

CSMAC Update

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Current Subcommittees

- 5G
- Band Key Characteristics
- Enforcement
- Spectrum Efficiency

5G

5G: Questions

1. What technologies (including waveforms and architectures) might be included in 5G standards to facilitate sharing between federal and non-federal systems?
 - a. Among other things, please consider specifically the key receiver performance requirements for sharing, particularly with respect to IoT devices, including a device's capacity for resilience and interference detection and avoidance.
 - b. Consider any 5G-specific technologies that might facilitate interference prevention, detection, and resolution.
 - c. Identify the standardization challenges with respect to such technologies and what actions NTIA should take to address these challenges.

2. What commercial 5G deployment scenarios (e.g., specific commercial use cases) exist that could potentially maximize the shared use of this spectrum (e.g., dynamic shared access between federal and non-federal users)?

5G: Recommendations

- Establish a formal and transparent process where NTIA receives input for its SDO (standards development organization) engagement. There have been several outreach discussions by the subcommittee to identify existing opportunities to establish the formal engagement process:
 - FCC: Initial discussions indicate that they would be open to an engagement with the NTIA once a formal framework is in place by the NTIA
 - ITS: Several discussions and a presentation to the subcommittee took place with the ITS. ITS is a key expert group who is active within SDOs to implement requirements, they have also been collaborating with the industry through appropriate mechanisms
 - State Department: Productive guidance provided, but no engagement on any formal level has been taken place with them
 - ATIS: a portal for industry and federal agency discussions. The most appropriate group in ATIS is WTSC-RAN, to act as a staging area for sharing issues
- Based on the above discussions, the subcommittee recommends that ITS lead the SDO work and utilizes organizations such as ATIS as a means to collaborate with the industry and other stakeholders (e.g. academia, civil society)

Band Key Characteristics

Band Key Characteristics: Question

- Develop a methodology to help assess federal bands for potential sharing, using key characteristics identified previously to assess industry desirability of a frequency band. This methodology will be considered and potentially incorporated into the interagency process to identify and prioritize bands for repurposing.

Band Key Characteristics: Response

- The key factors when industry looks to evaluate particular spectrum bands are divided into several categories:
 - propagation and coverage;
 - capacity;
 - contiguity;
 - international harmonization (scale); and
 - incumbency issues.
- In general, no single spectrum band will meet every requirement for a particular use, given the diversity of industry requirements and use cases. Relative priority for each of these characteristics is likely to vary based on industry and use case.

Band Key Characteristics: Recommendation 1

- The subcommittee recommends that NTIA approach the question by using the map of the key characteristics identified previously to assess desirability of a frequency band:
 - **Low frequency bands (below 1 GHz)**—propagation and coverage is the key characteristic of the band. Finding enough bandwidth and contiguity will be challenging. Here NTIA’s methodology should start with contiguity –like services or fairly easy relocation of dissimilar services. Note: it is unlikely that the federal government will have much, if anything, to consider in this range of frequencies.
 - **Medium-low (1-3 GHz)**—propagation and coverage are good. Also, propagation characteristics in this range make it well suited for a variety of sharing techniques. There likely is an opportunity for larger bandwidths and greater capacity with contiguity to existing commercial operations. As such, contiguity and incumbency are likely the most important key characteristics, particularly in a sharing environment. Bandwidth will follow in importance.
 - **Medium (3-6 GHz)** –propagation and coverage are better than higher bands, but not as good as low and medium-low bands. There may be opportunities for greater bandwidth. As with medium-low, NTIA’s methodology in examining medium spectrum should start with contiguity and incumbency. It should be followed by bandwidth.
 - **Medium-high band and high band (>6 GHz)** –We’ve combined the medium-high and high band frequencies because propagation and coverage are less of a concern and capacity becomes the most important trait. The NTIA’s procedure should ensure that there is adequate bandwidth (including for multiple competitors), followed by contiguity and incumbency. For many services in this band, such as satellite services, international harmonization is very important.

Band Key Characteristics: Recommendation 1

- From this map, a decision tree (provided in detail in the subcommittee paper) could be used to inform relocation or sharing options, with a summary as follows:

General Guidelines for Assessing Industry Desirability of Federal Bands

Key Characteristics	Band			
	Low (<1 GHz)	Medium low (1-3 GHz)	Medium (3-6 GHz)	High (>6 GHz)
Propagation and coverage	Green	Yellow	Yellow	Red
Capacity	Red	Yellow	Yellow	Green
Contiguity	Green	Green	Green	Yellow
International harmonization	Generally band specific			satellite
Incumbency	Yellow	Green	Green	Yellow

Relative Importance	Key
High	Green
Medium	Yellow
Low	Red

Band Key Characteristics: Recommendation 2

- NTIA should develop and maintain a written “technology radar” for commercial wireless technologies that are most likely to need access to federal spectrum.
- On a periodic basis, NTIA should conduct a spectrum technology assessment with vendors providing technology to the market.
- The goal of the technology assessment is to inform NTIA with respect to changing or advancing silicon and/or radio capabilities servicing the commercial sector.

Band Key Characteristics: Recommendation 3

- NTIA should seek input from the private sector, in accordance with the law, on the characteristics of a band being considered for reallocation for relocation or sharing.
- As an example, NTIA could obtain input from industry at various critical points of the investigation:
 - (1) at the beginning of the process when considering the types of services that may be interested in this band along with the incumbencies,
 - (2) in the middle of the process when more information is known about the incumbencies and the possibilities of relocation or sharing, and
 - (3) prior to or upon the release of the final analysis.
- NTIA may desire to target the 3450-3550 MHz band for this process as a test case.

Enforcement

Enforcement: Questions

Objective: “Assess the extent to which SAS/ESC systems and technologies may be able to support automated interference prevention, detection, and resolution today and potentially in the future” ...

1. What options do you see for making enforcement more robust, including by increasing automation to prevent interference, and to identify and respond to interference when it does occur in the near or longer term?
2. What are the principal technical and operational options for enabling automated enforcement, at both the network and device levels, and how would you address cybersecurity and privacy requirements? Please consider, among others, options related to: station IDs; data cloud/fog architectures; and crowd-sourcing.
3. What options for automated enforcement are unique to the development and deployment of 5G technologies/applications?
4. What steps do you recommend the Federal Government, specifically NTIA, take to implement automated enforcement processes? What steps will the private sector need to take? Please consider steps relating to technical, process and policy issues, including potential operator-to-operator coordination approaches?

Enforcement: Response Organization

- **Technical Capabilities** – What are the technical capabilities that are available today, and what can be the technical capabilities available in the near future for interference prevention, detection and resolution?
- **Legal Issues** – What are the legal issues/challenges that must be addressed to implement automated enforcement prevention, detection and resolution mechanisms?
- **Policy Issues** – What are the policies that could be implemented to generate support for an automated enforcement prevention, detection and resolution mechanism, or conversely, cause fears/concerns from participants?

Enforcement: Conclusions

1. The ESC capabilities being deployed for the 3.5 GHz band (as well as the RF monitoring systems under development for AWS-3) are limited in scope but demonstrate the capacity to create sophisticated environmental monitoring that could be used for both interference protection as well as interference detection
2. A commercial system for the identification of the interferer or source of interference has yet to be developed in a direct manner. The Radio Frequency Interference Monitoring System (RFIMS) for AWS-3 may be the first attempt in which an automated system is developed for interference identification purposes. This is an area of research
3. A mechanism is needed to confirm that the indirect resolution action was undertaken and successful. A cause and effect mapping mechanism is needed and event validation confirmation methods will need to be developed to allow devices to return to their previous operational states as soon as practical

Enforcement: Recommendation 1

- One legal issue involves liabilities associated with computing or applying the device parameters necessary for prevention. NTIA should investigate with the FCC the definition of liability for:
 - Harm caused by an interference event if the SAS computed and applied everything correctly;
 - Harm caused if the SAS computes the same incorrectly;
 - Operations that are suspended to prevent interference where actual interference was unlikely; and
 - Interference from rogue, malicious or non-compliant devices.

Enforcement: Recommendation 2

- To the extent automated systems are capable of resolution of actual interference, then to the extent regulators wish to access, or act upon (such as in an enforcement proceeding), the facts of the resolved interference event, additional legal questions are raised.
- NTIA and the FCC should develop the specifics of what data, how it would be obtained, and how it might be used, should be specified with reference to underlying legal authority.

Enforcement: Recommendation 3

- A methodology to validate and accredit a device so that an interference detection function could directly monitor interference events has yet to be developed. NTIA should investigate two potential mechanisms:
 - A means to accredit signal level measurements at a device in order to provide evidential characteristics of an interference event; or
 - A means to accredit the detected interference event in order that it may be used as evidence. Securing a consensus baseline from the SASs providers is recommended.

Enforcement: Recommendation 4

- NTIA/Federal Agencies should identify desired policy objectives. Specifically, should users of the band be required to forgo certain aspects of anticipated privacy for the benefit of a safer spectrum environment and/or access to the band?

Enforcement: Recommendation 5

- Further, NTIA should undertake (or cause to be undertaken by an appropriate body) a forward-looking study to better understand:
 - The relationships between the increasing capabilities of monitoring equipment and processes and the speed and accuracy of detecting, classifying, identifying, locating and reporting interference incidents;
 - Privacy and other issues that are implicated by these increasing capabilities; and,
 - The optimum tradeoffs associated with increased technological capabilities and privacy requirements.

Spectrum Efficiency

Spectrum Efficiency: Questions

1. What additional regulatory, procedural, legislative, or policy actions could be implemented to improve spectrum efficiency without harming effectiveness, including enhanced funding options for the federal agencies?
2. What economic mechanisms could be employed to increase spectrum efficiency via sharing options, such as a federal mechanism to monetize assets on a non-permanent basis (e.g., a secondary markets model)?

Spectrum Efficiency: Mechanisms

Most Promising

- Funding
- Spectrum Property Rights
- Bi-Directional Spectrum Exchanges or Barter/Swaps
- Expansion of NTIA Authority and Resources

Promising

- Overlay Rights
- Spectrum Scoring Reform
- Dynamic Federal Spectrum Secondary Markets
- Auction Revenue

Others

- Spectrum Auditor
- Spectrum Use/Rental Fees
- Shared-Use Spectrum Superhighways, Spectrum Currency, and Spectrum Efficiency Fund
- Defense Base Closure and Realignment (BRAC) Model

Spectrum Efficiency: Recommendations

1. NTIA should focus on exploring the most promising mechanisms – including through the use of test beds. NTIA should specifically consider whether some of the mechanisms could be explored on a limited basis through regulatory or operational test beds, etc. to develop a proof of concept. CSMAC believes the proposals under the “other” category may not be worth pursuing, due in part to logistical, legal and/or political challenges that could drain government resources without offsetting public interest benefits.
2. NTIA should work with Congress and the Administration to explore ways to reduce the barriers to more efficient federal spectrum use, in a way that does not impact mission effectiveness.

Spectrum Efficiency: Recommendations

3. In the context of its development of a national spectrum strategy, NTIA should include the development of a set of guiding principles to focus on spectrum efficiency. Guiding principles should include a definition of spectrum efficiency goals, such as optimizing use of spectrum and functions required, as well the multi-dimensional aspects of efficiency. The guiding principles could include a science-based assessment that leverages spectrum according to its physical or unique properties; considerations in spectrum use include both function and the bands allocated for those services. It could provide guidance on sharing, such as recommendations on opportunities for similar systems to share spectrum and when even dissimilar systems should share. It could also include a process for collaborating and partnering with other agencies to address common needs, such as consolidating systems as part of an architectural strategy or partnering with other agencies or organizations. Some systems may be more efficient and other systems may be better at sharing spectrum.

Spectrum Efficiency: Recommendations

4. Once the spectrum efficiency guidelines and larger strategy are developed, NTIA should consider working with the FAR Council/OMB on requiring spectrum efficiency factors in RFPs, through the Federal Acquisition Regulations (FARs), with the departments then able to implement according to their own particular missions. A cross-cutting policy could include as an incentive for agencies to select equally effective, but higher cost spectrally efficient solutions provision to increase the appropriations for such a solution.

Spectrum Efficiency: Recommendations

5. NTIA should continue a constructive two-way dialogue with agencies to address, plan, and implement increased spectrum efficiency collaboratively and strategically, while meeting mission objectives. It should evolve cross-agency collaboration, such as the Spectrum Efficient National Surveillance Radar (SENSR) program, to explore spectrum uses systematically and strategically, and to identify more spectrum-efficient cross-agency solutions, address cross-agency challenges and risks, and set timelines for activities. NTIA should continue to collaborate with the FCC to evolve the spectrum efficiency policy for both federal agency and commercial uses of spectrum.
6. NTIA should consider the findings in this report as it works with the FCC, OMB, and the affected federal agencies to develop a report to Congress with recommendations that could incentivize federal entities to improve efficiency through future acquisition to increase opportunities for sharing with commercial services, including wireless and satellite broadband services, without adversely affecting mission effectiveness.

Summary

- All recommendations will be reviewed for approval by CSMAC this week.
- This cycle closes Sep 30. New CSMAC starts Oct 1.
- Seeking suggestions for future topics.

"Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Networking and Information Technology Research and Development Program."

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