

**Before the
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE
Washington, D.C. 20230**

Re: *Developing a Sustainable Spectrum Strategy for America's Future; Docket No. 181130999-8999-01*

**COMMENTS OF STARRY, INC.
January 22, 2019**

Starry, Inc. (Starry)¹ respectfully submits these comments in response to the National Telecommunications and Information Administration (NTIA) Request for Comment (RFC) on the development of a National Spectrum Strategy.² A National Spectrum Strategy is critical to near- and long-term planning for non-federal and federal spectrum rights. With specific goals and a strategic policy framework, policymakers, industry, and federal spectrum users have a unifying direction and can all work together to achieve common goals.

Within the National Spectrum Strategy, we strongly encourage NTIA to recognize and incorporate shared spectrum access as a fundamental component of the framework. We believe that policymakers and spectrum users have evolved beyond binary and zero-sum spectrum debates to recognize the real benefits of making shared spectrum an essential element of an overall policy strategy.

NTIA, the FCC, and federal agencies have worked together in recent years to uncover opportunities for new or more intensive uses of spectrum by leveraging sharing strategies.³ We believe these efforts can be enhanced through several programmatic actions to improve the efficiency of spectrum sharing throughout federal and non-federal spectrum bands.

Specifically, we encourage NTIA to develop a strategy that seeks to improve the efficient use of spectrum by leveraging shared access whenever possible, either as a stand-alone access

¹ Starry, Inc., is a Boston- and New York-based technology company that is utilizing millimeter waves to re-imagine last-mile broadband access as an alternative to fixed wireline broadband. Starry is currently deploying its proprietary fixed 5G wireless technology in the Boston, Washington, DC, Los Angeles, and Denver areas, with plans to expand to our presence to additional U.S. cities in 2019.

² U.S. Department of Commerce, National Telecommunications and Information Administration, *Developing a Sustainable Spectrum Strategy for America's Future*, 83 FR 65640 (Dec. 21, 2018) (NTIA RFC).

³ For example, the AWS-3 bands (1755-1780 MHz and 1695-1710 MHz), the 600 MHz band, the Citizens Broadband Radio Service (3550-3650 MHz), and all the bands incorporated in the Upper Microwave Flexible Use Service (24 GHz, 28 GHz, 37-40 GHz, and 47.2-48.2 GHz) all rely on some level of spectrum sharing.

solution or in combination with other access solutions; to enhance the availability and use of information about both federal and non-federal spectrum uses and needs, focused on actual or planned deployments; and to consider the costs and benefits of making any spectrum band available for new uses equally on an exclusively-licensed, shared, or unlicensed basis in every instance including through the use of a more objective optimization algorithm.⁴

I. Shared Spectrum is a Cornerstone of Effective and Modern Spectrum Policy, and Will Increase American Innovation and Global Competitiveness

NTIA seeks input on the risks to global competitiveness of U.S. industries associated with spectrum management and policy decisions.⁵ We believe that spectrum management and policy decisions should not be viewed through a lens of minimizing risk, but instead of maximizing opportunity.

The FCC and NTIA, in conjunction with Congress and various Administrations, have made spectrum policy decisions over the last 25 years that have propelled U.S. technology innovation and leadership in wireless. These decisions have not always been made in furtherance of an established goal or within a specific framework, but there are several consistent elements. Clear rights and responsibilities, honesty about users' needs and requirements, largely permissive technical rules, and hard compromise are all prevalent in historic spectrum policy decisions.

Most importantly, thoughtful forward-thinking policies that require policymakers to take some risk to unlock an opportunity is the unifying thread. Consider the early spectrum auctions and the experimentation on various other assignment mechanisms in advance of spectrum auctions; or the very early decisions to allow unlicensed access to specific bands on a non-interference basis with almost zero barriers to entry; or, more recently, leveraging database sharing years before other countries, these all stand out as examples of policy decisions that helped the U.S. lead the world in wireless technology innovation and policy.

⁴ We note that a National Spectrum Strategy could also enhance federal agencies' ability to access auction funds to more broadly study new opportunities for sharing through targeted changes to the Spectrum Relocation Fund (SRF). Congress significantly improved the utility of SRF in the 2015 Spectrum Pipeline Act, and could take additional steps to further incentivize agencies to conduct research on ways to more efficiently use and share spectrum by further decoupling funded research with a future reallocation (necessarily by taking a greater portion of auction proceeds unrelated to federal spectrum earmarked for these activities). *See* Bipartisan Budget Act of 2015, Pub. Law No. 114-74, 129 Stat. 584, Title X (Nov. 2, 2015). This would, however, require Congressional action.

⁵ NTIA RFC at 65641.

Spectrum sharing is a critical part of a comprehensive spectrum strategy that will ensure economic and technical leadership while putting Americans' spectrum resources to the greatest use possible. We believe this is true for two reasons: 1) lower-barrier access to spectrum encourages new firms to provide wireless-enabled services, including consumer broadband; and 2) as a result of a larger user base, a more diverse and robust technology ecosystem will develop and flourish.

First, low-barrier access to spectrum encourages new service providers of varying types to enter the market. Wireless technology has the power to revolutionize industries that directly rely on it – like wireless broadband – and others in which wireless becomes a necessary input over time – like the Internet of Things. The power of low-barrier access is that it enables investment, experimentation, risk taking, and ultimately the proliferation of successful new services and applications. This is largely because a new entrant is not faced with the massive economic barrier of raising capital to purchase spectrum licenses at auction, and instead is able to access spectrum when and where its required.

The Wireless Internet Service Provider (WISP) community is a great example. Most WISPs rely on unlicensed or licensed-light spectrum access to provide their services. Instead of attempting to raise capital or taking on risky debt to finance spectrum acquisition, WISPs can put their capital resources into network construction to better serve their customers. And in many instances, WISPs are the only true broadband providers available in their service areas, playing a critically necessary role in communities across the country. They would largely not exist but for low-barrier access to essential wireless spectrum.

Starry is also a meaningful example of this principle. Starry entered the market as an integrated technology developer and service provider. This is unique in the U.S. and worldwide – Starry is designing, developing, manufacturing, deploying, and operating our own network, all from the ground up. We can do so because of the FCC's and NTIA's pro-innovation decision to make the Lower 37 GHz band available on a licensed-shared basis.⁶ As a result, we have raised more than \$160 million in venture financing, developed our own technology domestically, and provide new competitive broadband service to customers in Boston, Los Angeles, Washington,

⁶ See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services; *Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking*, 33 FCC Rcd 5576 (2018).

D.C., Denver, and New York City. Starry plans to invest even more, building out our network in more than a dozen additional markets in 2019. This investment is a direct result of a decision to make low-barrier access shared spectrum available.

Second, low barrier access to spectrum facilitates wireless innovation. This occurs for two reasons: 1) low-barrier access allows technology developers to take risks in advance of a defined or mature market developing; and 2) low-barrier access increases the diversity of technology buyers.

With low-barrier shared spectrum available, innovators have the freedom to envision and develop new technologies that leverage spectrum but that are not constrained by the existing marketplace. The unlicensed space is the greatest example of this, in which billions of dollars have flowed into a massive ecosystem of diverse and sophisticated devices and providers.

Starry's own technology is a much smaller, but meaningful example of this principle. Because the FCC and NTIA decided to make the Lower 37 GHz band available on a licensed shared basis, Starry focused its resources on developing its own millimeter wave wireless technology, instead of using its resources to attempt to purchase spectrum. And, Starry leveraged the massive unlicensed wireless ecosystem in the process by relying on IEEE 802.11 radios within its base stations and transceivers.

Shared spectrum also helps drive U.S. wireless leadership by stimulating and supporting competition and driving diversity in the supplier ecosystem. Wireless service provider consolidation over time naturally constrains the U.S. technology ecosystem; with fewer buyers, the market sustains fewer suppliers. The result is a homogenized ecosystem that is pushed to thin margins and unable to robustly develop new technology. But with lower-barrier spectrum access schemes, new service providers and new services can develop and evolve, which will stimulate a diverse and robust domestic technology ecosystem.⁷

For these reasons, we strongly suggest that NTIA incorporate shared spectrum access as a fundamental component of the National Spectrum Strategy and believe that doing so is essential to the U.S. retaining its global leadership position in wireless.

⁷ The Citizens Broadband Radio Service provides an instructive example. In a band in which the barriers to entry are low, private LTE networks have become a prevailing use case along with traditional mobile broadband. In addition, a massive equipment and provider ecosystem has developed, with a diverse set of users from mobile wireless providers, to cable operators, to large industrial manufacturers, to WISPs and others. See The CBRS Alliance, <https://www.cbrsalliance.org>. This is a clear and direct result of the Commission's decision to make low-barrier shared spectrum available.

II. Spectrum Policy Requires Accurate, Timely, Updated, and Detailed Information about Current and Future Uses

Both the FCC and NTIA maintain databases that contain some information about the authorized uses in many spectrum bands. The National Spectrum Strategy should focus on enhancing these databases and collecting the best information available on which to make spectrum policy decisions across all bands, and sharing that information as appropriate with all stakeholders.

Spectrum policy decisions generally require policymakers to take an action that effects a set of spectrum users. The existing information about those users vary, but is generally an insufficient basis on which to make a well-reasoned and balanced policy decision. For example, to reallocate federal spectrum, NTIA, the FCC, and effected federal agencies must go through a lengthy process to study the federal systems that might move or share, and the costs of such relocation or sharing.⁸ They must do this every single time a reallocation is made. Similarly, before the FCC makes significant decisions affecting an incumbent non-federal user, it generally seeks to supplement its existing dataset. For instance, within the context of the FCC's ongoing Mid-Band proceeding, it is developing a much more robust dataset concerning the actual satellite usage in the band.⁹

Both NTIA and the FCC can enhance their spectrum policy decision making processes by expanding the amount of information they gather and retain for all systems, not just systems that might be relocating or forced to share a band. This would streamline the decision-making process dramatically and would help identify new opportunities for more intensive spectrum utilization.

With respect to non-federal users, the amount of information in the FCC's Universal Licensing System (ULS) varies depending on the type of access scheme, and is generally commensurate with the information that is necessary to manage an access scheme. For spectrum

⁸ See 47 U.S.C. § 923; U.S. Department of Commerce, National Telecommunications and Information Administration, *Commercial Spectrum Enhancement Act (CSEA) Annual Progress Report For 2017* (June 2018), https://www.ntia.doc.gov/files/ntia/publications/csea_2017_report_june_2018.pdf.

⁹ See Expanding Flexible Use of the 3.7 to 4.2 GHz Band; Expanding Flexible Us in Mid-Band Spectrum Between 3.7 and 24 GHz; Petition for Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission's Rules to Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3.7-4.2 GHz Band; Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Band Shared Between the Fixed Service and the Fixed Satellite Service; *Order and Notice of Proposed Rulemaking*, 33 FCC Rcd 6915 (2018).

licensed on a large geographic basis for flexible use services, there is relatively limited information about the actual spectrum usage at any point in time within the geographic area. For unlicensed spectrum, in which the Commission has made a policy decision that no specific authorization is required and the technical limitations minimize the impact of operations in the band on other operations in the band and in other bands, there is no information about deployed devices and services. And for licensed-light or site-based licensed bands, the Commission requires licensees to provide varying amounts of more detailed information, including location information, transmit power, equipment specifications, and other relevant details necessary to facilitate coordinated shared access.

The information within ULS could be enhanced with information about actual usage, particularly in geographically-licensed bands. It could be enhanced to take in more regular information about all types of deployments, providing a current view of actual usage across a band (or all bands). Simple spectrum analysis could determine the intensity of unlicensed use within a geographic area, which could supplement ULS. With more information about all systems, all stakeholders can help drive towards more efficient and effective decisions.

On the federal side, NTIA maintains a non-public and partially classified database of federal systems that are authorized in a frequency in the Government Master File.¹⁰ This database necessarily includes much more detailed information about the authorized systems because of the way NTIA authorizes federal uses.¹¹ However, this information is, for the most part, not available to non-federal operators and likely has limited distribution within the FCC. Both databases could be enhanced by incorporating more granular and specific information, appending information about future uses, and increasing access to information about federal systems while protecting information classification.

The information in the GMF could be made more widely available while still protecting information classification. NTIA has taken some steps in this direction by releasing its *Quantitative Assessment of Spectrum Usage*.¹² However, it would be more efficient if there were

¹⁰ See U.S. Government Accountability Office, Report to Congress, *Spectrum Management: NTIA Planning and Processes Need Strengthening to Promote the Efficient Use of Spectrum by Federal Agencies*, GAO-11-352 (Apr. 2011); <https://www.gao.gov/new.items/d11352.pdf>.

¹¹ U.S. Department of Commerce, National Telecommunications and Information Administration, *Manual of Regulations and Procedures for Federal Radio Frequency Management* (Sept. 2017).

¹² U.S. Department of Commerce, National Telecommunications and Information Administration, *Quantitative Assessment of Spectrum Usage* (Nov. 2016); https://www.ntia.doc.gov/files/ntia/publications/ntia_quant_assessment_report-no_appendices.pdf

means to release this information as it exists in the GMF without producing separate reports. This could be achieved while still protecting information classification, through obfuscation or other means.

Furthermore, ULS and GMF should be interoperable in order to exchange information between them. ULS and the GMF contain the most complete picture of spectral assignments in the U.S., but they do not aggregate into a coherent database – they must be referenced separately (for the limited community that have access to both). If nothing else, they should be capable of either sharing information among each other, or being queried centrally through an interface that could produce consolidated reports.

Ensuring some level of interoperability between ULS and GMF is essential to implementing modern spectrum sharing decisions. Spectrum sharing technologies – like advanced dynamic databases and sensing – can enhance the frequency, time, power, and geographic dimensions on which spectrum can be shared. These tools should be leveraged not just to improve non-federal sharing, but to facilitate opportunities for better federal/non-federal sharing. To do so, federal systems both need to share more information about their use in a timescale closer to real time, and must be able to receive authorizations in a more streamlined manner.

The need for improved information also applies in the context of future needs, perhaps to an even greater extent. Most spectrum policy debate is focused on future needs and uses, generally with incumbent users (federal or non-federal) pitted against potential new users. The incumbent seeks to maintain the status quo, or if is moving or sharing, seeks to expand the extent of its incumbency to maximize the value it can extract for moving or sharing. The new entrant focuses on national priorities and opaque future needs and demands, but rarely specifically quantifies them. The National Spectrum Strategy should require a regular reporting of the actual current and future needs of federal and non-federal users based on a record developed publicly (to the greatest extent possible) from federal and non-federal users, based on real and accurate needs. This information would be a supplement to the information in ULS and the GMF as the basis on which spectrum policy decisions are made.

Information is critical to effective and efficient spectrum policy decisions, and the National Spectrum Strategy should focus on the collection, retention, and use of a robust dataset

of current and future spectrum uses and needs. This will improve spectrum policy-making and actual spectrum allocation and assignment decisions, leading to greater spectrum efficiency.

III. With More Information, Spectrum Policy Decisions Should be Objectively Optimized Equally Considering the Costs and Benefits of All Possible Access Schemes

As a first principle, spectrum policy is an optimization problem. With a fixed supply of spectrum and a variety of technical, political, and other constraints, policymakers must attempt to optimize for the efficient allocation and assignment of the spectral resource. This algorithm can be significantly enhanced with better information about the current and future uses – both of which are variables and constraints. The algorithm could also pull from vast amounts of government and publicly-available datasets, leveraging enhanced geographical information system data and weather data, for example. With better information, NTIA and the FCC can better optimize their decision-making, as discussed above.

More specifically, with more information NTIA and the FCC could attempt to more objectively make spectrum policy decisions by building a mathematical optimization model that aides in the decision-making process. The optimization model should equally consider the costs and benefits of all available access schemes to generate outcomes primarily focused on optimizing efficient and intensive use of a spectrum band or bands.

NTIA could task the Commerce Spectrum Management Advisory Committee with developing the conceptual framework for the optimization algorithm. Then the Institute for Telecommunications Studies and the National Institute for Standards and Technology could leverage their significant expertise to develop a baseline optimization algorithm that could intake variables and output an optimized allocation decision. The output would help form the basis of a fact-based policy decision regarding an allocation decision.

The algorithm could be continually improved and enhanced over time, starting simply and evolving as information improves and lessons are learned. And, in addition to aiding the specific allocation or assignment decision-making process, it could also be used as a tool for considering variations in licensing or technical rules to further optimize decision-making and spectrum utilization. For instance, given an outcome on which to optimize for, it could consider

all the variants and relationships between power levels of disparate systems to determine spectrum-efficiency optimized outcome.

With better information, the FCC and NTIA have the foundation on which to make the optimal decision, and leveraging on an optimization algorithm can make sense of the data, reduce the decision-making timeline, and could enhance spectrum efficiency and utilization.

IV. Conclusion

Starry strongly supports the development of a modern National Spectrum Strategy and encourages NTIA to make spectrum sharing a fundamental component, along with improved information and enhanced policy-making optimization.

Respectfully submitted,
Starry, Inc.

*Virginia Lam Abrams
Senior Vice President, Communications &
Government Relations*

*Brian Regan
Vice President, Legal, Policy, and Strategy*

Starry, Inc.
38 Chauncy Street, 2nd Floor
Boston, Massachusetts 02111

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