

Recent FCC Rulemakings Panel



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Note: Views expressed in this presentation are those of the authors and may not necessarily represent the views of the Federal Communications Commission

Key FCC Spectrum Initiatives & Proceedings

- **Mid Frequency Spectrum:**

- Mid-Band Spectrum Notice of Inquiry (3.7 GHz to 24 GHz; GN Docket No. 17-183)
 - 3.7-4.2 NPRM (GN Docket No. 18-122)
 - 6 GHz NPRM (Future)
- 6th FNPRM on 4.9 GHz (WP Docket No. 07-100)

- **High Frequency Spectrum:**

- Spectrum Frontiers (above 24 GHz; GN Docket No. 14-177)
- Spectrum Horizons (above 95 GHz; ET Docket No. 18-21)

- **Section 7 NPRM** (GN Docket No. 18-22)

Mid Band

Notice of Inquiry (rel. 8/3/2017)

- Sought comment on potential opportunities for flexible use in bands between 3.7 and 24 GHz
- Focused on three specific mid-range bands
 - 3.7-4.2 GHz
 - 5.925-6.425 GHz
 - 6.425-7.125 GHz
- Asked commenters to identify other mid-range bands that might be suitable candidates for expanded flexible wireless use
- **Significance:** 3.7 GHz is adjacent to 3.5 GHz band; 6-7 GHz is close to 5 GHz unlicensed bands

Two Focus Areas:

3.7 – 4.2 GHz – Licensed access to C-band satellite downlink spectrum?



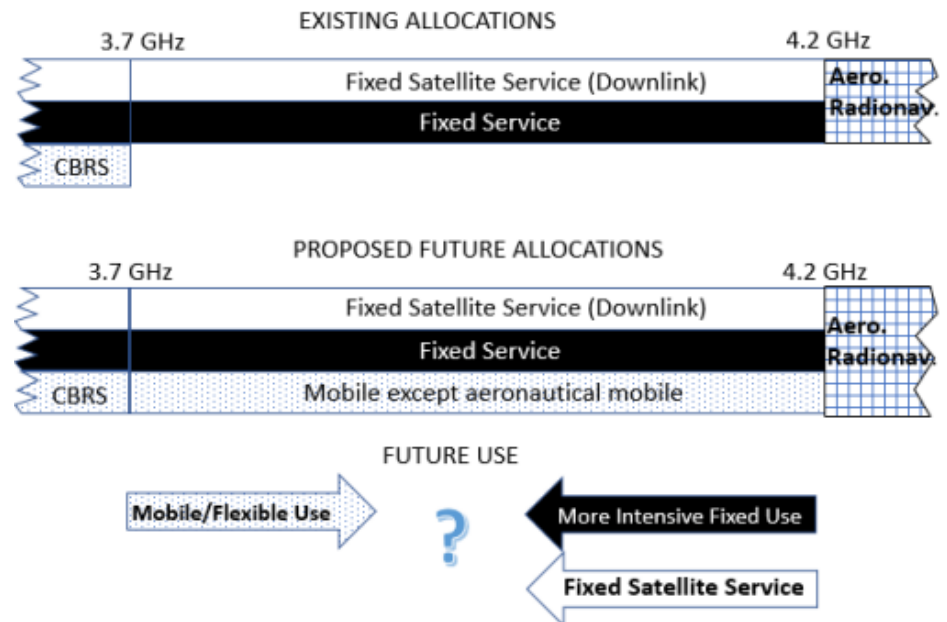
6 – 7 GHz – Unlicensed sharing with point-to-point microwave and satellite uplinks?



3.7-4.2 GHz Notice of Proposed Rulemaking (rel. 7/13/18)

- Collects information from incumbents in the band and seeks comment on transitioning some or all of the 3.7-4.2 GHz band to terrestrial fixed and mobile broadband services (i.e. 5G-suitable allocation)
- Incumbents: Fixed Satellite Service (downlink), Fixed Service (legacy microwave - limited)

Figure 1: 3.7-4.2 GHz Band Existing and Proposed Future Allocations and Use



3.7-4.2 GHz Notice of Proposed Rulemaking (cont.)

- Temporary freeze on applications for new or modified FSS Earth stations and fixed microwave stations in the 3.7-4.2 GHz band
- 90-day window to file applications for Earth stations currently operating in 3.7-4.2 GHz band
- Examines various proposals for expanding flexible use in the band – e.g. transition all or part of the band through a market-based mechanism, auction mechanisms, or alternative mechanisms.
- Key Technical Proposed Rules
 - Power Limit: Similar to Part 27.50 AWS Rules for Base Stations and Mobile Stations
 - Emission Limit: Similar to Part 27.53 Rules (i.e. $43+10\log P$)
 - Power Flux Density of $-76\text{dBm/m}^2/\text{MHz}$ is required at geographical border per Part 27.55, unless a different PFD is agreed by affected licensee(s)

6 GHz Notice of Proposed Rulemaking (planned – Oct 2018)

- Incumbents – point-to-point microwave links, Fixed satellite systems (uplinks), mobile services (BAS, CARS)
- Anticipate proposing allowing unlicensed operations, with limitations
- Unlicensed use would be tailored to protect incumbent services that operate in distinct parts of the 6 GHz band:
 - 5.925-6.425 GHz and 6.525-6.875 GHz, devices must be under control of automated frequency control system
 - 5.425-6.525 GHz and 6.875-7.125 GHz, devices operate at lower power, indoor only (but no AFC requirement)
 - Client devices would operate under to control of an access point

4.9 GHz 6th Further Notice of Proposed Rulemaking (rel. 3/23/18)

- In 2002, the Commission designated 50MHz of spectrum in the 4.9GHz band to public safety
- Although nearly 90,000 public safety entities are eligible for licenses in this band, there are fewer than 3,200 licenses in use
- Seeks comment on proposals, technical in nature, to encourage greater use of and investment in this public safety band, including manned aeronautical mobile and robotic terrestrial operations on Channels 1-5 (4940-4945 MHz)
- Seeks comment on whether an appropriate sharing mechanism could encourage more opportunistic use of the band while ensuring the priority, integrity, and security of public safety operations

High Band Spectrum Frontiers

Spectrum Allocations

- 12.55 GHz for mobile
- **Licensed Bands (5.55 GHz):**
24.25-24.45 GHz and 24.75-25.25 GHz; 47.2-48.2 GHz; 27.5-28.35 GHz; 37-38.6 GHz; 38.6-40 GHz;
- **Unlicensed Bands (7 GHz):**
64-71 GHz

Service Rules

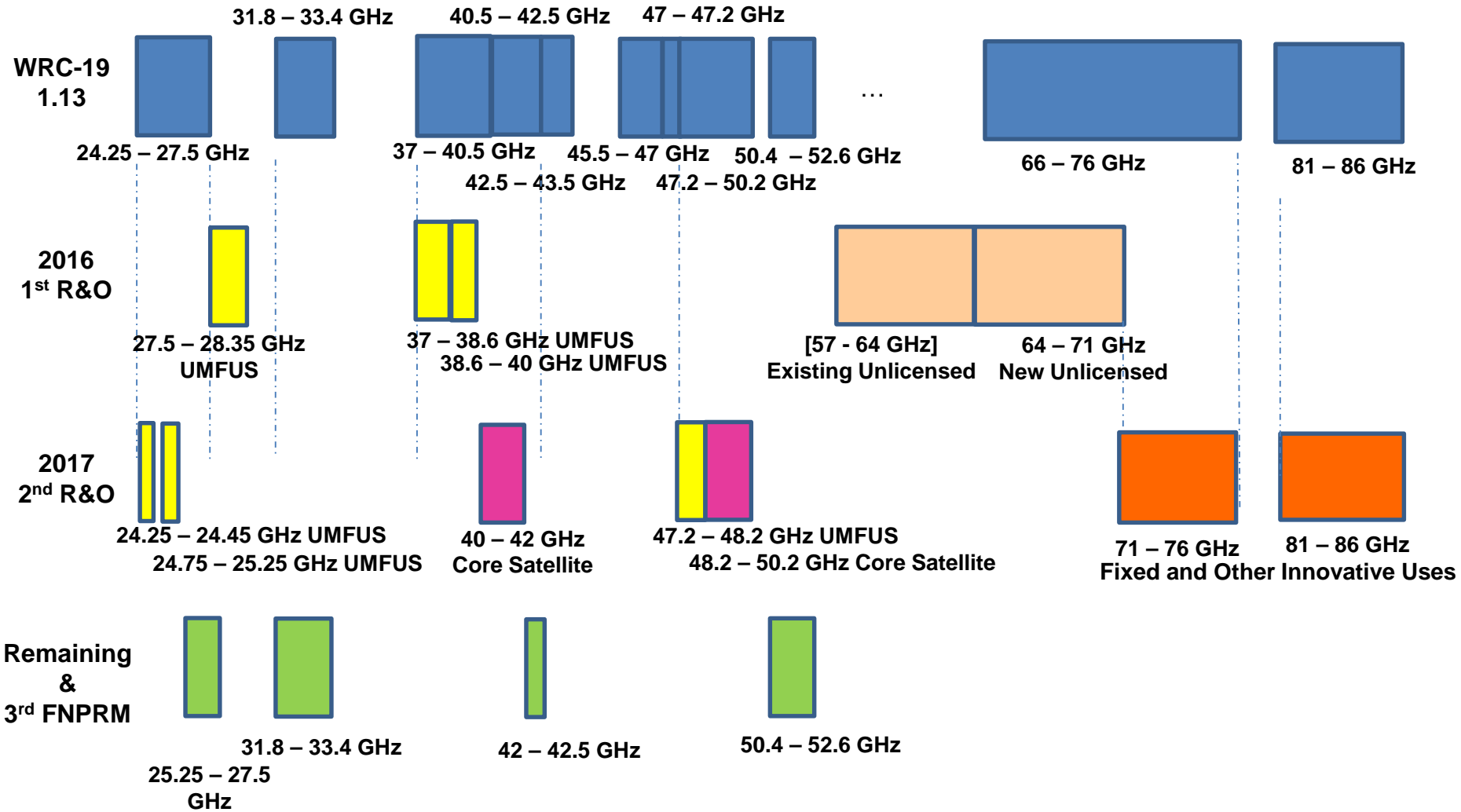
- Part 30: Upper Microwave Flexible Use Service (UMFUS)
- Geographic Area Licensing, Area Size, Band Plan, License Term, Overlay Auctions
- Technical rules
- Performance Requirements

Often Associated with “5G” – but 5G is not band specific

Spectrum Frontiers – Milestones

- ❑ NOI on October 2014: Sought comment on bands above 24GHz
- ❑ NPRM on October 2015: Multiple bands were proposed
 - ❑ 24GHz, 28GHz, 31GHz, 37GHz, 39GHz, 42GHz, 48GHz, 50GHz, 60GHz, 70/80GHz
- ❑ 1st R&O on July 2016 adds 10.85 GHz of spectrum for mobile
 - ❑ Licensed Bands (3.85GHz): 27.5-28.35 GHz; 37-38.6 GHz; 38.6-40 GHz;
 - ❑ Unlicensed Bands (7GHz): 64-71 GHz
- ❑ 2nd R&O on Nov 2017 adds 1700 MHz of spectrum for flexible wireless use
 - ❑ 24.25-24.45 GHz; 24.75-25.25 GHz; 47.2-48.2 GHz
- ❑ 3rd R&O, MO&O, and 3rd FNPRM on June 2018
 - ❑ Sets an operability requirement for the entire 24 GHz band, FSS sharing in a portion of 24 GHz band, a band plan for the Lower 37 GHz band, and spectrum aggregation rules applicable to certain bands
 - ❑ Denies petitions for reconsideration asking for geographic area licensing in the Lower 37 GHz band and asking to allocate the 42 GHz band for satellite use
 - ❑ Seeks comment on making 2.75 GHz of additional spectrum in the 26 GHz band 42 GHz bands

Spectrum Frontiers – Band Overview



Spectrum Frontiers – Technical Rules

❑ Final Rules

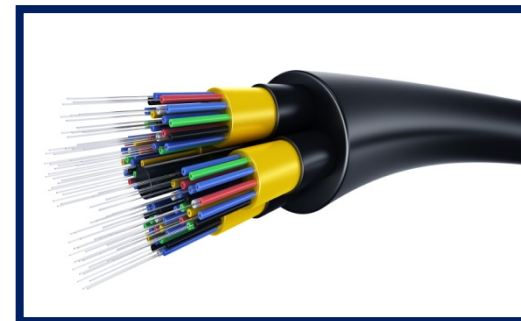
- ❑ Flexible Duplexing (TDD or FDD)
- ❑ TX Power: max EIRP of 75dBm/100MHz for BS; 43dBm for MS; 55dBm for Transportable Stations
- ❑ Out of Band Emissions (OOBE): -13dBm/MHz in conducted or radiated equivalent (i.e. includes TRP measurement)
- ❑ Field Strength at Market Borders: -76dBm/m²/MHz (measured at 1.5 meters above ground)
- ❑ Same Part 15 rules for 57-71 GHz band
- ❑ Existing Part 101 limits for fixed point-to-point and point-to-multipoint service
- ❑ Provides two 425 MHz blocks for the 28 GHz band on a county basis and operability across the band
- ❑ 200 MHz block sizes for 37-40 GHz with Partial Economic Areas (PEA) with operability across the band (the 4th FNPRM proposes 100 MHz block size)

❑ Auction Schedules

- ❑ 28 GHz (Auction 101)/24GHz (Auction 102) auctions are scheduled to start on Nov 14, 2018
- ❑ 39/37 GHz auctions are planned for 2nd half of 2019

Spectrum Horizons Notice of Proposed Rulemaking (rel. 2/28/18)

- Much of the spectrum above 95 GHz is allocated for passive services, but new interest in licensed applications
- Proposed a combination approach – unlicensed, licensed and expanded experimental licensing



high-bandwidth short-distance links could provide fiber-like capacities

- Total of 15.2 GHz for unlicensed use. Similar to 60 GHz rules, focused on high-absorption bands
- New type of experimental licenses > 95 GHz. Longer license terms, ability to sell devices
- Total of 102.2 GHz to for licensed point-to-point services. Similar to 70/80/90 rules, licensed nationwide (non-exclusive basis), links registered with a database manager, comment sought on mobile use

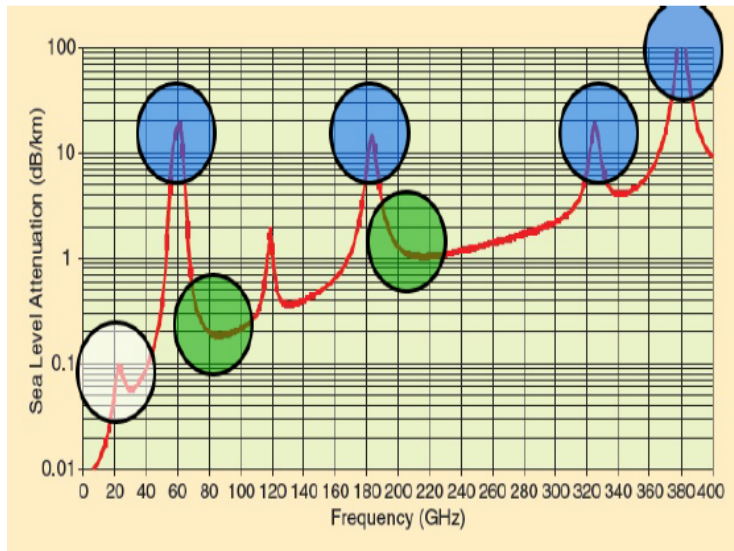
Spectrum Horizons - 2013 TAC Slide on Atmospheric Loss



NEW YORK UNIVERSITY



Atmospheric Attenuation: mm-waves



- 0.012 dB over 200 m at 28 GHz
- 0.016 dB over 200m at 38 GHz
- White
 - Current cellular frequencies and low mm-wave
- Blue
 - Short-range indoor communications, whisper radios of the future
 - Higher attenuation
- Green
 - Future backhaul and cellular frequencies
 - Low atmospheric attenuation
 - Multi-GHz Bandwidth
 - Directional Antenna Arrays with Beamsteering
 - CMOS: cost-effective with high frequency limits
 - Atmospherics are challenging

Your mileage may vary:

Foliage loss at 80 GHz and 10m penetration = 23.5 dB (15dB higher than @ 3 GHz)

Heavy rain in 70/80/90 GHz band results in 10 dB/km fade
Source: Samsung

T. S. Rappaport, J. N. Murdock, and F. Gutierrez, "State of the Art in 60-GHz Integrated Circuits and Systems for Wireless Communications," Proceedings of the IEEE, vol. 99, no. 8, pp. 1390–1436, August 2011.

Section 7 Notice of Proposed Rulemaking (rel. 2/23/18)

- Section 7 of the Communications Act states that “...it shall be the policy of the US to encourage the provision of new technologies and services to the public.”
- On Feb. 22, 2018, the Commission adopted a Notice of Proposed Rulemaking that proposed a set of rules to implement Section 7 (GN Docket 18-22)
- Goal: establish a process that ensures the timely availability of new technologies and services that are in the public interest

Section 7 Notice of Proposed Rulemaking (cont.)

- Proposes to adopt a new subpart in Part 1 of the rules
 - Sets specific procedures and timetables for action
 - Petitions or applications will need to invoke Section 7 and describe how petitioner/applicant meets criteria
 - If acceptable for filing, a public notice and comment process starts
 - OET-led team will make determination whether the request qualifies for Section 7 treatment within 90 days of the public notice
 - Commission (or bureau on delegated authority) then decides the appropriate course of action with respect to the petition or application or the proposed technology or service within 1 year of filing date

Section 7 Notice of Proposed Rulemaking (cont.)

- Record closed/no final decision yet (most likely outcome is a Report and Order)
- Could apply to rulemaking petitions, rule waivers, and service authorization applications
- Would establish a mechanism for expedited action on petitions/applications.
 - Does not create a presumption in favor of granting any particular petition or application
 - Does not modify underlying application or processing rules (e.g. Part 2 equipment authorization rules)

Questions?