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2022 Wireless Spectrum Update

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Introduction and Agenda

- Background
- ECIP
- 6 GHz Band
- 900 MHz Rebanding
- 4.9 GHz
- 800 MHz Interstitials
- T-band
- Offshore Spectrum NOI
- 2.5 GHz Band Auction

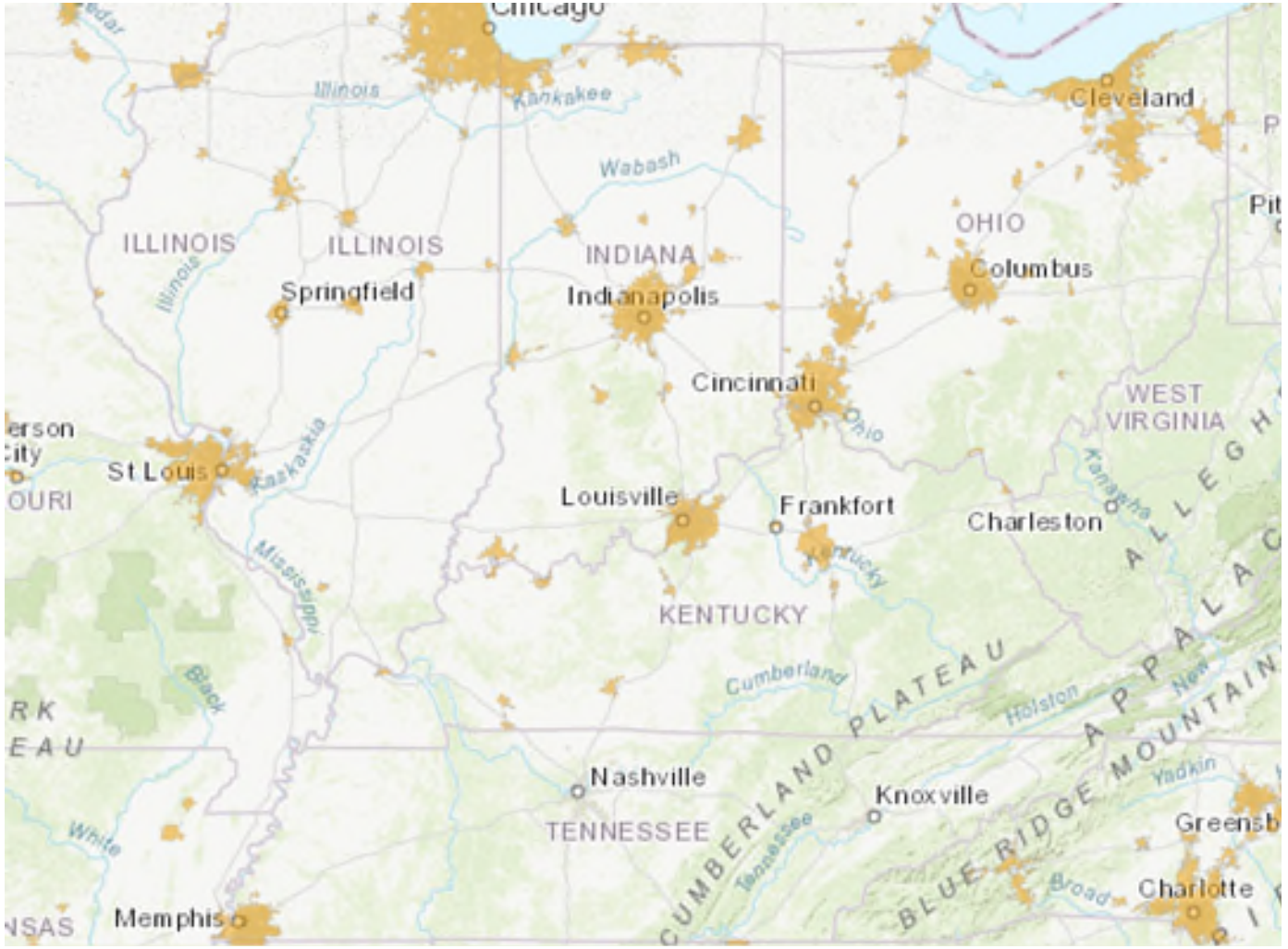
Enhanced Competition Incentive Program

- ECIP – Provides incentives for holders of unused licenses to sell all or portions of those licenses to others, in order to encourage putting the spectrum to beneficial use
- Two Options
  - Small Carrier/Tribal Nation Prong
    - Available in rural and urban areas
    - Certain minimums for included spectrum and geography
  - Rural-Focused Prong
    - Available to all users
    - Certain minimums for included spectrum and geography
    - Must include Qualifying Geography

ECIP – Definitions

- Small carrier. A small carrier is a carrier, engaged as a common carrier, that has no more than 1,500 employees and offers services using the facilities of the carrier.
- Rural area is any area except:
  - A city, town, or incorporated area that has a population of more than 20,000 inhabitants;
  - An urbanized area contiguous and adjacent to a city or town that has a population of more than 50,000 inhabitants.
- Qualifying Geography
  - 300 contiguous square miles for licenses up to 30,000 square miles
  - 900 contiguous square miles for licenses between 30,001-90,000 square miles
  - 5,000 contiguous square miles for licenses between 90,001-500,000 square miles
  - 15,000 contiguous square miles for licenses with more than 500,001 square miles

ECIP – Rural Areas



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ECIP – Benefits

- Five-year license term extension provided to:
  - Partition/Disaggregation – All Parties
  - Spectrum Lease – Lessor
  - Full Assignment - Assignee
- One-year construction extension also provided
  - For both interim and final benchmarks
- Alternative Construction Requirement
  - Assignee must construct and operate, or provide signal coverage and offer service to, 100% of the Qualifying Geography

Reaggregation

- Reaggregation of licenses. Allows licensee to reaggregate two or more licenses that were previously disaggregated or partitioned.
  - Licenses to be reaggregated must be of the same radio service, and have the same market and channel block
  - Licenses to be reaggregated must have met all applicable performance requirements, including any interim and final requirements, prior to the filing of the reaggregation application
  - License to be reaggregated must have been renewed for at least one license term since the applicable performance requirements were met
  - None of the licenses for which an applicant seeks reaggregation have violated the Commission's permanent discontinuance rules, as applicable to that license

Further Notice of Proposed Rulemaking

- Asks whether to expand Small Carrier/Tribal Nation ECIP Prong
- Asks about flexible construction standards for private licensees
  - Proposes three zone approach
    - Core usage zone in which all spectrum must be used to support licensee
    - Expansion zone into which usage may extend in future
    - Protection zone to provide interference protection
- Comments due by October 20; Reply Comments due by November 21

6 GHz Band

- April 24, 2020 – Report and Order and Further NPRM allowed unlicensed use of 5.925-7.125 GHz Band
  - Two device classes
    - Standard power (36 dBm EIRP) and indoor low-power (30 dBm EIRP)
  - Standard power must use ULS-based AFC
    - Limited to U-NII 5 and U-NII 7 (PtP bands)
  - AFC not required for low-power
    - May operate across entire 6 GHz band
    - Low-power APs must be indoors
    - Cannot be weather resistant, may not use battery power, must have integrated antennas
    - Must use contention-based protocol

6 GHz Band

- Court appeals filed by UTC, EEI, NAB, AT&T, APCO, APPA, NRECA, CenturyLink
- FCC supported by Apple, Broadcom, Cisco, Google, HP, Intel, Microsoft, NCTA, Wi-Fi Alliance, CableLabs
- December 28, 2021 – US Court of Appeals issues Order in favor of FCC
  - "[T]he Commission's "'predictive judgments about areas'" within its "'discretion and expertise are entitled to particularly deferential review, as long as they are reasonable.'""
  - "[T]he Commission never said that no harmful interference would occur; it concluded only that, given the Order's safeguards, "the potential for harmful interference to incumbent services operating in the 6 GHz band is insignificant.""
- Remand on limited question

6 GHz Band

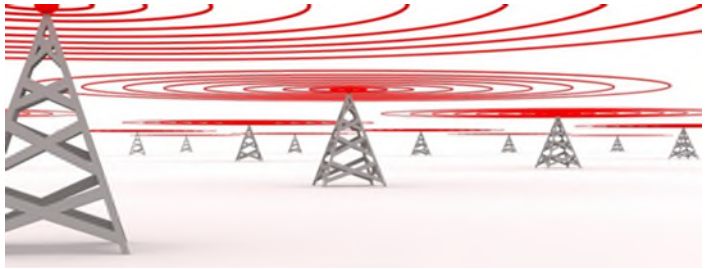
- FCC Public Notice seeking Comment on Court Remand
- Based on NAB argument
  - "Because mobile operators frequently work indoors, the provisions of the [6 GHz Report and Order] designed to restrict low-power routers to indoor operation offer mobile licensees little protection."
  - Should exclude low power devices from portion of 6 GHz band.
  - Contention-based protocol not enough. Does not work well at 2.4 GHz and FCC has ignored call to make changes there.
- Comments filed May 25, 2022; Reply Comments filed June 9, 2022

6 GHz Band

- December 7, 2021 Petition for Rulemaking filed by Public Safety and CII
  - Cited Southern Company report that unlicensed device interference potential higher than anticipated
- States Low Power devices should be controlled by an AFC system
- Also requested a cost recovery mechanism to reimburse for interference mitigation
- Petition for Stay also filed to pause certification of new LPI devices

6 GHz Band

- WiFi 6e
  - WiFi 6 extended into 6 GHz band
- January 26, 2021 – Large industry stakeholder group filed letter urging FCC to pause equipment certifications for 6 GHz unlicensed low-power indoor devices until rigorous testing is conducted to demonstrate coexistence with fixed-microwave licensees
- Hundreds of devices now certified



6 GHz Band

- September 28, 2021 – FCC Public Notice requesting AFC system operator applications
- Review to include lab and field testing
- FCC requires public trial period for each AFC
  - Interested parties may access and confirm accurate results
- Applications from Google, Broadcom, Comsearch, RED Technologies, Sony, Kyrio, Nokia, Federated Wireless, Wireless Broadband Alliance, Plume Design, Amdocs (since withdrawn), Wi-Fi Alliance, Key Bridge, Qualcomm
  - Many through Open AFC Project
- AT&T, APCO have objected to the applications

6 GHz Band

- Public Notice reminding licensees to maintain accurate ULS records – March 8, 2022
  - Reminds licensees that AFC protection will rely on the accuracy of the information on record in the ULS.
- 2021 WINN Forum Report:
  - 1,200 6 GHz paths where receive site licensed with no associated transmit site.
  - 6,000 records missing receive antenna.
  - 200 records missing antenna gain.
  - Numerous other errors including radio models in antenna fields and incorrect gain (highest = 449 dBi).

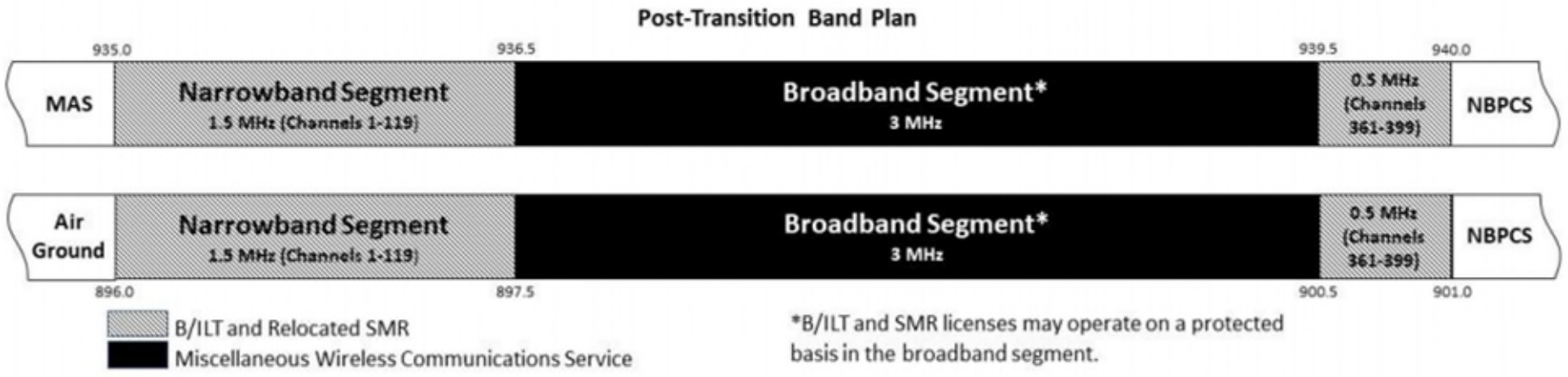
6 GHz Band

- August 15, 2022 – *Ex Parte* on Univ. of Michigan's Wi-Fi Upgrade Project
  - University replaced more than 16,000 wireless access points in 225 indoor and outdoor locations.
    - Wi-Fi 6E system consists of 15,500 WiFi 6E indoor access points
  - Groups urged FCC to use actual operating characteristics from Univ. of Michigan to measure impact over week-long period
- October 12, 2022 – *Ex Parte* from FirstEnergy disclosing results of July 2022 field testing of potential interference from LPI unlicensed devices
  - Results: potential for significant impact to existing licensed operations within the 6 GHz fixed microwave band
  - Phase 2 Study in February 2023

900 MHz

- 896-901/935-940 MHz
  - 399 12.5 kHz paired channels
- Anterix holds large portion for 3x3 MHz LTE service in 897.5-900.5/936.5-939.5 MHz Broadband segment
  - To be cleared primarily through voluntary, market-based relocations for band realignment

900 MHz



900 MHz

- Most relocations likely to be through voluntary, market-based approach
  - Only restriction is that the prospective broadband licensee may offer no more spectrum than the incumbent currently holds, except where doing so is necessary to achieve equivalent coverage and/or capacity.
- FCC provides process to trigger mandatory relocations
  - Broadband licensee must pay all reasonable relocation costs, including providing comparable facilities
  - Mandatory process does not apply to “Complex Systems”
- Broadband license applicant must hold licenses for more than 50% of the total amount of licensed 900 MHz spectrum (whether SMR or B/ILT) in the relevant county, including spectrum included in an application to acquire or relocate a covered incumbent

900 MHz

- Three Anterix deals so far
  - Long-term lease (30 years) – Ameren in Missouri/Illinois
  - License purchase agreement – SDG&E
  - Spectrum lease (20 years) with Evergy in Missouri/Kansas
- Focused on Utility market
  - Many utilities at various stages of pipeline
- Anterix projects $1.8 Billion in proceeds through FY 2024

4.9 GHz Band

- September 30, 2021 – Order on Reconsideration and Eighth Further Notice of Proposed Rulemaking
  - Rescinds prior rules
    - Fragmented band negative for equipment development and operations
  - Proposes to retain largely for Public Safety
    - Asking for coordination process/standards
      - Manual (Part 90) or automated (CBRS)
    - Would allow manned aeronautical use on lower 5 MHz (no UAVs)

4.9 GHz Band

- Asks to what extent non-Public Safety should be allowed to use the band
  - Should PS have priority/preemption rights?
  - Excess capacity leasing model?
- Specifically about CII
  - “railroad, power, and petroleum entities use radio communications […]“as a critical tool for responding to emergencies that could impact hundreds or even thousands of people.”
  - Should critical infrastructure (CII) eligible entities should be permitted access to the band in a way distinct from other classes of non-public safety users

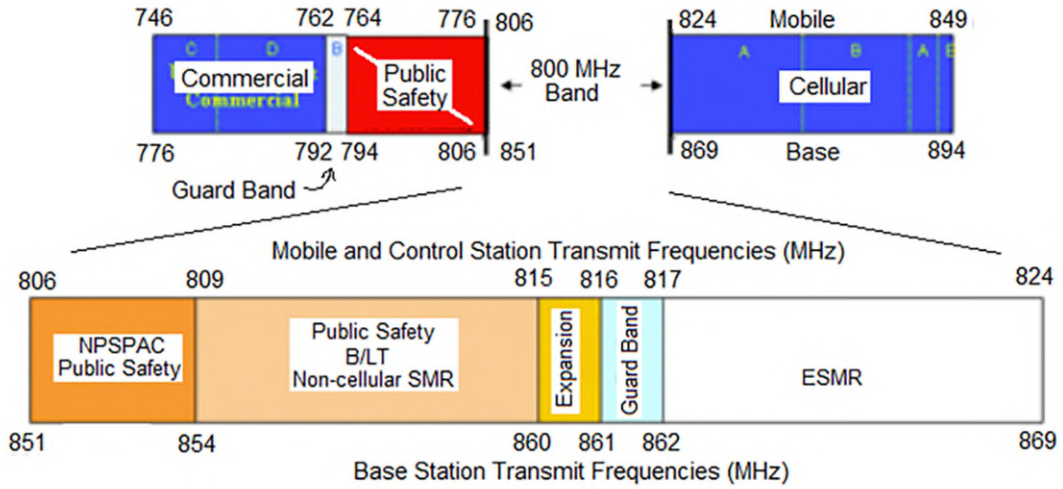
4.9 GHz Band

- Public Safety opposes commercial use, FirstNet
- API, EWA, UTC, NPSTC, others generally support CII sharing
- Drone/robotic use generally supported
- SAS coordination largely opposed
- Recent proposals for Band Manager
  - Non-profit to oversee
  - Accommodate multiple use cases such as fixed, mobile, microwave, robotics, WiFi, UAS, and other technologies
  - Develop a registration/application process pursuant to FCC MOU

800 MHz

- Re-Banding
  - 2004: 800 MHz re-banding begins to eliminate harmful interference to public safety and critical infrastructure radio systems from commercial cellular networks.
  - 2004 – 2021: Region-by-region licensing freezes
  - April 22, 2021: FCC concludes 800 MHz band reconfiguration program
    - Over 2,100 systems relocated to new channels

800 MHz



Sprint-Vacated Interleaved

- 809-815 / 854-860 MHz

Expansion Band/Guard Band

- 815-816 / 860-861 MHz
- 816-817 / 861-862 MHz

Interstitials

- 809-817 / 854-862 MHz

TV Band

- 470-512 MHz (UHF)
  - PS and CII in Boston, Chicago, Dallas/Fort Worth, Houston, LA, Miami, NYC, Philadelphia, Pittsburg, San Francisco/Oakland, and Washington, D.C. Metro
- 2012: Middle Class Tax Relief and Job Creation Act of 2012
  - Section 6103 mandates reallocation and auction by Feb. 22, 2021
- 2019: GAO Report
  - Reallocation unworkable
- 2020: Don’t Break Up the T-Band Act
- 2021: Incumbent Filing Window
- 2022: New Entrant Filing Window

Offshore Spectrum NOI

- June 9, 2022 – FCC releases Notice of Inquiry on offshore spectrum
- Site-based licensing provides spectrum access in U.S. Territorial Waters
  - ~1,400 offshore site-based licenses
- Geographic licensing provides a Gulf of Mexico area
  - But only for some radio services
  - And no areas exist for the Atlantic and Pacific
- FCC taking initial steps to address
  - See growth in offshore spectrum use for energy, research, safety, etc.

2.5 GHz Band Auction

- Auction 108 closed August 29, 2022
- ~8,000 licenses offered
- Three blocks— 49.5 MHz, 50.5 MHz, and 17.5 MHz
- Raised ~$420MM from 63 bidders; little CII involvement
- Follows 3.45 GHz band auction, which raised $22,418,284,236 in net bids from 23 bidders for a total of 4,041 licenses and CBRS which saw $200MM in CII winning bids
- FCC Auction authority expires December 16, 2022
  - Rosenworcel asking that Congress commit auction revenues to support a nationwide upgrade to next-generation 911

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