federated wireless

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Mr. Sean Conway
Deputy Chief Counsel
National Telecommunications and Information Administration (NTIA)

Re: Implementation of the National Spectrum Strategy

Dear Mr. Conway –

Federated Wireless, Inc. (Federated Wireless) appreciates the opportunity to provide input on the implementation of the National Spectrum Strategy (NSS).[1] We commend NTIA for its recognition of dynamic spectrum sharing (DSS)[2] and dynamic spectrum management systems (DSMS)[3] as essential tools that will enable the Biden Administration to meet the objectives articulated in the NSS. These objectives include ensuring federal users of spectrum have sufficient access to the resources needed for mission-critical operations; maximizing spectrum access options for a wide range of non-federal users, including consumers, enterprises, and other private network users; encouraging efficient spectrum usage by all users; and fostering innovation and the development of pioneering tools, technologies, and use cases that will achieve the above-mentioned goals.

To jump start the process that will "drive technological innovation (including innovative spectrum sharing technologies); boost U.S. industrial competitiveness; protect the security of the American people; foster scientific advancements; promote digital equity and inclusion; and maintain U.S. leadership in global markets for wireless equipment and services,"[4] Federated Wireless urges NTIA to begin immediately on three keys aspects of the NSS implementation:

1) Introduce DSS in three of the bands identified in the NSS pipeline (3.1-3.45 GHz, 37.0-37.6 GHz, and 7 GHz) for which existing DSMS tools and techniques are

[1] Available at https://www.ntia.gov/sites/default/files/publications/ntia-nss-implementation-public-notice.pdf.

[2] Federated Wireless defines DSS (also referred to as Dynamic Spectrum Access or DSA) as the use of software, cloud-computing, automation, as well as alternative spectrum licensing approaches to enable more efficient use of spectrum by multiple network operators and/or end users.

[3] Federated Wireless defines DSMS as the technology and tools, including cognitive radios, spectrum sensing and environmental sensing technologies, spectrum access systems, and dynamic frequency coordinators, that together support DSS to dramatically improve spectrum utilization, increase the reach and reliability of wireless communication systems, and reduce the cost and complexity of deploying and managing wireless networks.

[4] NSS at 1.

available that can accelerate commercial access while allowing incumbent systems to continue to operate and expand as needed.

2) Engage the private sector to develop automated spectrum management and analysis tools, including "cloud-based spectrum management, AI/ML, advanced antenna technology, open and interoperable network architectures, cognitive transceiver technologies, advanced RF microelectronics, simultaneous transmit and receive, and edge intelligence,"[5] as part of a common spectrum management platform that could be made available to federal agency stakeholders to collect and analyze data about current real-world usage, while taking issues like cybersecurity into account.
3) Invest today in Open RAN projects that focus on operational use cases and address market adoption challenges by small and medium-sized enterprises, can be exported globally, and can become self-sustaining through commercial adoption.

In the following sections, we offer additional details on these three recommended courses of action.

1) Implementing Dynamic Spectrum Sharing in Three Pipeline Bands

Federated Wireless encourages NTIA and other federal agencies to begin work as soon as possible to introduce DSS in three bands identified in the NSS for which current demand exists from both consumer-oriented services as well as private wireless networks, in which global equipment ecosystems are currently developing, and for which existing DSMS solutions can be readily adapted to protect incumbent operations and expedite access by a wide range of new use cases. The three bands we recommend NTIA focus on initially are 3.1-3.45 GHz, 37.0-37.6 GHz, and 7 GHz.

We further recommend that NTIA build on the process established by DoD and the National Spectrum Consortium (NSC), known as the Partnering to Advance Trusted and Holistic Spectrum Solutions (PATHSS), to ensure that all stakeholders have the ability to participate in spectrum studies and solution development. The PATHSS process worked very well in that it sought and incorporated a wide range of views from both a policy and technical perspective. We would recommend, however, encouraging federal agencies to share as much information as possible about incumbent systems in a non-classified setting, much as what occurred during the development of DSMS solutions for the Citizens Broadband Radio Service (CBRS) band. Requiring participants to acquire and maintain security clearances to participate in the PATHSS technical discussions was both costly and time-consuming, and it significantly slowed that group's study.

[5] NSS at 14.

3.1-3.45 GHz. Federated Wireless encourages NTIA and the other federal agencies to engage as soon as possible with private sector experts in DSMS technology and tools to define how the 3.1-3.45 GHz band will be shared with commercial systems and start development of solutions tailored specifically for the band. As the success of the CBRS band has shown, there are existing techniques and processes that can be readily adapted from CBRS to the 3.1-3.45 GHz band. While additional studies regarding incumbent systems are ongoing, work can and should commence in parallel to identify which CBRS sharing tools can be leveraged, adjusted, and optimized for the protection of incumbent 3.1-3.45 GHz systems. By building on existing DSMS solutions, it will speed time to market and allow the phased introduction of new capabilities over time without the need to reimagine the entire system.

37.0-37.6 GHz. The framework for coordinated sharing of the Lower 37 GHz band has not yet been decided and is hindering widespread use by both commercial and federal systems. To accelerate use of these frequencies, meet demonstrated demand, and maintain optionality for future federal use, Federated Wireless encourages NTIA and the FCC to prioritize the development of a sharing approach that leverages DSMS capabilities. The band is already being used on an experimental basis by commercial users for consumer-oriented wireless broadband services. It is also being used by the U.S. Marine Corps and other private wireless users to support a variety of 5G use cases, including data-intensive, latency-sensitive applications such as robotics, telehealth, AR/VR, high-definition video transmission, and holograms.[6] Finalizing a sharing framework using proven DSMS solutions will accelerate the band's use for both federal and non-federal operations.

7.125-8.4 GHz. The 7 GHz band is a near-term opportunity for sharing between federal and non-federal users that should also be prioritized. The lower part of the band is immediately adjacent to the 6 GHz band where the FCC has authorized Part 15 license-exempt device operations on a shared basis. Standard power and outdoor Part 15 devices are able to operate in the 6 GHz band under management of an Automated Frequency Coordination (AFC) system, which ensures protection of incumbent commercial systems. Extension of this sharing framework to the lower part of the 7 GHz band would enable use of an additional 320 MHz channel by devices using Wi-Fi 7 technology. The remainder of the 7 GHz band could also be explored for sharing with commercial licensed, licensed-exempt, or license-by-rule systems using other proven DSMS solutions.

[6] *See* https://www.fiercewireless.com/private-wireless/federated-demo-dod-highlights-benefits-shared-spectrum.

2) Engage the Private Sector to Develop Automated Spectrum Management and Analysis Tools for Use by Federal Agencies

Federated Wireless agrees with NTIA's plans to collect data about federal spectrum use. To accurately understand, model, and measure current as well as anticipated future use of spectrum, real-world measurements (not just modelling) should be used to progressively refine propagation models, use patterns, as well as interference. Visibility into how intensively bands are used will help identify opportunities for improving co-existence, spectrum access, and efficiency.

Commercially available API-enabled DSMS technology embedded with reporting mechanisms can be used for such real-world data gathering, measurement, and validation of actual use. Together with a regular heartbeat or check-in, APIs can be leveraged to report interference, while measurement reports can provide the data and justification necessary to more quickly and automatically resolve interference incidents. API-enabled DSMS technology can also be utilized by incumbent federal users to dynamically reserve and release spectrum in real-time rather than reserving spectrum for longer periods of time than actually necessary. API-enabled DSMS solutions can also accelerate the transition from manual data entry to automation, which will help to minimize the human error factor and streamline operations.

As NTIA considers how to implement DSMS solutions to achieve the goals articulated in the NSS, we recommend that two projects, namely the Federal Spectrum Data System (FSDS) and the Incumbent Informing Capability (IIC), be incorporated into a wholistic plan so that a solid foundation can be laid upon which building blocks can be easily and efficiently added.

By leveraging existing automated DSMS technology to make more intensive sharing of spectrum among federal users, NTIA will have greater visibility into current uses and future needs, make the process of sharing with the commercial sector less burdensome, spur fundamental product research and development that can be ported to the commercial sector, and ensure a more coordinated and comprehensive approach to federal spectrum management.

3) Invest Today in Open RAN Projects That Focus on Market Adoption Challenges

As discussed in our response[7] to NTIA's request for comment on the implementation of the Public Wireless Supply Chain Innovation Fund (Innovation Fund), there are several development hurdles that need to be overcome in the near-term to promote competition in the provision of wireless radio access and network equipment and ultimately in the provision of wireless broadband services, which are key tenants of the NSS. These hurdles include:

- Traditional wireless telecommunications networks rely on a single supplier's proprietary equipment, which has resulted in proprietary end-to-end solutions, "vendor lock-in," and

[7] Submitted January 27, 2023 and available at: https://www.ntia.gov/sites/default/files/publications/federated_wireless.pdf.

limited competition. The virtualization of RAN functions and formation of multi-vendor interoperability will be important initial steps to break this cycle and promote competition.

- Increased access to spectrum by a wide and diverse group of users beyond traditional public mobile network operators (MNOs), which will drive development of a larger and more diverse ecosystem.

- The development of open interfaces to manage network control, configurability, and optimization, which will, in turn, drive the development of applications that will make more efficient use of network and spectrum resources.

- Focus on solving practical commercial use case challenges and rapidly transitioning solutions from testbed to market.

While overcoming the first hurdle has received widespread attention as well as funding, Federated Wireless's comments will focus on the last three development hurdles and the relationship between spectrum access, Open RAN, and the goals of the NSS.

a) Increased Spectrum Access

Access to spectrum is a gating item for the provision of wireless broadband communications services. Historically, the FCC has made spectrum available for wireless broadband services, such as 5G and its predecessor technologies, by auctioning exclusive licenses for different sized, albeit generally large, geographic areas. While today the FCC's service and technical rules are flexible and permit a variety of mobile and fixed use cases by operators with different business models, one obvious result of the FCC's auctions over the past thirty years is that a limited number of large MNOs have acquired rights to utilize spectrum for what is known as 3GPP technologies. This limited number of spectrum license holders, which rely on a single supplier's proprietary end-to-end solutions, has led to suppressed competition in the market for technology and equipment.

In recognition of the limitations of traditional auctions, the FCC developed the rules for the CBRS band that would provide multiple access options to spectrum conducive to 3GPP technology deployments. The CBRS licensing framework has resulted in a record number of users having access to "carrier-grade" spectrum. The CBRS Priority Access License (PAL) auction resulted in 228 entities acquiring licenses, while the CBRS GAA tier has seen some 1200 different users emerge over the four years of commercial operation. The existence of multiple spectrum access options under the CBRS licensing framework, especially the license-by-rule General Authorized Access (GAA) tier and use-or-share PAL rules, has led to increased competition by a diverse set of operators and stimulated investment in innovative business models. It has also spurred the development of

a larger equipment supplier ecosystem where over 40 vendors, many of whom are domestically based, are providing solutions for both PAL licensees and GAA users.

This massive expansion of non-traditional 3GPP network operators is reaching every aspect of the U.S. economy. From agriculture to automotive, manufacturing to media, energy, retail, commercial real estate, in addition to schools, libraries, and civil society groups, private wireless networks are springing up as the result of the combination of easily available spectrum, lower cost equipment, and tailor-made solutions from multiple vendors.[8]

Given the relationship between increased spectrum access and a larger technology and equipment ecosystem, Federated Wireless encourages NTIA to support projects through the Innovation Fund that enable licensing frameworks that will facilitate the broadest range of services and maximize competition by a diverse set of operators. Projects that involve DSMS, for example, should qualify for Innovation Fund support.

b) Common RAN Intelligent Controller (RIC) with Service Management and Orchestration (SMO) Platform

Another challenge to the development of a successful Open RAN capability is the need for a common, open RAN Intelligent Controller (RIC) with Service Management and Orchestration (SMO) capability. Having a commercial-ready, common RIC/SMO platform will facilitate a wide community of developers to build applications to make more efficient use of 5G networks and spectrum on a massive scale and tailored to the use cases needs of various enterprises. Without such a platform, technology and solution development will remain hampered by the limitations associated with the closed, vendor-locked and preferred network configurations of large MNOs and their preferred suppliers.

A RIC/SMO platform that works across multi-vendor reference architectures will enable third party applications to be developed and onboarded quickly and securely, while also being managed and de-conflicted. Such applications will incorporate automation, machine learning, as well as network optimization and configuration to meet the needs of diverse enterprises and government entities. Having access to an integrated, multi-vendor network management capability will support a wide range of different use cases and multi-vendor components and combinations, which is an important aspect of Open RAN.

[8] Examples of the wide variety of private wireless networks enabled by the CBRS shared access licensing framework can be found at links provided in the Appendix.

At this time, there is no single entity or group that has the incentive or resources to create a standardized RIC/SMO platform. Therefore, Federated Wireless recommends that NTIA use the Innovation Fund to support projects that will ensure the development of a common RIC/SMO platform and increase the pace of technology development by a larger group of solution providers.

c) Focus on Solving Practical Commercial Use Case and Operational Challenges

A third obstacle to widespread adoption of Open RAN is a customary concentration of attention and resources on large traditional mobile network requirements, rather than on solving challenges facing a larger, more diverse set of users and use cases. As described above, Federated Wireless maintains that Open RAN adoption will be accelerated when a broader and more diverse community of users have access to spectrum for their broadband connectivity needs.

Additionally, broader adoption will be accelerated when solutions for those diverse users' specific needs can be rapidly developed and implemented in a commercial context. This includes creation of operations-ready reference architectures that are designed as end-to-end solutions and address the security concerns of a multi-vendor RAN environment. These reference architectures should be further complemented by deployment and configuration automation templates that make Open RAN deployments at scale as easy as what DevOps enables for cloud applications today. A vendor neutral approach is critical to avoid siloed solutions that work only with a single vendor's Open RAN stack.

By recognizing that nearly all industries and sectors can benefit from 5G technology advancements and that private wireless networks (not just large MNO networks) will play an increasingly important role in delivering that capability, NTIA can direct Innovation Fund resources towards projects that will solve practical business challenges and speed the transition from testbed to market.

To accelerate schedules and deliverables and leap ahead of global competition in Open RAN, industry needs access to funding today rather than 8-10 years from now. In order to have meaningful impact on U.S. leadership in this space, we recommend that NTIA front-load funding and prioritize projects that have practical outcomes and a focus on commercial readiness while also leveraging multi-vendor Open RAN solutions that facilitate the growth of an ecosystem that includes U.S. vendors with differentiated and disaggregated solutions.

Furthermore, while a portion of NTIA's funding should go to academic grants, the majority should go to small and medium enterprises to address operational and market adoption challenges, such as commercial readiness of development, security, and operations (DevSecOps), scale and availability, enterprise and security integration, monitoring and management, end-to-end testing, etc. Increasing and easing spectrum access for more enterprises to launch commercially relevant capabilities and supporting development of a common vendor-neutral

RIC/SMO platform should be two areas that NTIA funds in the immediate future, which can be exported globally and become self-sustaining.

Conclusion

Federated Wireless appreciates the opportunity to submit these comments on the implementation of the NSS. We stand ready to assist NTIA and other federal agencies to advance dynamic spectrum sharing to ensure both federal and non-federal users have sufficient access to spectrum now and in the future, maximize spectrum access options for the widest and most diverse group of users, and foster innovation that will drive U.S. economic growth and leadership.

Respectfully submitted,

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Appendix

Example Private Wireless Deployments Using CBRS Shared Spectrum

Agriculture

https://www.federatedwireless.com/news/blue-white-robotics-and-federated-wireless-collaborate-with-intel-to-chart-a-new-path-to-autonomous-agriculture-with-flexible-robotics-and-private-wireless/

https://www.celona.io/resources/farmers-use-private-lte-in-cbrs-to-increase-yields

Education/Libraries

https://www.rcrwireless.com/20230526/private-networks/cal-poly-deploys-private-network-neutral-host-capabilities

https://www.privatelteand5g.com/sacramento-city-unified-school-district-using-cbrs-to-go-private/

https://www.fiercewireless.com/private-wireless/google-virginia-tech

https://www.nypl.org/spotlight/nypl-wireless

Energy

https://www.fiercewireless.com/private-wireless/cpchem-deploys-eight-private-lte-networks

https://www.rcrwireless.com/20221102/5g/from-a-standing-start-in-texas-the-story-of-dow-chemicals-multi-site-private-lte-push

Healthcare

https://blinqnetworks.com/case-study-cbrs-lte-healthcare-deployment-montour-county/

https://www.fiercewireless.com/wireless/rf-connect-builds-a-private-cbrs-network-for-covid-healthcare-tents

Manufacturing/Logistics

https://staceyoniot.com/how-john-deere-built-its-own-cellular-network-for-its-factory/

https://www.automation.com/en-us/articles/may-2023/dow-private-cellular-network-empowers-manufacturer

https://4ksolutions.com/news/press-release/team-4k-delivers-private-cbrs-cellular-network-to-us-marines/

Military

https://www.boingo.com/good-stuff/boingo-wireless-to-help-bring-private-5g-to-naval-air-station-whidbey-island/

https://www.federatedwireless.com/news/federated-wireless-oversees-successful-12-million-5g-private-network-pilot-using-shared-spectrum-for-united-states-department-of-defense-2/

Municipal

https://www.fiercewireless.com/private-wireless/ntt-builds-municipal-private-wireless-network-city-las-vegas

https://www.lightreading.com/digital-divide/colorado-muni-fiber-operator-unlocks-smart-city-options-with-private-wireless

https://www.federatedwireless.com/news/federated-wireless-and-city-of-tukwila-launch-innovative-cbrs-private-lte-network-for-student-learning/

https://www.businesswire.com/news/home/20200721005155/en/Fujitsu-Builds-Smart-City-Infrastructure-for-Dublin-Ohio

Real Estate

https://www.federatedwireless.com/news/federated-wireless-to-work-with-jbg-smith-and-aws-on-private-wireless-for-national-landing/

Retail/Hospitality

https://jmawireless.com/jmas-xran-private-lte-cbrs-solution-powers-pioneering-network-for-american-dream-complex/

https://www.fiercewireless.com/private-wireless/caribe-royale-deploys-cbrs-neutral-host-network

Sports

https://www.lightreading.com/private-networks/nfl-coaches-using-private-3-5ghz-cbrs-network

https://www.fiercewireless.com/private-wireless/haslam-sports-group-deploys-private-wireless-celona-2-stadiums-kerravala

Transportation

https://tecknexus.com/5gusecase/private-5g-manufacturing-bmw-spartanburg-facility/

https://airportscouncil.org/2023/06/09/airport-5g-update-leveraging-cbrs-for-smart-operations/

https://www.prnewswire.com/news-releases/minneapolis-st-paul-international-airport-msp-completes-successful-trial-of-cts-cbrs-based-private-wireless-network-as-a-service-301660367.html

https://www.cio.com/article/415822/maersk-embraces-edge-computing-to-revolutionize-supply-chain.html