Status update on lower 3 GHz and 7-8 GHz:

WInnForum International Spectrum Sharing Workshop

Amit Mukhopadhyay, Ph. D.
Technology Standards Planning
Verizon

Agenda

- Introduction
- 3.1 - 3.45 GHz
- 7.125 - 8.4 GHz
- Looking ahead

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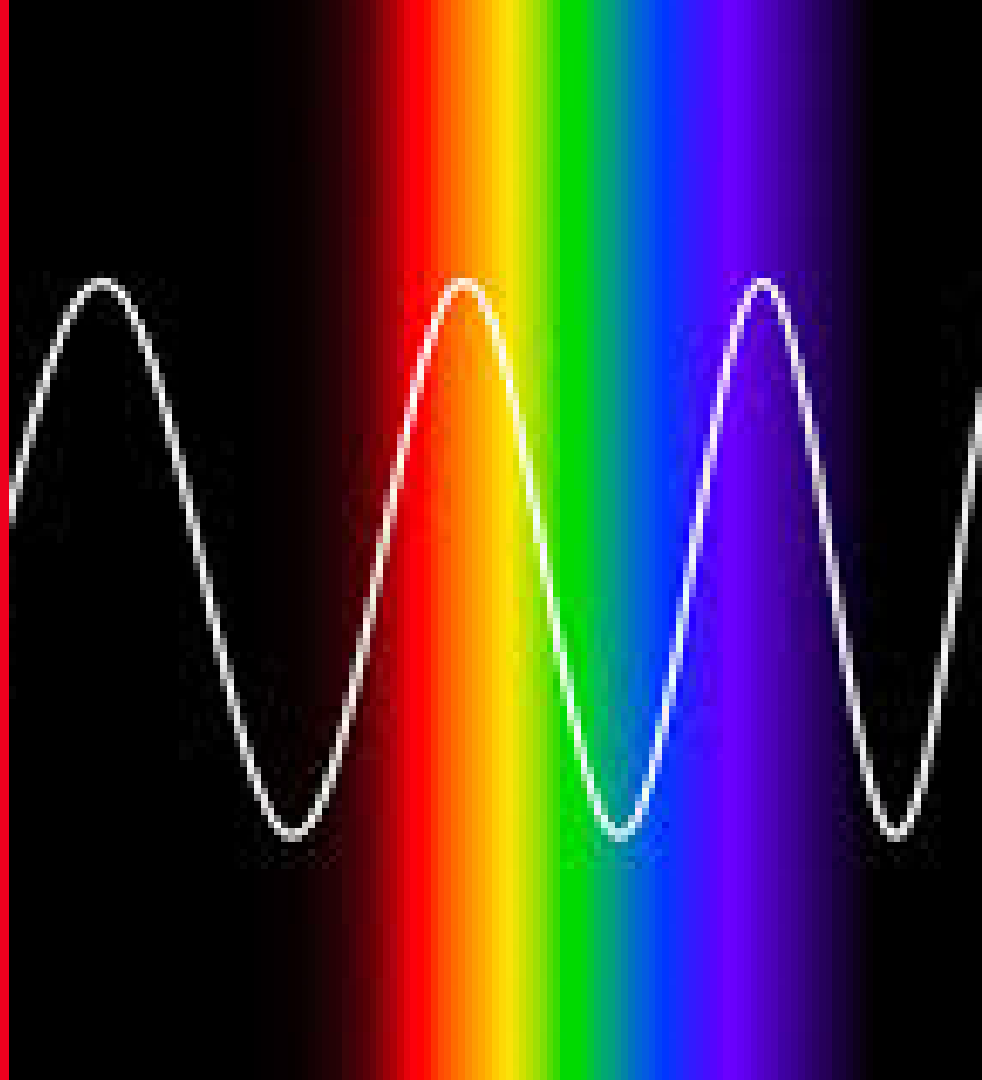
Introduction

Need for spectrum

New spectrum options



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Need for spectrum, WRC Agenda Items, National Spectrum Strategy

Spectrum Demand

- Traffic growth is expected to drive 5x data increase over the next 5 years, fuelled by new devices
- 6G will be introduced while 4G and 5G are still operational
- Based on Nokia and Qualcomm estimates, channel size of 400-500 MHz will be necessary to deliver expected performance of 6G
- 3GPP is also considering 200 MHz channel size

Band considerations

- Retaining network architecture (including reuse of existing site grid) is a key requirement for new spectrum
- The likely bands available are lower 3 GHz and 7-8 GHz
- Different propagation characteristics
- Both spectrum ranges have government/military usage

WRC Agenda Items

- Identification of 3.3-3.4 GHz for IMT at WRC-23
- New IMT/6G Agenda Item for WRC-27 is approved, which gives positive outlook enabling suitable studies to be conducted. Bands agreed for study are:
  - 4400-4800 MHz (in EMEA and Asia)
  - 7125-8400 MHz (excluding 7250-7750 MHz in Europe)
  - 14.8-15.35 GHz (global)

National Spectrum Strategy

- Following bands were proposed for further study in the NSS:
  - 3.1-3.3 GHz: DoD determined that sharing is feasible if certain advanced interference mitigation features and a coordination framework to facilitate spectrum sharing are put in place.
  - 7.125 – 8.4 GHz for mobile broadband studied for coexistence with incumbents;
  - 37 – 37.6 GHz; further studied to implement a co-equal, shared-use framework allowing Federal and non-Federal users to deploy operations in the band

National and International efforts to find new spectrum: 7.125-8.4 GHz is the only common band

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Multiple paths to explore new spectrum

NSS Implementation Plan

- Interagency Spectrum Advisory Council (ISAC) band study, in coordination with industry kicked off in summer of 2024
- Band studies for 3.1-3.45 GHz and 7.125-8.4 GHz spectrum to be completed by October 2026
- Coordinated among FCC, NTIA and all federal agencies using spectrum (DoD, FAA, NOAA, NASA etc.)
- Repacking, relocation etc. all options on the table

PATHSS2

- Follow-on to first PATHSS and EMBRSS Report
- Being conducted in parallel with ISAC 3.1-3.45 GHz band study
  - ISAC study informed by engagement with NTIA-managed multistakeholder group
- Both PATHSS and the multistakeholder group are being conducted under the National Spectrum Consortium

DSS Demo

- Federal government RPP to develop a DSS demo by the NSS target date (Sep 2025) but now moved to November 2025
- Demo is likely to encompass best practices and other technology and policy developments contributed by a variety of fora
- Demo would also be informed by band studies and analysis being conducted by ISAC and PATHSS2

Three parallel activities initiated in 2024

3.1-3.45 GHz

- Incumbencies
- PATHSS 1 scope
- PATHSS1 outcome

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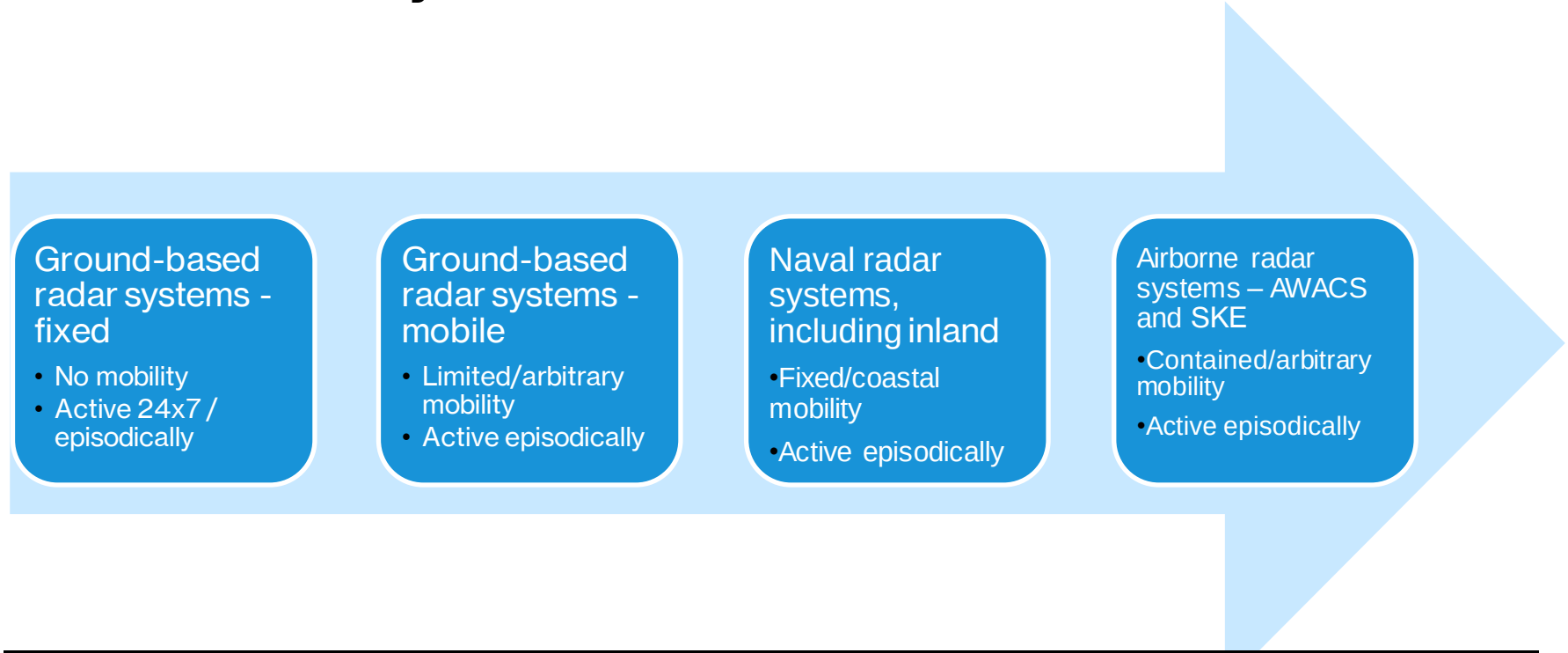
Incumbent radar systems have diverse set of characteristics



Different solutions needed for various radar systems to coexist with commercial mobile networks

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PATHSS1 Study Summary

Overview

- The study assessed the baseline protection levels (i.e., separation distances) between DoD radars and 5G base stations, while assessing various interference mitigation techniques
- In addition to separation distances, the main interference mitigation techniques considered were:
  - Active 5G RAN (sensing and action by 5G network)
  - Dynamic Spectrum Management System (SAS/AFC-type)
  - Digital cancellation of 5G signal (by radar)
- Spectrum sharing principles for DoD:
  - Cannot result in loss of access to spectrum for systems
  - Cannot degrade performance of current/future systems
  - Does not include vacating, compression or repacking

Key Study Results

- Dozens of systems were studied at various locations, most of which resulted in large separation distances from radars
- (DoD concluded that) Without a reliable mechanism for reducing or eliminating 5G emissions, USG systems will experience interference when operating in the same frequency band as 5G systems
- Spectrum sharing in the 3100-3450 MHz band is possible for shipborne and ground-based systems in the 3100-3450 MHz band with the development and implementation of a robust coordination framework
- The framework will maximize availability of spectrum for commercial operations when USG systems are not active in the band.
- USG airborne systems would require sophisticated dynamic spectrum sharing mechanisms.

Spectrum sharing between federal radars and commercial mobile networks would involve innovative solutions

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7.125-8.4 GHz

- Incumbencies
- Coexistence considerations
- Uncertainty factors

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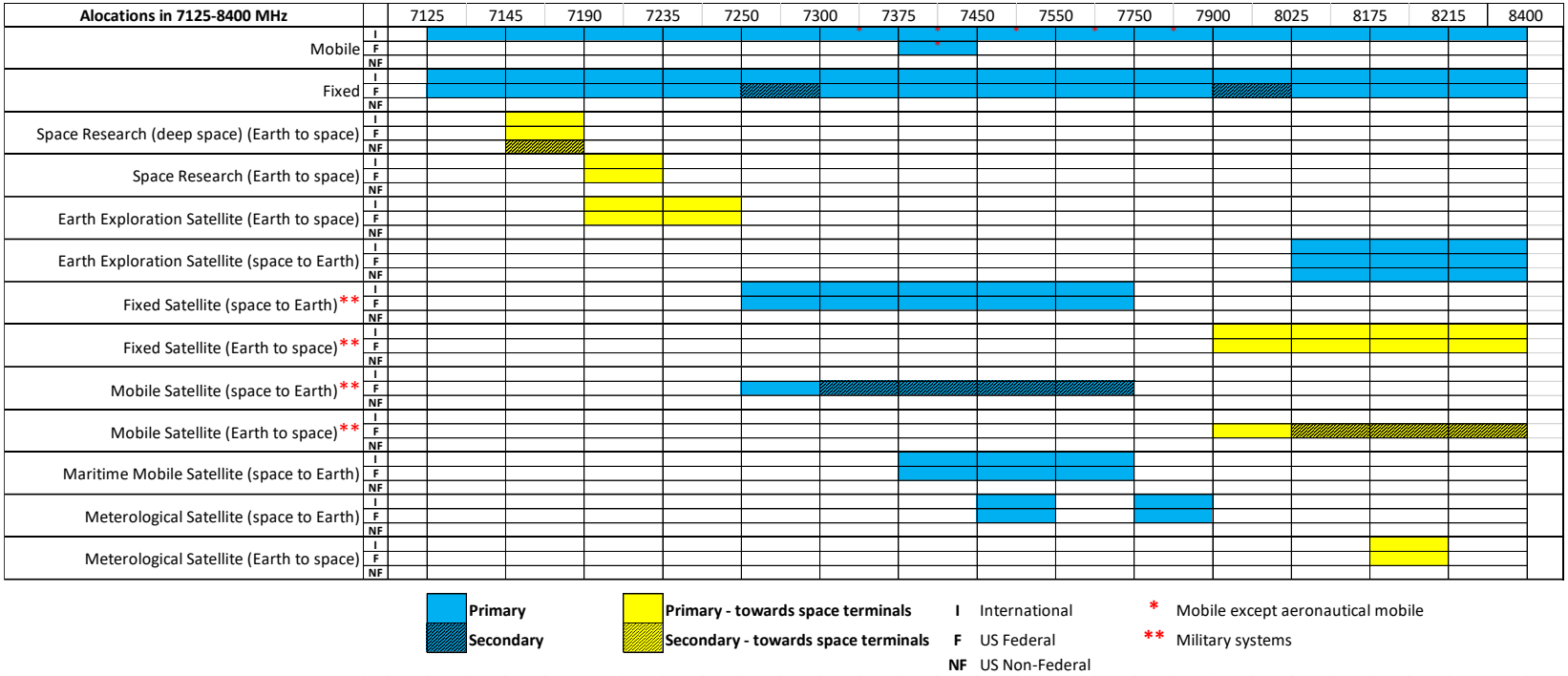
Spectrum allocations in 7.125-8.4 GHz: International, Federal, Non-Federal



Mostly Fixed Service (FS) and various satellite services (FSS, MSS, EESS, SRS, MMS, etc.)

Three main types of allocations

Fixed service

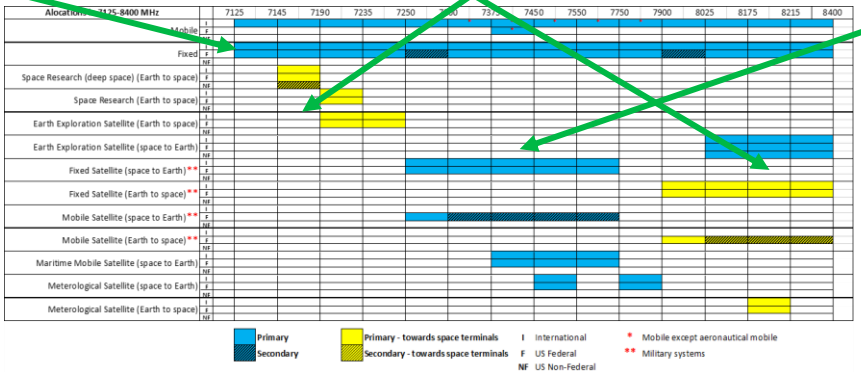
- Allocated over the entire spectrum range
- Band segmentation, if possible, is a more practical option for potential use of this band by IMT
- Possibility of co-existence/sharing depends upon the density of links

Satellite uplink service

- Allocation spread between the lower (7145 -7250 MHz) and upper (7900-8400 MHz) parts
- Studied for coexistence in other bands, no need for dynamic sharing
- Stringent requirements on ground-based equipment on radiation patterns and emitted power

Satellite downlink service

- Allocation mostly in the middle part of the range (7250-7750 MHz) and one in upper part (8025-8400 MHz)
- Small number of EESS Earth Stations in the upper part (including non-federal)
- Possibility of co-existence/sharing depends upon the extent of MSS



Satellite uplink has been analyzed in other bands, downlink and FS need new approaches

Incumbent allocations

Fixed Services

- The federal agencies use of this band is mostly for fixed point-to-point microwave communication systems.
- This includes the Federal Aviation Administration's (FAA) use of this band for fixed point-to-point microwave communications networks to connect remote long-range aeronautical radio-navigation radars to air traffic control centers.
- Approximately 20% of FS use is by the Department of Defense (DoD).
- However, the use of the band for fixed assignments has been declining.

Satellite downlink

- Federal agencies operate the Defense Satellite Communications Systems (DSCS) series of geostationary satellites in this range. Federal agencies also operate the Wideband Gapfiller Satellite (WGS) here. FSS uses 7.25 – 7.75 GHz as downlink and 7.9 – 8.4 GHz as uplink; this includes both DSCS and WGS.
- DSCS provides the United States with military communications to support globally distributed military users. As of 14 September 2021, six DSCS-III satellites were still operational.
- WGS is an international system, with Australia, Canada, Denmark, Luxembourg, the Netherlands, and New Zealand also investing in the satellite constellation. A group of eleven was set to be completed by 2023.

There are opportunities to pack some incumbents within a smaller part of the spectrum range

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Key factors

Fixed Services

- The number and geographical distribution of links is currently unknown; NTIA is expected to provide the data during execution of the NSS Implementation Plan
- Repacking may increase the density of links operating within specific spectrum ranges
- The plan to replace some links with fiber and move some other links in different frequency ranges is still evolving

Satellite downlink services

- It is not known how many earth stations are there and where they are located. Furthermore, EES allocation in 8025-8400 MHz allows non-federal use.
- Maritime Mobile Satellite Service is expected to be most prevalent around ports. But ports are often surrounded by high population density areas where capacity demand will be high.
- It is unknown how widely and where mobile satellite service (MSS) is used.

Re-allocation of some services may allow commercial mobile use of this spectrum

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Looking ahead

- Comparison of the two bands
- Recent developments
- Options for new commercial spectrum

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Comparison of the two bands

3.1-3.45 GHz

- Good propagation characteristics
- 3.3-3.4 GHz has international allocation for mobile
  - Good possibility of global ecosystem
- Adjacent to existing bands
  - Re-use of existing deployment grid possible
  - Likely roadmap to integrated radio

- Federal military incumbents
  - Technical operating conditions expected to be quite restrictive
- Dynamic sharing may cause uncertainty of availability
  - Suitable more for secondary connectivity

7.125-8.4 GHz

- Large amount of spectrum may be available
- Aligned with WRC-27 Agenda Item 1.7
- Most incumbents are located in relatively contained geographies (stationary)
  - Few moving terrestrial spectrum users (except for MSS allocation, which is mostly secondary)

- Different propagation characteristics
  - May require revised deployment strategy
- Existing ecosystem only for non-mobile services
  - 6 GHz mobile ecosystem may need to be re-tuned/repurposed

The two frequency ranges can serve very different sets of deployment objectives

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Recent developments

Dynamic Spectrum Sharing Demo

While Pentagon officials generally advocate against allowing commercial use of spectrum currently held by DoD, there are different messages emerging:

- According to an article published (April 23, 2025) by the National Spectrum Consortium (NSC),

"General Guillot, Commander of U.S. Northern Command (NORTHCOM), has warned that an Iron Dome-like system in the U.S. would be unworkable without adequate spectrum. The U.S. cannot afford delays in developing **spectrum-sharing** solutions to accommodate both defense and commercial operations…"

- A Defensescoop article (April 23, 2025) mentions that:

"…the Defense Department is looking to demonstrate emerging **dynamic spectrum-sharing** capabilities before the end of the year."

Proposal for New Commercial Spectrum

According to a recent Light Reading article (May 1, 2025), DoD is proposing the following spectrum to be released for commercial use:

- 100 MHz of CBRS spectrum
- 50 MHz of spectrum in 1.3 GHz range
- 75 MHz of spectrum in 1.8 GHz range
- 75 MHz spectrum in 5 GHz range
- 125 MHz spectrum in 7 GHz range

Notably, there is no mention of releasing 3.1-3.45 GHz or 7.250-8.4 GHz spectrum

DOD's perspectives about sharing spectrum with commercial networks are still evolving

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Options for new commercial spectrum

Dynamic Spectrum Sharing

- Technical Implementations
  - Incumbent activity detection
    - Sensing: Performance requirements to avoid false positives and false negatives
    - Notification: Operational security, trust
  - Decision: Which set of commercial radios to take action and what mitigation action
  - Implementation: Confirmation of effectiveness of mitigation action, duration of mitigation action to minimize impact on commercial operation
- Business Case Implications
  - Capital expenses: cost of developing and improving the solution
  - Operational expenses: cost of operating the solution
  - Cost recovery: Who pays and how

Traditional spectrum co-existence/Clearing

- Technical Implementations
  - Stationary federal users with continuous operation
    - Separation distances (geographical sharing)
  - Stationary federal users with intermittent operation
    - Time-based usage (geographical plus temporal sharing)
  - Non-stationary federal users
    - Moving to another band/repacking in smaller spectrum segment resulting in spectrum clearing (even if partial)
    - Tracking planned evolution of federal users – even if a few years away
    - Mission specific prioritization – Highest priority for (rare) homeland defense, but training, maintenance, testing etc. can be preplanned
- Business Case Implications: Cost of implementation/ reallocation and reimbursement through auction

A holistic techno-economic analysis should be conducted to decide the best course of action

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Key takeaways

- Additional spectrum is essential for the commercial mobile industry to keep up with traffic demand and usher in the era of 6G
- The Administration is studying the 3.1 - 3.45 GHz and 7.125 - 8.4 GHz bands for potential commercial use*
- The two bands have very different propagation characteristics, incumbent allocations
- A holistic techno-economic analysis is necessary to determine how much spectrum can be made available and how

* 3.1-3.45 GHz has been “carved out” per House Energy and Commerce Committee budget reconciliation package voted on May 13, 2025 (https://www.insideglobaltech.com/2025/05/14/energy-and-commerce-committee-votes-on-gop-house-spectrum-plan/)

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