O3b Networks
- ViaSat – Exede
- Intelsat EPIC
- Hughes - Jupiter
- Inmarsat – Global Xpress

Skjei TELECOM

O3b Networks, Ltd.

- **Serving Other 3 Billion People in emerging and less developed economies**
- **MEO constellation**
- **Bent-pipe**
  - No on-board processing or crosslinks
- **Services**
  - Expand cellular backhaul
  - Provide broadband IP connectivity





Skjei TELECOM

O3b Networks, Ltd

- Launching June 24, 2013
- Backed by SES World Skies, Google, HSBC, Liberty Global, Allen and Company, Northbridge Venture Partners
- The initial launch of O3b includes eight satellites
  - Four ready to be launch as soon as this June, with second four in September
  - 16 additional satellite to be launch within 18 months of initial launch
- MEO orbit at 8000 km
- The coverage zone is between +/- 45 degrees of equator

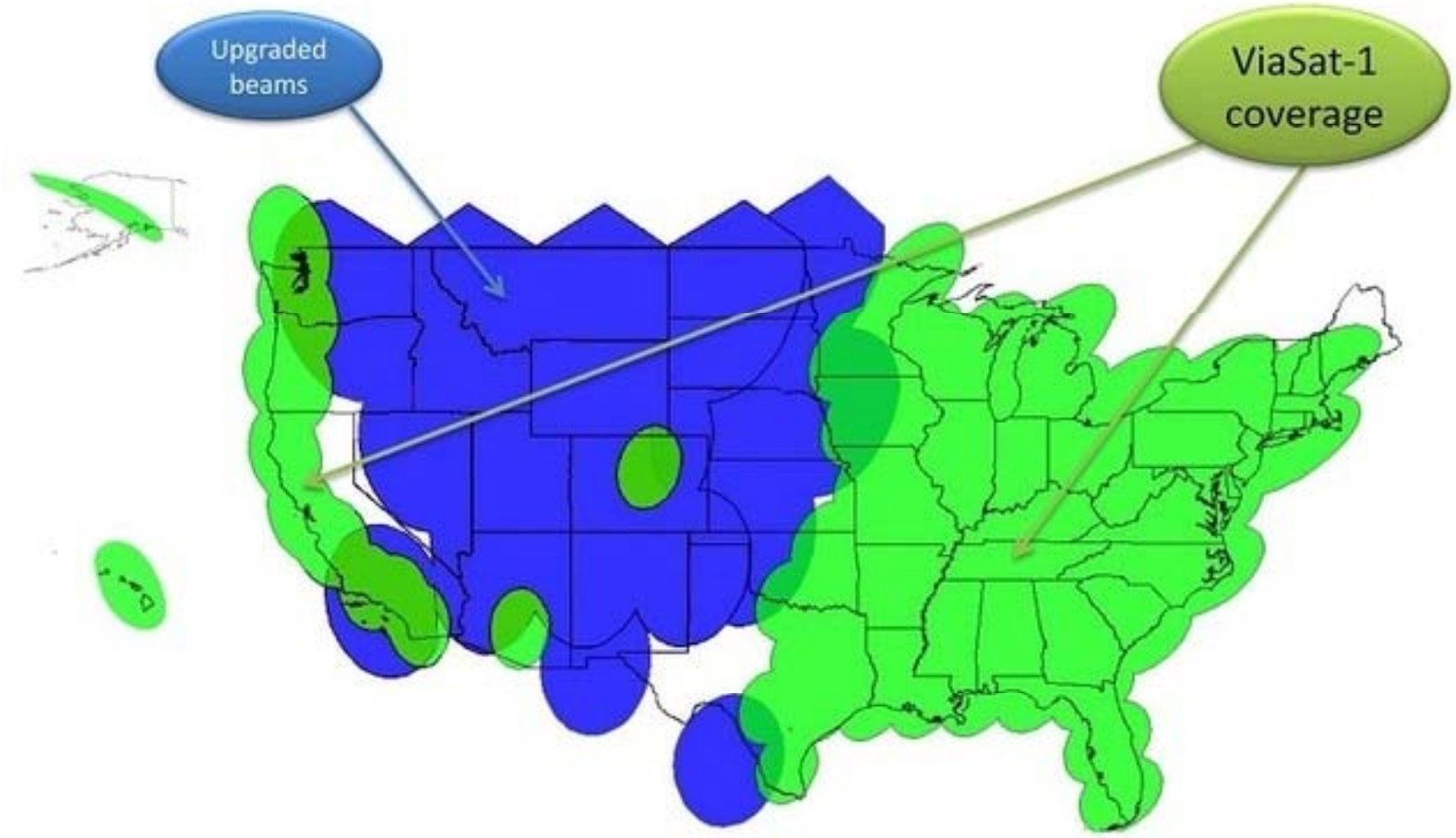
Skjei TELECOM

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
- ViaSat is launching in-flight connectivity on JetBlue this year, delivering more than 12 Mbps to the passenger.

Skjei TELECOM

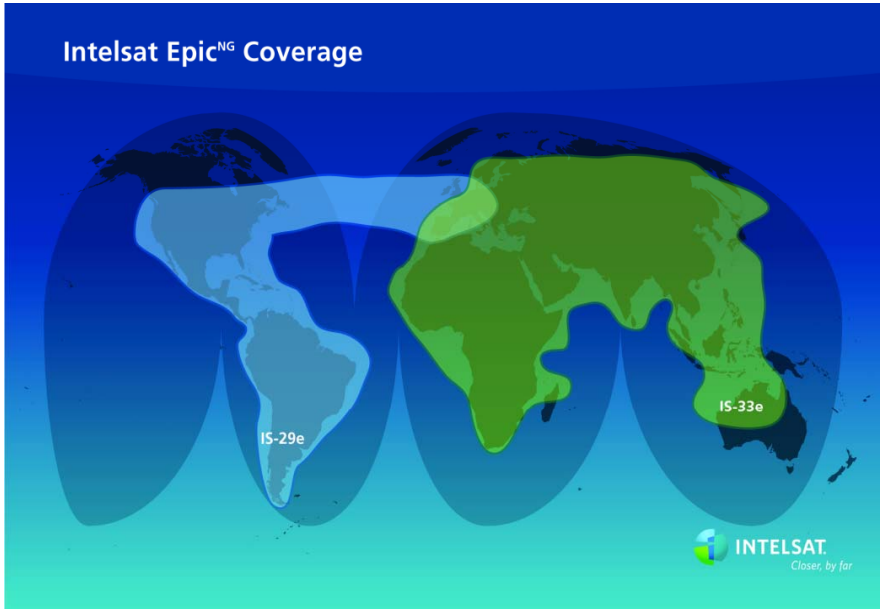
Exede coverage map



Skjei TELECOM

Epic^{NG}

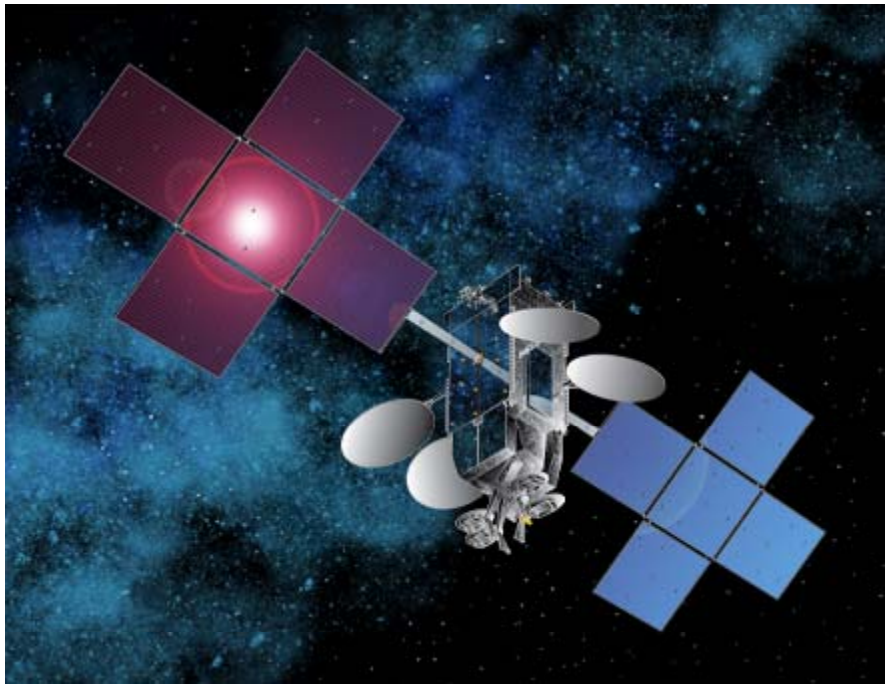
- The Intelsat Epic^{NG} platform utilizes C-, Ku- and Ka-bands
- Two Intelsat Epic^{NG}-class satellites with expected in-service dates in 2015 and 2016
  - IS 29e serves the Americas and North Atlantic
  - IS33e in 2016 along with three more satellites to follow, total of 5 satellites
- Fully integrated 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



Skjei TELECOM

Jupiter 1

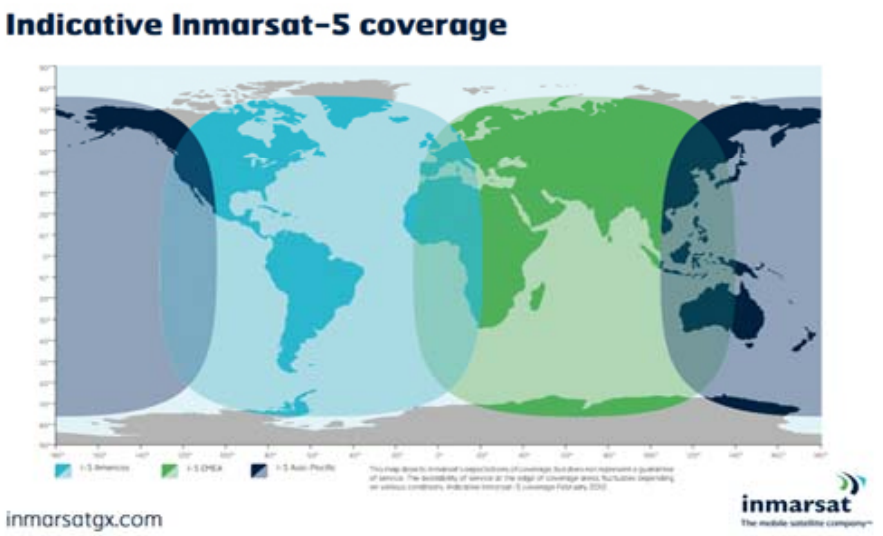
- EchoStar XVII, also known as Jupiter 1, is operated by Hughes Network Systems
- Launched in July 2012
- GEO Slot at 107.1° W.L.
- JUPITER will provide over 100 Gbps capacity at Ka-band using 60 spot beams
- Bent pipe architecture



Skjei TELECOM

Global Xpress

- Worldwide wireless broadband network by Inmarsat
- Constellation of three Inmarsat-5 satellites
- Full global coverage by end of 2014
- 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



FSS Mobility

- AESS
- ESV
- VMES
- ESOMPS

Skjei TELECOM

Aeronautical Earth Station Services (AESS)

- FCC IB Docket 12-376
  - Adopted December 20, 2012
  - NPRM and R&O for Aeronautical Earth Station operating in GSO FSS Ku-band
  - Terminates 2005 proceeding IB docket 05-20
  - Placed on Federal Register on March 8, 2013
  - The R&O is effective 30 days after publication in the Federal Register except for Sections §25.132(b)(3), §25.227(b), and the notification provisions of §25.227 (c)(1)-(2), (d)(1)-(3)
  - Comments were due April 8, 2013 and replies April 29, 2013

Skjei TELECOM

Aeronautical Earth Station Services (AESS)

- The R&O implements Earth Stations Aboard Aircraft (ESAA) as an application of the Fixed-Satellite Service (FSS):
  - Primary in the 11.7-12.2 GHz (space-to-Earth) band
  - Unprotected in the 10.95-11.2 GHz and 11.45-11.7 GHz (space-to-Earth) bands,
  - Secondary basis in the 14.0-14.5 GHz band (Earth-to-space)
  - Requires coordination with Space Research Service and the Radio astronomy Service
  - Adopts Part 25 technical service rules, §25.227
  - Licensing and operational requirements for ESAA for both U.S.-registered aircraft and for non-U.S.-registered aircraft operating in U.S. airspace
  - Requiring ESAA licensees to operate consistently with the Communications Assistance to Law Enforcement Act (CALEA)
  - Does not extend certain requirements concerning 1.5/1.6 GHz safety services to other frequency bands, including those used by ESAA (Part 87)
- Seeks comment on proposal to make ESAA in 14.0-14.5 a primary allocation, same as ESV and VMES

Skjei TELECOM

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

Skjei TELECOM

Earth Stations Onboard Vessels (ESV)

- FCC ESV IB Docket 02-10
  - Initially Released in January 2005
  - Reconsideration order July 2009
- 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

Skjei TELECOM

Earth Stations on Mobile Platforms (ESOMPS)

- Developed by CEPT ECC, ECC Decision 13(AA)
- Deployment of mobile earth stations operating at Ka-band
  - 27.5-29.5 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

Skjei TELECOM

Regulatory

- Smalls Cells NPRM
- Qualcomm ATG
- Regulatory Parity
- 5 GHz WiFi NPRM
- OET TAC Rx Performance

Skjei TELECOM

Small Cell NPRM

- FCC GN Docket 12-354
  - Released 12/12/2012
  - Comment 2/20/13
  - Reply Comments 3/22/13
- Creates new Citizens Broadband Service (CBS) operating in 3550-3650 MHz Band
  - 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

Skjei TELECOM

Qualcomm ATG – FCC NPRM

- Qualcomm proposes Air-Ground communications service on secondary base 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

Skjei TELECOM

Regulatory Parity

- FCC Newly released NPRM and NOI
  - ET Docket No. 13-115 , RM-11341, Adopted: May 9, 2013 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 next slide)
- 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

Skjei TELECOM

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

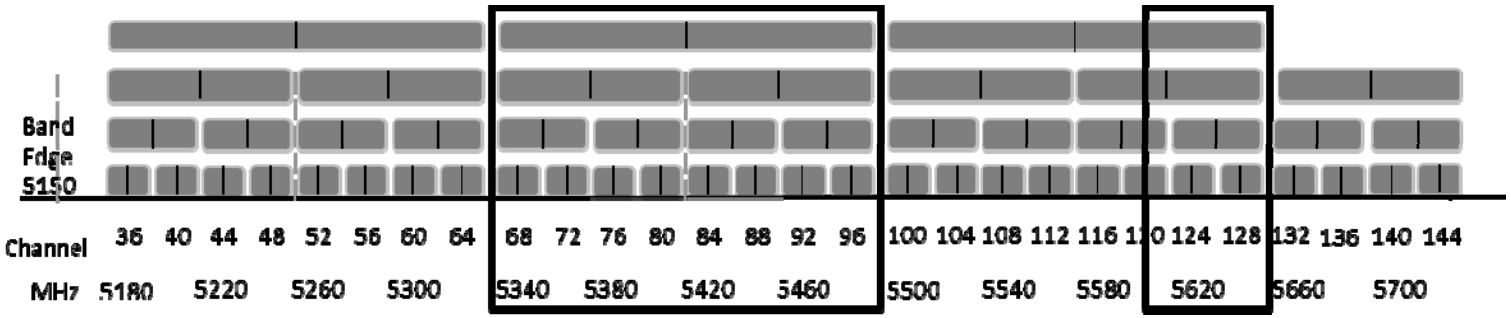
Skjei TELECOM

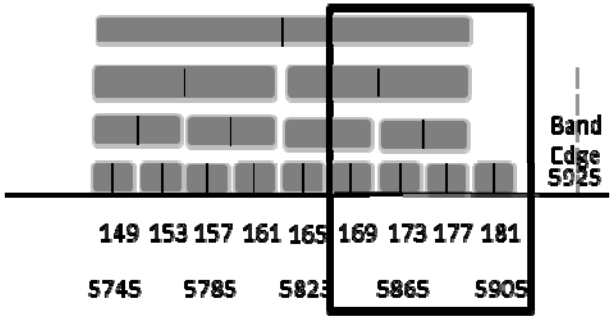
5 GHz WiFi NPRM

- FCC NPRM allowing use of unlicensed WiFi devices at 5 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
  - Comment Date: 45 days after publication in the Federal Register
  - Reply Comment Date: 75 days after publication in the Federal Register
- Satellite users have interference concerns regarding interference at 5.9 GHz

Skjei TELECOM

5 GHz WiFi NPRM





Announcement in advance of public meeting on 20 February 2013 to introduce Notice of Proposed Rule Making

- Make available 5350 – 5470MHz for Wi-Fi
- Make available 5850 – 5925MHz for Wi-Fi
- Total of 195MHz new spectrum
- Publish new rules for the 5600 – 5650 band used by weather radars (Terminal Doppler Weather Radar)
- New spectrum will probably be subject to spectrum sharing rules and protocols – includes current Federal users

Channels proposed for 5 GHz bands (new U.S. regulations), showing 20, 40, 80 and 160 MHz channels

(tentative conclusions from public announcement by Julius Genachowski, FCC chairman, at CES 9 January 2013)

Skjei TELECOM

OET TAC Receiver Performance

- FCC Office of Engineering and Technology
- Technology Advisory Council (TAC) White Paper Comments request on Recommendations for Improving Receiver Performance
  - ET Docket No. 13-101, DA 13-801
  - April 22, 2013
- Paper entitled *"Interference Limits Policy – The use of harm claims thresholds to improve the interference tolerance of wireless systems*"
  - Interference Limits Policy Approach
  - Specifies "harm claims thresholds"
  - In-band and out-of-band limits must be exceeded before claims of harmful interference can be made

Skjei TELECOM

Conclusions

- Several new items just released:
  - Regulatory Parity NPRM
  - 14 GHz Air Ground NPRM
  - AESS service rules, expect to see more licenses granted
- Several new broadband systems continue to roll out and will provide enterprise and consumers with access to broadband satellite services
- Items to keep your eye on
  - Small Cells at 3.5 GHz
  - WiFi at 5.9 GHz
  - OET Receiver Requirements

Skjei TELECOM