Comments for the Record

Development of a National Spectrum Strategy

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Comments of Jeffrey Westling[1]

Spectrum management in the United States has always been a challenge, but as the radio environment gets more crowded, regulators will need to balance a wide range of interests and carefully police the ecosystem to minimize harmful interference. Undoubtedly, comments in this proceeding will provide valuable insight into a wide range of issues, including the balance of licensed to unlicensed allocations, the balance between federal and non-federal allocations and assignments, the service rules for different band plans, new sharing technologies, and the relationship between the National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC) in managing radio operations. These are all critical questions, though the answers will largely depend on the perspectives of current radio operators.

Instead of weighing in on these questions, these comments focus in on one key question in the request for comment: "What policies should the National Spectrum Strategy identify to enable development of new and innovative uses of spectrum?"[2] The issue isn't one of policy, but instead of framing. Too often, spectrum management discussions focus solely on "spectrum" as a scarce natural resource, implying similar properties to other resources. While a useful analogy, this framing can mislead regulators into thinking of spectrum management as solely an exercise in resource allocation, and not the process of managing concurrent radio operations and minimizing the risk of harmful interference. By broadening its view of spectrum to more fully consider radio operations, the NTIA can craft better rules that explore different strategies for making federal incumbents more spectrally efficient within existing allocations, freeing up additional bandwidth for commercial use and better assessing the potential for harmful interference.[3]

Consideration of Receiver Performance

Specifically, this framing helps contextualize the need to ensure that incumbent operations are not subject to harmful interference due to the use of outdated technologies. In many disputes regarding the allocation and assignment of radio operating rights, incumbents and new entrants disagree regarding the potential for harmful interference. There will always be noise, and receivers are designed to filter out that noise. By framing the spectrum management discussion in the context of allocating a "scarce natural resource", the focus stays mainly on the new entrant, adjusting service rules to ensure that they do not disrupt incumbent operations. But this is just one side of the equation, and improvements to the incumbent's receiver performance can mitigate these risks.

Federal Operations

Unlike the commercial operators, federal users often don't face the same incentives to maximize spectral efficiency. Further, many federal operations are classified, and the specifics of the equipment being used cannot be made available to the public.[4] As a result, it will be even more important for the NTIA to shift its view

away from protecting incumbents to instead maximizing the spectral efficiency of federal users without jeopardizing critical missions.

By shifting the more common view of spectrum away from a pie to be sliced up and instead back toward managing concurrent radio operations, the NTIA can better examine the equipment of federal users and explore different techniques to make operations more resistant to potential harmful interference. This sometimes will require shifting operations to different frequency ranges, and other times may allow for more robust sharing within the band. And as with all radio operators, any federal agency would oppose deployment of additional radios that may increase the chance of harmful interference, regardless of how small that chance may be. While this isn't a new challenge for the NTIA, strong leadership will be critical to ensure federal operations can filter out additional noise so that additional commercial networks and services can operate.

Clearly, the NTIA understands this challenge, but this framing of the issue should permeate all the work the Office of Spectrum Management does. Ultimately, the Interdepartment Radio Advisory Committee serves as a body designed to protect incumbents from harmful interference, not necessarily to make these operations utilize the minimum bandwidth to achieve their mission.[5] Embracing a more radio operation focused approach will undoubtedly help the agency as it navigates individual proceedings and interference analysis.

Commercial Networks

Commercial operations are not free from this challenge, but profit maximizing firms will often constantly upgrade equipment to maximize spectral efficiency of their network: If a radio can better filter out noise, the network can add additional radios without facing harmful interference. While not always perfect, the market realities drive innovation and improvement in equipment. And for unlicensed operations such as Wi-Fi, there are no legal protections from harmful interference, meaning devices must constantly improve to ensure user experience isn't degraded. To address shortfalls, the FCC has recently taken steps to more carefully examine receiver performance in commercial networks, filling in gaps where perhaps the market fails to drive investments into improving receivers.[6]

To the extent that further action is needed, rather than imposing strict receiver standards, the administration should explore ways of developing secondary markets.[7] Currently, FCC rules add costs for rights holders when attempting to disaggregate, partition, or otherwise sell off specific operating rights to third parties. These transaction costs drive down potential profits, and as a result the secondary market for operating rights doesn't really exist. Making it easier for rights holders to allow additional operations in their assigned frequency ranges incentivizes license holders to improve spectral efficiency: If an incumbent can allow other operators to utilize excess bandwidth, the incumbent will further minimize the bandwidth necessary to operate its network.

Even with expanding secondary markets, rethinking how regulators view spectrum will see marked improvements. For example, in the C-band, the FCC determined that 5G operations wouldn't cause harmful interference to altimeters operating at a neighboring frequency.[8] The FAA and airline industry disagreed, however, and ultimately the industry needed to retrofit altimeters, an ongoing challenge. If the FAA more fully considered the potential for harmful interference to outdated receivers, and the FAA and the FCC worked collaboratively on the issue, the FCC could have designated auction proceeds for the retrofit. Instead, airlines were left scrambling as the FAA issued airworthiness guidance threatening to ground planes across the country.

To be clear, this approach doesn't mean that upgrading equipment will always be necessary to allow for additional commercial operation, or that the costs of doing so will justify repurposing rather than a shared or

unlicensed regime. Rather, simply rethinking how we view spectrum will allow the regulator to fully consider all aspects of the radio environment, including how to ensure incumbents' filter noise.

Risk-Informed Interference Assessment

Another benefit of focusing on radio operations is contextualizing the potential impact of harmful interference, and more fully considering the risks associated with additional noise, when performing interference analysis. In the past, and due in part to the framing of spectrum as a scarce natural resource, regulators reviewing new deployments would look primarily at worst-case scenarios regarding harmful interference.[9] This approach ensured that incumbent operations would continue with no additional risk, regardless of the likelihood of that risk. As a result, allowing additional radio deployments had to meet a high standard, largely preventing allocation of additional operating rights.

Regulators have since shifted towards risk-informed interference assessments, and a national spectrum strategy should embrace such an approach. Risk-based interference assessments take three steps.[10] First, the assessor makes an inventory of all significant harmful interference hazard modes. Second, the assessor defines a consequence metric to characterize the severity of the hazards. Finally, the regulator assesses the likelihood of and consequence of each hazard mode. Using this quantitative approach, regulators can quantify likelihood and consequences rather than merely using probabilistic language without quantification, leading to a more accurate depiction of the radio environment.[11] With more information available, the regulator can better balance the benefits of allowing a new service against the potential risks, and harms associated with that risk, of harmful interference to incumbents.

Defining Sharing

As a small aside, the NTIA also asks about the definition of sharing, proposing to define "spectrum sharing" as optimized utilization of a band of spectrum by two or more users that includes shared use in frequency, time, and/or location domains. This definition does a good job of describing sharing generally, but the NTIA may want to be more specific. As this definition illustrates, spectrum management is necessarily a process of sharing. A broadcaster with a license to operate channel 5 in El Paso, Texas shares that band with a broadcaster in Scranton, New Jersey, but the sharing occurs in the location domain. And many common sharing models such as Citizens Broadband Radio Service in 3.5 GHz share in multiple domains. In common usage, however, sharing mainly refers to different services operating in the same band. If the NTIA wants sharing to refer to particular models of coexistence, it may want to be more specific in the definition.

Conclusion

Undoubtedly the NTIA will receive a wide range of comments describing the different needs of U.S. businesses, agencies, and consumers, as well as fierce debate regarding how to allocate and assign radio operating rights. Finding the right balance to these questions will be no easy task. These comments simply serve to help frame the way the NTIA should think about spectrum management as a whole and work these concepts into the framework of the strategy. I eagerly await the opportunity for further engagement with the administration on these issues.

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[2] "Development of a National Spectrum Strategy," Docket No: 230308-0068, National Telecommunications and Information Administration, 88 Fed. Reg. 16244, 16247 (Mar. 16, 2023).

[3] Jean Pierre De Vries and Jeffrey Westling, "Not a Scarce Natural Resource: Alternatives to Spectrum-Think," TPRC45 (Apr. 13, 2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2943502.

[4] *See* Spectrum Management: Information Technologies for Managing Federal Uses," U.S. Government Accountability Office p.3 (Feb. 17, 2022), https://www.gao.gov/assets/gao-22-105221.pdf.

[5] Jeffrey Westling, "Rivalrous Regulators: Historical Analysis of the Dual Agency Approach to Spectrum Management," R Street (Oct. 2021), https://www.rstreet.org/wp-content/uploads/2021/10/4Oct21_RSTREET241.pdf.

[6] "Promoting Efficient Use of Spectrum through Improved Receiver Interference Immunity Performance," Notice of Inquiry, ET Docket No. 22-137 (Apr. 21, 2022), https://www.fcc.gov/document/fcc-launches-proceeding-promoting-receiver-performance-0.

[7] Joe Kane, "The Role of Markets in Spectrum Policy," R Street Institute (June 2018), https://www.rstreet.org/wp-content/uploads/2018/06/Final-No.-146-for-posting.pdf.

[8] Jeffrey Westling, “Interagency Challenges to Allocating 5G Spectrum,” American Action Forum (Dec. 7, 2021), https://www.americanactionforum.org/insight/interagency-challenges-to-allocating-5g-spectrum/.

[9] “A Quick Introduction to Risk-Informed Interference Assessment,” Federal Communications Commission’s Technological Advisory Council (April 1, 2015), https://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting4115/Intro-to-RIA-v100.pdf.

[10] Ibid.

[11] Ibid.