

Mr. John Alden  
Office of Spectrum Management  
National Telecommunications and Information Administration  
U.S. Department of Commerce  
1401 Constitution Avenue NW  
Washington, DC 20230

In the Matter of )  
 )  
Developing a Sustainable ) Docket No. 181130999-8999-01  
Spectrum Strategy for )  
America's Future )

**COMMENTS of RUCKUS NETWORKS,  
a company of ARRIS U.S. HOLDINGS, INC.**

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**COMMENTS of RUCKUS NETWORKS,  
a company of ARRIS U.S. HOLDINGS, INC.**

Ruckus Networks, a company of ARRIS U.S. Holdings, Inc., is pleased to provide these comments in response to the National Telecommunications and Information Administration's (NTIA) Notice requesting comments on the development of a comprehensive, long-term national spectrum strategy.<sup>1</sup>

**I. INTRODUCTION**

Ruckus Networks is a leading provider of wireless infrastructure solutions. We are consistently ranked in the top three manufacturers of Enterprise and Carrier Wi-Fi solutions in both unit volumes and revenues. A recent example of our Wi-Fi leadership was the introduction of the Ruckus R730, the world's first IEEE 802.11ax Wi-Fi Access Point with IoT and LTE expandability.<sup>2</sup>

Ruckus Networks also has been, and continues to be, an active and leading participant in the realization of the innovative vision for the 3.5 GHz Citizens Broadband Radio Service (CBRS). We are active in the Wireless Innovation Forum's (WinnForum) Spectrum Sharing Committee (SSC), serving on the Steering Group and chairing the CBSD Test Task Group within Working Group 4. Ruckus was a founding member of the CBRS Alliance, serves on the Board, currently fills the Presidency, and leads the In-Building Task Group. Ruckus was honored

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<sup>1</sup> DEPARTMENT OF COMMERCE, National Telecommunications and Information Administration, Docket No. 181130999-8999-01, RIN: 0660-XC044, *Developing a Sustainable Spectrum Strategy for America's Future* (Dec. 22, 2018).

<sup>2</sup> <https://www.ruckuswireless.com/press/releases/20180717-new-ruckus-r730-first-iot-and-lte-ready-80211ax-access-point-stadiums-public> .

to receive the Federal Communications Commission’s (FCC) first CBRS Device (CBSD) authorization on September 6, 2018 for our Q710 and Q910 small cell products.<sup>3</sup>

Ruckus Networks proposes the following four principles to help guide NTIA as it prepares the long-term National Spectrum Strategy for submission to the President.

**1. The National Spectrum Strategy Should be Comprehensive**

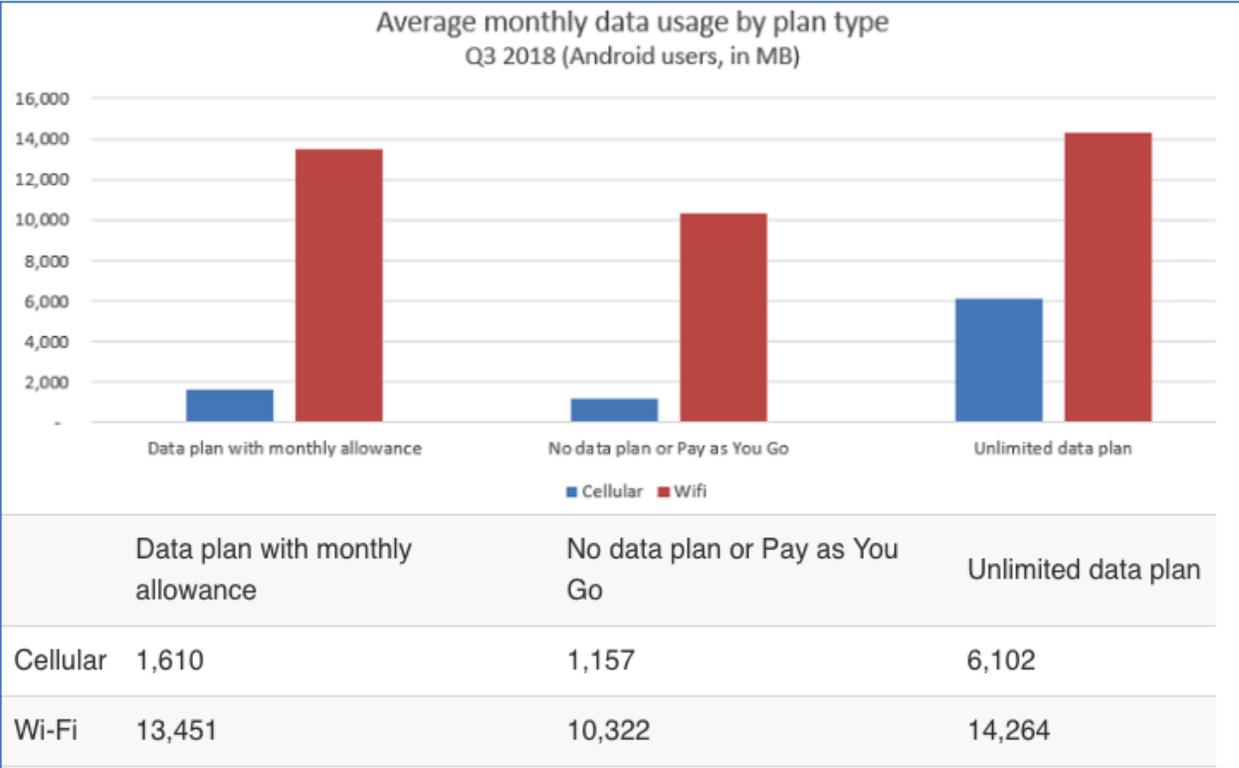
The President’s Memorandum includes an introductory statement that: “*The growth in the availability of mobile wireless broadband connectivity over the past decade has reshaped the American experience—*” and goes on to detail a number of specific ways that our citizens’ lives have been impacted by improved connectivity.<sup>4</sup> Ruckus completely agrees with this statement, but would like to clarify that it is not just mobile wireless connectivity (i.e. mobile cellular networks) that have enabled our nation’s transformation over the last decade. Connectivity by other wireless technologies, including, most prominently, 802.11 Wi-Fi and IEEE 802.15 Bluetooth, coupled with the introduction and resulting mass proliferation of mobile devices (e.g. smartphones, tablets, IoT devices, etc.), has also played a critical role. Due to the prevalence of Wi-Fi technologies in the home, office, and public spaces, and the fact that much of the high-bandwidth consumption (e.g. video streaming) occurs in those locations, Wi-Fi accounts for a much larger percentage of smartphone wireless data usage than cellular.

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<sup>3</sup> <https://www.lightreading.com/mobile/spectrum/ruckus-networks-scores-cbrs-certification/d/d-id/745967> .

<sup>4</sup> Presidential Memorandum, *Developing a Sustainable Spectrum Strategy for America’s Future*, October 25, 2018, Section 1, Paragraph 2.

FierceWireless and Strategy Analytics have been tracking the smartphone data usage of the subscribers of the four leading U.S. mobile operators and determining how much use occurs over the cellular and Wi-Fi networks. The following chart from their most recent report, which was released in October 2018, underscores how Wi-Fi usage predominates.<sup>5</sup>



As shown in the third bar graph above, even when U.S. consumers subscribe to unlimited data plans from their cellular carriers, they utilize Wi-Fi connectivity for more than 70 percent of their total wireless data use.

Ruckus believes that the societal transformations noted in the Memorandum will continue into the next decade. In our increasingly wirelessly-connected world, the demand for spectrum is

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<sup>5</sup> <https://www.fiercewireless.com/wireless/how-much-data-we-re-using-by-network-operator-and-service-plan-q3-2018> .

almost certain to continue increasing dramatically, driven largely by commercial interests and with resulting benefit to our nation's economic prosperity. An adequate supply of spectrum in the low, mid, and high bands will be critical to ensuring our nation competes effectively and remains the leader in wireless technology innovation. Developing and implementing a long-term roadmap for enabling licensed and unlicensed usage across these bands will provide industry with the predictability (i.e. certainty) necessary for ongoing investment and innovation.

The Presidential Memorandum calls for a "balanced" approach to spectrum management.<sup>6</sup> Ruckus respectfully submits that the term "comprehensive" may more appropriately convey the principles that should guide policymaking across differing technologies, spectrum bands, use cases/constituencies, and deployment models. In contrast, "balance" may be construed to imply like-for-like allocations of spectrum based on these various considerations, which may be neither necessary, desirable, nor achievable in many situations.

## **2. The National Spectrum Strategy Should be Flexible**

The Presidential Memorandum repeatedly emphasizes the importance of flexibility, in terms of the approach to spectrum management, spectrum access by the government, models for spectrum management, and spectrum licenses themselves.<sup>7</sup> Ruckus strongly agrees that flexibility in these areas will be critical to the success of our National Spectrum Strategy over the next decade or more.

While a comprehensive spectrum strategy with predictability of spectrum access is a very worthwhile goal, it is also important to note that the wireless technologies and market demands

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<sup>6</sup> Presidential Memorandum at Section 1 – Paragraph 1.

<sup>7</sup> Presidential Memorandum at Section 1 - Paragraph 1, Section 1 – Paragraph 3, Section 4(b).

of 2029 or 2034 are impossible to predict in 2019 with any degree of certainty. Therefore, Ruckus believes that new, flexible spectrum access frameworks that support a dynamic mix of licensed and unlicensed uses of spectrum should be factored into the National Spectrum Strategy. As a component of a comprehensive strategy that also includes the longstanding models for fully licensed and unlicensed spectrum, flexible frameworks can be structured so that they react and adjust to technology advances and market forces over time. The CBRS band provides a model for such a flexible framework, mixing and dynamically reapportioning spectrum among the three tiers of users based upon priority and preemption mechanisms. While the particular sharing mechanisms of CBRS are tailored to the unique protection requirements of the incumbent operations, including Federal uses, the principle of dynamic and flexible allocation of spectrum should be embodied in the National Spectrum Strategy, serving as an elastic cushion to the static allocations.

### **3. The National Spectrum Strategy Should Broadly Assess the Economic Impacts of Spectrum**

The Presidential Memorandum highlights the vital role that spectrum plays in fulfilling the nation's economic goals, enabling economic activity, and improving the global competitiveness of United States industries.<sup>8</sup> Ruckus agrees that the National Spectrum Strategy will help drive our nation's continuing prosperity and competitiveness.

In assessing the economic impacts of spectrum and spectrum policy, Ruckus recommends that contributions to Gross Domestic Product (GDP) and economic surpluses (producer and consumer surpluses) be included as valuation inputs. Assessments and policy directives that focus solely on Treasury revenues from the auctions of spectrum licenses significantly

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<sup>8</sup> Presidential Memorandum at Section 1 – Paragraph 1, Section 1 – Paragraph 3, Section 4(e).

undervalue the total economic impact and also fail to account for the massive economic contributions of unlicensed and licensed-by-rule spectrum.

For instance, a recent report from Telecom Advisory Services estimates the total economic value of Wi-Fi to the United States in 2018 to be \$499.09 billion. The report forecasts that this value will increase to \$993.07 billion in 2023.<sup>9</sup> The fact that there were no auction revenues related to the initial availability of the unlicensed spectrum bands does not mean that their enormous economic impact should be overlooked or neglected in our National Spectrum Strategy or its execution.

Similarly, a 2017 report from economist and former FCC Commissioner Harold Furchtgott-Roth analyzing the economic value of the CBRS band estimated the market value based upon license revenues to be from \$7.5 to \$15.6 billion, but also estimated the consumer surplus value to be from \$8 to \$26 billion.<sup>10</sup> The report also utilized the estimated net present value of consumer surplus in the band as an implicit measurement of the value to incumbent users of not being forced to relocate their operations to other bands.<sup>11</sup> This example demonstrates how a valuation assessment based solely on license revenue may significantly undervalue the economic impact – in this case by at least fifty percent.

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<sup>9</sup> Telecom Advisory Services, *The Economic Value of Wi-Fi: A Global View (2018 and 2023)*, October 2018, at pages 33 and 34.

<sup>10</sup> Harold Furchtgott-Roth, *The Potential Market Value and Consumer Surplus Value of The Citizens Broadband Radio Service (CBRS) at 3550-3700 MHz in the United States*, November 2017, at page 1.

<sup>11</sup> *Ibid* at 13.

As the Presidential Memorandum points out, the National Spectrum Strategy must account for Federal uses for national security, science, safety and other goals.<sup>12</sup> While these Federal uses of spectrum are not usually the result of auctions of spectrum licenses, their importance and value to the nation are assumed. Similarly, the National Spectrum Strategy should assess the value of non-Federal spectrum uses based on broader measurements of economic impact.

**4. The National Spectrum Strategy Should Recognize the Increasing Importance of Spectrum Sharing**

The Presidential Memorandum states that: “*The United States Government shall continue to look for additional opportunities to share spectrum among Federal and non-Federal entities.*”<sup>13</sup> It also specifically includes shared spectrum as an option to increase spectrum access and states that the National Spectrum Strategy should include recommendations on automation capabilities that would better track spectrum allocations and facilitate sharing arrangements and coordination.<sup>14</sup> Ruckus is firmly convinced that spectrum sharing will become an increasingly important tool in the toolkit for policymakers, regulators, and spectrum managers.

As the world’s most popular form of shared spectrum, unlicensed spectrum is already vital to our nation’s interests. As noted previously, unlicensed spectrum carries the great majority of smartphone wireless data traffic over a Wi-Fi airlink. Unlicensed spectrum is also utilized for the primary or only connectivity by a wide variety of other Wi-Fi and Bluetooth products,

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<sup>12</sup> Presidential Memorandum at Section 1 – Paragraph 1.

<sup>13</sup> Presidential Memorandum at Section 1 – Paragraph 4.

<sup>14</sup> Ibid at Section 4(a) and 4(d).

including laptops, tablets, headphones, gaming consoles, televisions, and myriad other IoT devices. Additionally, as Telecom Advisory Services noted in an April 2018 report, the future economic value and demand for unlicensed spectrum will be driven not only by Wi-Fi, but also by other unlicensed IoT and cellular technologies (e.g. LTE Licensed Assisted Access or “LTE-LAA”).<sup>15</sup> This continually shifting mix of uses underscores the versatility and adaptability of shared spectrum when it is made available on an opportunistic or permissive basis for the development and deployment of innovative technologies and services. Unlicensed wireless technologies can also share spectrum resources with protected incumbent services such as the protection of radar systems in the 5 GHz U-NII 2A and U-NII 2C bands via Dynamic Frequency Selection (DFS) mechanisms, or the protection of incumbents via an Automated Frequency Coordination (AFC) function that has been proposed for unlicensed operation in the 5925 to 7125 MHz (i.e. 6 GHz) band.<sup>16</sup>

While unlicensed is certainly the most established example of spectrum sharing, technological advancements in areas such as radio frequency modeling, database coordination, incumbent protection, and deterministic preemption have enabled more sophisticated, dynamic sharing frameworks. Ruckus believes that the National Spectrum Strategy should highlight these types of dynamic sharing frameworks as essential to meeting a number of the goals laid out in the Presidential Memorandum and the NTIA Notice.

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<sup>15</sup> Telecom Advisory Services, *A 2017 Assessment of the Current & Future Economic Value of Unlicensed Spectrum in the United States*, April 2018 at page 2.

<sup>16</sup> Federal Communications Commission, *Notice of Proposed Rulemaking In the Matter of Unlicensed Use of the 6 GHz Band*, October 23, 2018 at 17 and Appendix B - § 15.403(b).

It is important to note that dynamic sharing frameworks can be highly tailored to meet the specific requirements for access to a frequency range, e.g. the particular incumbents to be protected and characteristics of their operations, the types of services and use cases envisioned to be enabled via a new sharing regime, the desire for alignment with similar bands in other areas of the world, etc. Ruckus strongly believes that CBRS has provided a compelling example of the value and efficacy of these dynamic frameworks and that principles learned from the experience with CBRS, detailed further below, can be extrapolated to other frameworks, but also believes that other dynamic sharing frameworks should and will emerge for other bands.

*CBRS has clearly demonstrated that Federal and non-Federal (especially industry) stakeholders can work cooperatively, collaboratively, and effectively to address protection, sharing, and certification challenges.* As the FCC concluded, after noting all the significant progress in operationalizing CBRS, in its November 2, 2018 report to Congress on the status of CBRS, “Collaboration among all of the stakeholders is excellent.”<sup>17</sup> Federal stakeholders include NTIA, the Department of Defense (particularly the United States Navy), and the FCC itself. Non-Federal stakeholders include commercial fixed satellite and fixed wireless access incumbent providers and the large number of industry participants that have come together in multi-stakeholder organizations to commercialize the new access enabled by the CBRS framework. Ruckus agrees with the FCC’s assessment that collaboration had been excellent and believes this collaboration has established a solid foundation for future Federal / non-Federal joint efforts to share spectrum.

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<sup>17</sup> Federal Communications Commission, *Report to Congress Pursuant to Section 1008 of the Spectrum Pipeline Act of 2015, As Amended by the Ray Baum’s Act of 2018*, November 2, 2018 at 25.

*Multi-stakeholder organizations such as the WINnForum and the CBRS Alliance are effective for standardization and commercialization activities of dynamic sharing frameworks and also serve as important industry liaisons to Federal agencies.* The interactions between these industry organizations and Federal entities can encompass many critical topics including protection of Federal incumbents, certification / authorization of sharing components and equipment, and joint studies of new shared bands and frameworks.

*Dynamic sharing frameworks that include permissive or opportunistic access to frequency bands with established, or soon to be established, equipment and supplier ecosystems are very likely to attract significant commercial interest due to the range of use cases and deployment options that such access supports and the attractive economics of mass market equipment.* The General Authorized Access (GAA) tier of access in CBRS, coupled with the alignment of the 3550 – 3700 MHz frequency range with a large and growing ecosystem of LTE equipment globally, has resulted in extremely strong interest from a broad and diverse set of industries. This is reflected in the membership of the CBRS Alliance, which has grown from six founding members in August 2016 to one hundred and twenty members today, with representation from industries including mobile, cable, rural access, industrial, enterprise, hospitality, healthcare, and education.<sup>18</sup>

*CBRS demonstrates the United States' leadership in enabling spectrum access for the 5G era.* As the Presidential Memorandum highlights, fifth-generation (5G) wireless technologies will be characterized by high capacities, low latencies, and high speeds (i.e. data rates), while enabling innovation across diverse sectors of the economy.<sup>19</sup> The performance characteristics of

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<sup>18</sup> <https://www.cbrsalliance.org/about-us/>

<sup>19</sup> Presidential Memorandum at Section 1 – Paragraph 3.

5G will require dense deployments of small cells, both outdoors and indoors. CBRS enables exactly these types of deployments due to its optimization for small cell (i.e. lower power) operation and due to its support for a wide range of use cases. This versatility and flexibility has resulted in CBRS attracting interest from the diverse sectors represented in the memberships of organizations such as the CBRS Alliance and WinnForum. The ability of CBRS to support both public access (e.g. mobile broadband) and private communications (e.g. private LTE) services will result in dense deployments of small cells by a variety of industries, both indoors and outdoors. For these reasons, CBRS is helping position our nation as the leader in facilitating 5G technologies via spectrum policy especially suited for dense small cell deployment.

*The CBRS experience also demonstrates the importance of early engagement between Federal and non-Federal entities when bands are considered for shared use.* The timely and comprehensive (as possible) disclosures of incumbent systems, locations, and operational characteristics are critical to the development of effective protection and sharing mechanisms. The Commerce Spectrum Management Advisory Committee (CSMAC), or an authorized CSMAC subcommittee, could be considered for these types of sharing feasibility studies.

## II. CONCLUSION

Ruckus Networks is very encouraged by the President's direction that a National Spectrum Strategy be developed and the resulting NTIA Notice. We appreciate the opportunity to provide our input on this important undertaking.

Very respectfully,

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