

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services)	GN Docket No. 14-177
)	
)	
Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands)	IB Docket No. 15-256
)	
)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band)	RM-11664
)	
)	
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)	WT Docket No. 10-112
)	
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Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations)	IB Docket No. 97-95
)	

REPLY COMMENTS OF FEDERATED WIRELESS, INC.

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February 25, 2016

EXECUTIVE SUMMARY

Federated Wireless, an innovator in dynamic spectrum management technologies that will realize the promise of the 2012 PCAST report and enable spectrum sharing regimes that exponentially increase the capacity of our scarce spectrum resources, hereby replies to the comments filed in response to the Commission's NPRM in the above-captioned proceeding. A broad cross-section of commenters agree with Federated Wireless that SAS technology can further the Commission's mission to leverage the propagation characteristics of the mmW bands in a way that allows for dense spatial reuse and ensures robust spectrum utilization. SAS technology represents the fusion and evolution of a number of time-tested technologies—including propagation modeling, radio environment sensing, cloud computing, and cognitive radio—and the Commission should thus use this proceeding to continue this evolution by fully exploiting these technological advancements, not only in the bands proposed in the NPRM, but in high-frequency bands more generally.

A number of commenters also joined Federated Wireless in encouraging the Commission to adopt its proposed hybrid licensing scheme for the 37 GHz band. Providing spectrum rights directly to premises occupants would overcome the obstacles to indoor deployments inherent in exclusive geographic licensing schemes. This would constitute a significant step toward addressing the fact that indoor environments are dramatically underserved by indoor deployments of licensed wireless broadband, despite the fact that the vast majority of wireless use takes place indoors. In addition, this proposal would provide premises occupants access to secure, reliable licensed spectrum, which will only continue to grow in importance as machine-to-machine communications and other bandwidth-intensive applications develop and unlicensed bands become increasingly congested. The Commission should therefore adopt its proposed hybrid licensing scheme for the 37 GHz band, as it will best ensure the availability of meaningful indoor coverage.

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REPLY COMMENTS OF FEDERATED WIRELESS, INC.

Federated Wireless, Inc. (“Federated Wireless”), a leader in the development and implementation of spectrum sharing technology that will unlock the enormous potential of dynamically sharing spectrum resources, hereby replies to the comments filed in the above-

captioned proceeding.¹ Federated Wireless is pleased with the significant record support for two principles it advanced in its initial comments: (1) The Federal Communications Commission (“Commission”) should more broadly apply the framework from the 3550-3700 MHz band (“3.5 GHz Band”) to available bands above 24 GHz; and (2) the Commission should adopt the hybrid licensing scheme proposed for the 37 GHz band, as it will best ensure the availability of meaningful indoor coverage.

I. A BROAD CROSS SECTION OF COMMENTERS AGREE WITH FEDERATED WIRELESS THAT SAS TECHNOLOGIES AND THE REGIME ADOPTED FOR THE 3.5 GHz BAND SHOULD BE APPLIED MORE BROADLY TO THE BANDS ABOVE 24 GHz TO SOLVE THE SPECTRUM CRUNCH.

A. An Important Confluence of Commenters, Including Technology Companies, Carriers and Consumer Groups Agree that the Commission Should More Aggressively Utilize Spectrum Sharing Regimes in the Bands above 24 GHz.

Many commenters joined Federated Wireless in pointing out the extensive array of benefits the broader application of spectrum sharing technologies could provide in the pursuit of a national spectrum management policy that ensures widespread, dense utilization of spectrum and supports the development of future spectrum uses. In particular, Google, Inc. (“Google”), the Microsoft Corporation (“Microsoft”), the Open Technology Institute and Public Knowledge (“OTI/PK”), the National Cable & Telecommunications Association (“NCTA”), Comsearch, and the Consumer Technology Association (“CTA”) each highlighted the value spectrum sharing regimes and technology could bring to the millimeter wave (“mmW”) bands. For instance, Google suggests that “the Commission should extend to these bands its Part 96 framework for intensive, three-tiered sharing.”² Similarly, Microsoft “supports making more licensed and unlicensed spectrum available through any number of means, including dynamic spectrum sharing, in order to keep up with the

¹ See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, GN Docket No. 14-177, IB Docket Nos. 97-95, 15-256, RM-11664, WT Docket No. 10-112, Notice of Proposed Rulemaking, FCC 15-138 (2015) (“NPRM”).

² Comments of Google, Inc., GN Docket No. 14-177 *et al.*, at 4 (filed Jan. 28, 2016) (“Google Comments”).

demand for more data intensive services as well as the increasing number of connected devices that form the Internet of Things.”³ OTI/PK suggest that the Commission “promote widespread access and efficient spectrum re-use of the 28, 37 and 39 GHz bands by adopting a multi-tier spectrum sharing framework similar to the one adopted last year for the 3.5 GHz band.”⁴ Finally, NCTA notes that “[s]pectrum access database technology is already available in the TV bands and is under development for the 3.5 GHz band, and NCTA believes it could be easily adapted to foster efficient shared use of the 28, 37, and 39 GHz bands.”⁵ Federated Wireless agrees and urges the Commission to more fully exploit the advantages of the spectrum sharing regimes identified in 2012 by the President’s Council of Advisors on Science and Technology and first realized in the 3.5 GHz Band, where commercial operations will soon launch.

In addition, the Commission and the majority of commenters observe that the propagation characteristics of mmW spectrum make it particularly well-suited for dense spatial reuse and robust sharing.⁶ A number of commenters agree with Federated Wireless that use of spectrum sharing technologies would allow the Commission to leverage these characteristics in a way that ensures robust utilization of spectrum of the bands above 24 GHz. As CTA notes, “[o]ver the last few years, the Commission has correctly proposed and employed a range of unlicensed, exclusive licenses, licensed-by-rule, and sharing approaches to enable new uses of spectrum, and the Commission should consider whether these approaches would be appropriate to facilitate efficient use of spectrum above 24 GHz.”⁷ These approaches include the three-tier framework administered

³ Comments of Microsoft Corporation, GN Docket No. 14-177 *et al.*, at 2 (filed Jan. 28, 2016) (“Microsoft Comments”).

⁴ Comments of the Open Technology Institute and Public Knowledge, GN Docket No. 14-177 *et al.*, at 2 (filed Jan. 28, 2016) (“OTI/PK Comments”).

⁵ Comments of the National Cable and Telecommunications Association, GN Docket No. 14-177 *et al.*, at 12 (filed Jan. 28, 2016) (“NCTA Comments”).

⁶ NPRM at para. 212; *see also* OTI/PK Comments at 11; Google Comments at 2-3.

⁷ Comments of the Consumer Technology Association, GN Docket No. 14-177 *et al.*, at 7 (filed Jan. 27, 2016).

by a Spectrum Access System (“SAS”) implemented for the 3.5 GHz Band, but also more generally include database systems that dynamically allocate spectrum and provide interference protection based on the sensed operational environment and propagation characteristics of the spectrum. As Comsearch points out, “there are several sharing mechanisms that can be employed to facilitate robust sharing of the numerous systems in the UMFUS, both incumbent and proposed.”⁸

Federated Wireless agrees that “many of these mechanisms could also be used to enable sharing across all UMFUS bands and the Commission should entertain all feasible sharing mechanisms.”⁹ A SAS approach to managing sharing in the mmW bands would ensure that spectrum is efficiently allocated among potential uses across the country, particularly in view of the fact that “[t]errestrial base stations for mobile operations in the mmW bands will likely have small coverage areas and limited aggregate coverage . . . leaving expansive territory available for satellite [and other] operators to make opportunistic use of the same spectrum in nearby areas, based on information regarding the locations and frequencies of terrestrial base stations.”¹⁰ Managing uses in the mmW bands by mobile wireless and other users by deploying a SAS is consistent with what the SAS will accomplish in the 3.5 GHz Band, and the points raised by these commenters make plain the applicability and value of SAS technology to a mmW band spectrum sharing regime.

Moreover, as Federated Wireless made clear in its initial comments, SAS technologies can, in addition to enabling spatial reuse and spectrum sharing between disparate uses: (1) remove the guesswork inherent in traditional licensing schemes by allowing the Commission to simply set baseline technical rules for a particular spectrum band, which allows use cases to develop organically and obviates the current need for the Commission to guess at future use cases; (2) enforce operational requirements and rapidly implement any Commission modifications to those

⁸ Comments of Comsearch, GN Docket No. 14-177 *et al.*, at 3 (filed Jan. 26, 2016).

⁹ *Id.*

¹⁰ NPRM at para. 151.

requirements; (3) improve speed to market over the timeframes typical of traditional licensing schemes; (4) seamlessly protect and transition incumbent uses as new service rules are adopted; and (5) simplify regulatory compliance for device manufacturers and users by dictating power levels, frequencies, and other operational parameters.¹¹

A number of commenters also joined Federated Wireless in encouraging the Commission to allow opportunistic access to mmW spectrum immediately rather than waiting five years for a “use it or share it” obligation to become effective. Federated Wireless agrees with OTI/PK that “a robust ‘use-or-share’ obligation on licensees would accomplish a number of objectives, including more intensive use of fallow spectrum capacity, lowering barriers of entry to a diverse uses and users, and providing added incentives for licensees to construct and operate facilities.”¹² A SAS could manage opportunistic use as licensees develop and deploy necessary infrastructure, and provide interference protection to licensees—just as it does for Priority Access Licensees in the 3.5 GHz Band—as their operations ramp up. Thus, “there is no downside if a SAS ensures licensed operators are protected from harmful interference once they commence service.”¹³ Furthermore, NCTA points out that the proposed five-year buildout period preceding a licensee’s “use it or share it” obligation could significantly deter investment in unlicensed technologies in the band, undercutting the Commission’s goal to facilitate widespread sharing among disparate users of spectrum.¹⁴ Federated Wireless agrees with these commenters and encourages the Commission to authorize immediate opportunistic use of the Upper Microwave Flexible Use Service spectrum, coordinated by a SAS or similar platform.

In view of the significant evidence and broad support in the record demonstrating the benefits to be gained by the wider application of spectrum sharing technologies in high-frequency

¹¹ See Comments of Federated Wireless, Inc., GN Docket No. 14-177 *et al.*, at 8-15 (filed Jan. 27, 2016) (“Federated Wireless Comments”).

¹² OTI/PK Comments at 6.

¹³ *Id.*

¹⁴ NCTA Comments at 10.

bands such as the mmW spectrum above 24 GHz, Federated Wireless urges the Commission to exploit these technologies and the advantages they offer without delay.

B. A Few Commenters Argue in Favor of Traditional Licensing Because SAS Technologies are Untested, but Traditional Approaches Lead to Significant Delays in Spectrum Deployment and Are Not in the Public Interest.

A handful of commenters argue that the Spectrum Frontiers proceeding should produce licensing and service rules in keeping with the Commission’s traditional approaches, rather than seek to advance spectrum management through the use of tools such as SAS technologies.¹⁵ As Federated Wireless has pointed out, use of exclusive licensing regimes has led to decades-long delays as auctions are conducted, standards are fleshed out, and equipment developed and manufactured—as starkly illustrated in the case of the 700 MHz band, licensed under the Part 27 rules. Furthermore, if the service rules implemented under a traditional exclusive licensing scheme anticipate the development of a market that is never realized, the spectrum will lie fallow in the hands of the licensees or the Commission, as has been the case in the 28 and 39 GHz bands. It would make little sense for the Commission to follow the same steps that led to the underutilization of mmW spectrum in the first instance and again license the spectrum under a traditional approach when it has at its disposal tools to more readily support and respond to ongoing innovation in these bands.

To the extent that commenters object to the application of SAS technologies to the mmW bands on the grounds that the technology is “untested,”¹⁶ Federated Wireless acknowledges that a SAS is a recent innovation, but its technological underpinnings—including propagation modeling, radio environment sensing, cloud computing, and cognitive radio—are not. These are well known,

¹⁵ For example, CTIA suggests that the Commission “make bands above 24 GHz available predominantly on a licensed, exclusive use basis and should build upon the successful rules governing mobile services in Part 27 of the Commission’s rules,” while Qualcomm contends that “tried and true techniques should be applied to the millimeter wave bands, particularly at this early stage of equipment development and service deployments.” CTIA Comments at 3; Qualcomm Comments at 14.

¹⁶ Comments of AT&T, Inc., GN Docket No. 14-177 *et al.*, at 14 (filed Jan. 28, 2016) (“AT&T Comments”).

proven technologies widely used throughout the information and communications technology sector. The SAS represents a fusion of these technologies rather than a completely new and unproven technology.¹⁷ Federated Wireless also notes that the Commission has already initiated its process to certify SAS Administrators for the 3.5 GHz Band. Initial applications are due April 15, 2016, and through this process the Commission will gain a wealth of further knowledge on the functioning and valuable capabilities of SAS and Environmental Sensing Capability (“ESC”) technologies well before the Spectrum Frontiers proceeding is concluded.

Some commenters also argue that “complex models” such as the SAS-enabled sharing framework in the 3.5 GHz Band “take time to develop, and attempting to impose such brand-new sharing experiments in the priority mmW bands for 5G would inevitably create delays and uncertainties. The Commission should thus keep an open mind about similar approaches for mmW bands, but only for the additional mmW bands that it plans to repurpose around the corner—not for the priority bands it identifies for immediate and simple repurposing.”¹⁸ The claim of delays, however, is unfounded, as the sharing regime of the 3.5 GHz Band will have gone from Commission proposal to commercial operations in just under four years upon launch later this year. This clearly demonstrates that shared use and light licensing, administered by a SAS or similar platform, is the fastest and most flexible path to market. Furthermore, arguments that spectrum sharing will delay use of priority bands disregard the fact that 5G standards are not even expected until 2020, whereas SAS technology is here now and capable of managing operations in the mmW bands whenever 5G standards are finalized.

¹⁷ See, e.g., Jillian D’Onfro, *We just got a new hint about Google’s plans to beam super-fast Internet to your home*, BUSINESS INSIDER (Feb. 17, 2016) (detailing Google’s trials of wireless broadband at 3.5 GHz), available at <http://www.businessinsider.com/google-experimental-broadband-networks-test-in-kansas-city-2016-2> (last accessed Feb. 24, 2016).

¹⁸ *Id.* at 4-5.

Federated Wireless agrees with Verizon that flexible secondary market rules should be applied for flexible use licensed bands.¹⁹ However, the sheer volume of secondary markets transactions—and attendant coordination of operations among various licensees and lessees in each service area—necessary to achieve the level of sharing the Commission seeks in this proceeding would likely overwhelm licensees, lessees, Commission staff, and ULS. To avoid such paralysis—the likely outcome of which would be that indoor environments remain largely unable to access licensed wireless broadband spectrum—full sharing via secondary markets transactions would require the use of a SAS or similar platform operating as a dynamic frequency coordinator. In fact, the secondary markets context is yet another illustration of the flexibility of SAS technology to support new applications and the further evolution of the market. A SAS could readily take on such a management and coordination role among parties to secondary market transactions, leveraging the same technologies used in administering sharing regimes to enforce the provisions of these transactions and ensure that licensees and lessees gain the full benefits of their leasing, partitioning, or disaggregation agreements.

Finally, Federated Wireless encourages the commenters expressing reservations about the functioning of these technologies to avail themselves of the resources provided by the Spectrum Sharing Committee of the Wireless Innovation Forum, and to participate in the Committee themselves, if they are not already doing so. The Committee was established to support the development of sharing technologies not only in the 3.5 GHz Band, but in all bands that SAS technology could benefit, such as the mmW bands at issue in this proceeding. Federated Wireless looks forward to working with its partners in pursuit of these goals.

¹⁹ Comments of Verizon, GN Docket No. 14-177 *et al.*, at 2 (filed Jan. 28, 2016) (“Verizon Comments”).

II. COMMENTERS ALSO AGREE WITH FEDERATED WIRELESS THAT THE COMMISSION SHOULD ADOPT THE HYBRID LICENSING SCHEME PROPOSED FOR THE 37 GHz BAND BECAUSE IT WILL EFFICIENTLY ALLOCATE SPECTRUM FOR INDOOR USES, SUPPORT AN IMPORTANT SERVICE NEED, AND EXPLOIT THE NATURAL PROPAGATION CHARACTERISTICS OF THE BAND.

Microsoft, OTI/PK, Huawei, Rockwell Automation, and Cisco joined Federated Wireless in supporting the Commission’s proposed hybrid licensing scheme for the 37 GHz band to convey licensed-by-rule “local area” operating rights for indoor use by premises occupants and, separately, award geographic area licenses for wide area use. Federated Wireless agrees that there is “tremendous benefit in making some spectrum available to property owners for local area networks.”²⁰ As Cisco points out, “there is a marketplace need for privately deployed networks that support advanced enterprise applications.”²¹ This is particularly so where there is a need for “secure and reliable services for critical operations among enterprise, industrial and public service-based (i.e., hospital) users.”²²

Certain commenters object to the proposed hybrid licensing scheme on the grounds that it is “untested, unproven, and extraordinarily complex.”²³ Verizon observes that “licensees whose business plans involve providing both outdoor and indoor coverage would need to negotiate a patchwork of agreements with various building owners and tenants within their service territories.”²⁴ However, under an exclusive geographic licensing scheme in the mmW bands, carriers seeking to provide indoor coverage would likewise have to negotiate a “patchwork” of agreements for access rights to the facilities. The mmW bands are highly susceptible to signal attenuation by building

²⁰ Microsoft Comments at 18.

²¹ Comments of Cisco Systems, Inc., GN Docket No. 14-177 *et al.*, at 7 (filed Jan. 28, 2016).

²² Comments of Huawei Technologies, Inc. (USA) and Huawei Technologies Co., Ltd., GN Docket No. 14-177 *et al.*, at 18 (filed Jan. 28, 2016).

²³ Comments of Mobile Future, GN Docket No. 14-177 *et al.*, at 11 (filed Jan. 27, 2016).

²⁴ Verizon Comments at 8.

features such as walls and windows. As a result, carriers typically will not be able to provide sufficient coverage indoors with only outdoor systems, requiring carriers that want to provide indoor coverage to contact building owners to negotiate both access rights for indoor system installation and secondary markets transactions to make their spectrum available in the facility.

Providing spectrum rights directly to the premises occupants removes the need for both of these negotiations, as they would already possess both facility access and spectrum usage rights. In addition, as Federated Wireless has previously explained, the traditional approach of awarding exclusive, geographic area mobile rights has left indoor environments woefully underserved, with just 2% having internal access to licensed wireless broadband. In view of this fact, and ever-growing congestion in the unlicensed Wi-Fi bands, providing indoor spectrum rights to premises occupants would constitute sound policy and demonstrate a commitment to ensure broader availability of wireless broadband indoors, where, as the Commission has noted, the vast majority of wireless use takes place.²⁵

In addition, these indoor systems can be developed and deployed using infrastructure and devices common to the outdoor system deployments in the mmW bands. With a band interoperability mandate in the 37 GHz band, as is the case in the 3.5 GHz Band, the hybrid licensing scheme could create the opportunity for carriers to extend the reach of their networks and for building owners to participate in the technology and scale that carriers enjoy. By allowing carriers to extend their networks in this way, the hybrid licensing scheme increases usage of carriers' services, to their direct benefit. By allowing premises occupants access to the technology and scale generally reserved to the largest carriers, the hybrid licensing scheme will lower costs and better ensure the availability of robust indoor coverage.

²⁵ NPRM at para. 11.

Although the Commission seeks in this proceeding to expand unlicensed band allocations, there is no certainty that the consumer device ecosystem that exists today—characterized by smartphones and tablets equipped with chipsets that are able to support both licensed LTE and unlicensed Wi-Fi connections—will remain the dominant paradigm upon the advent of new 5G technologies and standards. Without a clear path to access licensed spectrum such as the hybrid scheme proposed for the 37 GHz band, enterprises face the prospect that the functioning of devices in heavy use by their workforce may be wholly dependent on connectivity to a carrier’s network for 5G services, leaving them in the same circumstances that have led 98% of indoor environments to be unserved by indoor wireless broadband deployments.

Finally, to the extent that commenters base their objections to the hybrid licensing scheme on interference concerns, a tiered framework in which the outdoor, geographic area licensee is protected against interference from premises occupants operations could provide the technical certainty these commenters seek. Under such a framework, geographic area licensees would occupy the primary tier and receive explicit protection from operations by users in the second tier, comprised entirely of authorized premises occupants. A SAS would manage operations, prevent interference from indoor operations to outdoor licensees’ systems, and as all systems are registered with the SAS, interference claims could readily be resolved.

III. CONCLUSION

Federated Wireless commends the Commission for seeking to move into new spectrum frontiers in this proceeding, and urges it to do so promptly by leveraging the innovative tools and regulatory schemes the Commission is embracing in other bands, such as the 3.5 GHz Band. In order to ensure robust spectrum utilization and maintain the United States’ global leadership position in the wireless industry, the Commission should heed the comments of Google, Microsoft, OTI/PK, NCTA, and others who agree with Federated Wireless that the Commission should: (1)

more broadly apply the framework from the 3.5 GHz Band to available bands above 24 GHz; and
(2) adopt the hybrid licensing scheme proposed for the 37 GHz band, as it will best ensure the availability of meaningful indoor coverage.

Respectfully submitted,

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