

**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

Amendment of the Commission's Rules
Regarding the 37.0-38.6 GHz and 38.6-40.0
GHz Bands

ET Docket No. 95-183
(Terminated)

Implementation of Section 309(j) of the
Communications Act – Competitive Bidding,
37.0-38.6 GHz and 38.6-40.0 GHz Bands

PP Docket No. 93-253
(Terminated)

Petition for Rulemaking of the Fixed Wireless
Communications Coalition to Create Service
Rules for the 42-43.5 GHz Band

RM-11664

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Table of Contents

Introduction and Summary	1
Discussion	1
I. A balanced approach to licensed, unlicensed, and shared use will best promote regulatory and technical innovation in the high-frequency bands.....	1
II. The high-frequency bands present an important opportunity to pursue spectrum sharing.	4
III. The high-frequency bands are well-suited to supporting experimentation and innovative uses.	9
Conclusion.....	11

Introduction and Summary

In its *Notice of Inquiry (Notice)* initiating this proceeding, the Commission observes that the frequency bands above 24 GHz can support a diversity of radio access technologies and facilitate the “emergence of a new and radically more capable generation of wireless mobile service.”¹ Indeed, as spectrum needs for wireless broadband continue to increase, higher-frequency spectrum has emerged as a potentially important complement to existing wireless allocations. In developing policy for the bands discussed in the *Notice* (collectively, the “high-frequency bands”), the Commission should recognize that these high-frequency bands represent an opportunity for regulatory as well as technical innovation. In particular, the Commission should enable spectrum sharing in these bands and designate sufficient spectrum to support emerging and innovative services and platforms.

Discussion

I. A balanced approach to licensed, unlicensed, and shared use will best promote regulatory and technical innovation in the high-frequency bands.

To make spectrum available to meet consumers’ increasing demands for wireless data, the Commission has to date pursued a successful, balanced approach to spectrum allocation. This includes a balance between licensed and unlicensed allocations, as well as between exclusive and shared access. Primary access to licensed spectrum provides the certainty major operators need to make large, long-term investments in wide-area networks, while broad eligibility for access to unlicensed spectrum fosters widespread contributions to innovation and fast-paced investment in emerging technologies. For instance, because unlicensed devices are “free from the

¹ *In the Matter of Use of Spectrum Bands above 24 GHz For Mobile Radio Services, et al.*, Notice of Inquiry, 29 FCC Rcd. 13020, ¶¶ 7, 13, 15 (2014) (*Notice*).

burden of the normal delays associated with the licensing process,” manufacturers can design equipment to “fill a unique need [that can] be introduced into the marketplace rather quickly.”² In addition, where clearing bands for exclusive broadband use is not feasible, sharing techniques have enabled increased spectrum utilization without disrupting incumbent operations. This strategy has fueled the wireless economy, benefiting consumers, innovators, and investors.

Much of the discussion in the *Notice* focuses on the high-frequency bands as a complement to or extension of traditional macrocell networks.³ There is no doubt that exclusive licensing of spectrum in large geographic areas, for substantial license terms, will continue to be an important part of the overall plan for meeting the nation’s wireless broadband needs. But attempting to “extend . . . the status quo” for many lower-frequency bands to spectrum above 24 GHz would be neither efficient nor successful.⁴ The high-frequency bands have different propagation characteristics than the lower-frequency spectrum that is most often used for wireless broadband today. Many of the high-frequency bands, moreover, will be partially encumbered for years to come. The Commission has an opportunity to adopt new approaches that make these bands

² Kenneth R. Carter, Ahmed Lahjouji, & Neal McNeil, FCC, *Unlicensed and Unshackled: A Joint OSP-OET White Paper on Unlicensed Devices and Their Regulatory Issues*, OSP Working Paper Series at 5 (May 2003).

³ See, e.g., *Notice* ¶ 11 (discussing progress in cellular technology in the 39 GHz band); *Id.* ¶ 27 (discussing millimeter wave operations as a “supplementary component” to a cellular network); *Id.* ¶ 19 (discussing base stations configurations in light of the requirements for 3G and 4G systems managed by today’s licensed network operators). In general, the *Notice* discusses “5G” technologies for this band, which—while undefined—are characterized generally as an extension of 3G and 4G technologies. 3G and 4G networks are largely macro-cell operated by licensed mobile broadband providers.

⁴ *Id.* ¶ 92.

commercially usable despite these differences. Indeed, while large mobile broadband providers have expressed a preference for clearing and licensing spectrum below 3 GHz, they have recognized that higher-frequency spectrum represent a fertile field for innovation in spectrum policy.⁵ For example, AT&T and Verizon have supported a three-tier framework for wireless use of the 3550-3700 MHz spectrum, which would allow existing incumbents, new wireless licensees, and opportunistic users to make intensive use of that band.⁶ Similarly, CTIA recommends opening up the 5 GHz band for a new generation of unlicensed technologies.⁷ As Chairman Wheeler and other Commissioners have emphasized, “[a]n effective spectrum strategy requires an all-of-the-above approach.”⁸ This proceeding presents a key opportunity to create more

⁵ Stacey Black, *Spectrum Sharing Models above 3 GHz*, Aug. 6, 2013, <http://www.attpublicpolicy.com/fcc/spectrum-sharing-models-above-3-ghz/>.

⁶ Letter from Joan Marsh, AT&T Services, Inc., and Austin Schlick, Google Inc., to Mignon Clyburn, Acting Chairwoman, FCC, GN Docket No. 12-354, Aug. 6, 2013; see Verizon Comments on Further Notice of Proposed Rulemaking, GN Docket No. 12-354, July 14, 2014 (supporting a three-tier framework but suggesting a staged approach in which some of the 3.5 GHz band would be available for three-tiered use immediately and some would initially be reserved for two-tier use).

⁷ See, e.g., Scott Bergman, *CTIA Statement on the FCC’s March Open Meeting*, Mar. 31, 2014, <http://blog.ctia.org/2014/03/31/fcc-march-open-meeting/>; Meredith Attwell Baker, *CTIA Statement on U.S. Senators Rubio and Booker 5 GHz Band Legislation*, June 20, 2014, <http://blog.ctia.org/2014/06/20/rubio-and-booker-5ghz-band/>.

⁸ Statement of Chairman Tom Wheeler, *In the Matter of Use of Spectrum Bands above 24 GHz for Mobile Radio Services, et al.*, GN Docket No. 14-177 (Oct. 17, 2014); see also Statement of Commissioner Mignon L. Clyburn, *In the Matter of Use of Spectrum Bands above 24 GHz for Mobile Radio Services, et al.*, GN Docket No. 14-177 (Oct. 17, 2014) (recognizing the need to “spur creative ideas for the best licensing and authorization blueprints on mobile operations above 24 GHz”); Statement of Commissioner Jessica Rosenworcel, *In the Matter of Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, ET Docket No 13-49 (Apr. 1, 2014) (recognizing the need for a variety of licensing schemes and policy approaches to support growth of the wireless broadband ecosystem); Statement of Commissioner Ajit Pai, *In the Matter of Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National*

options for the all-of-the-above approach by expanding the set of regulatory and technical tools with which the Commission can meet increasing demand for wireless bandwidth.

II. The high-frequency bands present an important opportunity to pursue spectrum sharing.

The Commission should consider methods for enabling sharing among a variety of users in these bands. The Commission's experience with sharing demonstrates its promise, and the characteristics of the high-frequency bands make them well-suited for shared use.

Spectrum sharing in the high-frequency bands can build on the Commission's existing use of dynamic spectrum access to improve spectrum utilization. The Commission has recognized that relying solely on the "traditional practice of clearing portions of federally held spectrum for exclusive commercial use" will not allow it to meet the nation's growing spectrum needs.⁹ Based on this recognition, it has pursued a variety of sharing initiatives: For example, the Commission has enabled unlicensed use of broadcast television spectrum on a shared basis with incumbent broadcasters and other protected entities, thereby allowing unlicensed devices to access television channels when and where the channels are not being

Information Infrastructure (U-NII) Devices in the 5 GHz Band, ET Docket No 13-49 (Apr. 1, 2014) (recognizing the importance of spectrum sharing in enabling greater access to spectrum for unlicensed devices); Statement of Commissioner Michael O'Rielly, *In the Matter of Use of Spectrum Bands above 24 GHz for Mobile Radio Services, et al.*, GN Docket No. 14-177 (Oct. 17, 2014) (recognizing that the Notice of Inquiry must be open to a variety of possibilities because "no one in this room knows where it will eventually take us").

⁹ *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking, 27 FCC Rcd. 15594, ¶ 40 (2012) (3.5 GHz NPRM).

used.¹⁰ Seizing that opportunity, the Institute for Electrical and Electronics Engineers (IEEE) recently developed a standard specifically for wireless use of vacant broadcast channels, or white spaces.¹¹ Commercial deployments in the white spaces spectrum power Wi-Fi for college campuses,¹² bring broadband to public spaces,¹³ and enable smart-city applications like energy consumption monitoring, water quality monitoring, and traffic management.¹⁴ Trials are exploring how the technology can be used in disaster relief situations.¹⁵

The Commission also is approaching completion of a proceeding to enable wireless broadband use on a shared basis in the 3550-3700 MHz band.¹⁶ In that proceeding, the Commission proposed that a spectrum access system (SAS) manage three tiers of users—incumbents, priority access users, and general authorized access users.¹⁷ Such an approach will require priority and general authorized access services

¹⁰ See 47 C.F.R. Part 15, Subpart H.

¹¹ IEEE, Official IEEE 802.11 Working Group Project Timelines - 2014-11-11, http://www.ieee802.org/11/Reports/802.11_Timelines.htm (last visited Jan. 14, 2015).

¹² Alan Norman, *Launching Our Spectrum Database to Help Users Dynamically Access TV White Space Spectrum*, Nov. 14, 2013, <http://googlepublicpolicy.blogspot.com/2013/11/launching-our-spectrum-database-to-help.html>.

¹³ Lyndsey Gilpin, *White Space Broadband: 10 Communities Doing Big Projects*, TECHREPUBLIC, Mar. 19, 2014, <http://www.techrepublic.com/article/white-space-broadband-10-communities-doing-big-projects/>.

¹⁴ *Id.*; see also Amar Toor, North Carolina Launches FCC-approved TV White Space Network in Wilmington, ENGADGET, Jan 30, 2012, <http://www.engadget.com/2012/01/30/north-carolina-launches-fcc-approved-tv-white-space-network-in-w/>.

¹⁵ See Gilpin, *supra* note 13 (discussing trials in Pascagoula, Mississippi, and Visayas, Philippines).

¹⁶ 3.5 GHz NPRM.

¹⁷ *Id.*

to avoid interference to incumbent military and non-governmental users.¹⁸ Private sector interest has been strong. The FCC convened a meeting in 2014 to discuss the design and characteristics of SAS infrastructure for managing multiple tiers in the band, and Alcatel-Lucent, BAE Systems, CableLabs, Cisco, Comsearch, Google, iconectiv, Intel, Microsoft, Nokia, Qualcomm, Spectrum Bridge, T-Mobile, and Verizon all participated.¹⁹ Since then, Google has demonstrated a prototype of its own SAS, which can facilitate three tiers of users, protect incumbent users on a real-time basis, use information regarding the characteristics of incumbent operations to provide site-specific, tailored protection against harmful interference, and make adjustments based on the aggregate presence of priority and general authorized access users.²⁰

Earlier this year, the Commission also took steps to make 5 GHz spectrum more usable for broadband. As industry has recognized, the Commission's recent changes to the rules for the 5150-5250 MHz band will drive a "substantially faster Wi-Fi experience" for American consumers while protecting Globalstar's operations in the same

¹⁸ *Id.* at ¶¶ 22-25, 65-69.

¹⁹ *FCC Wireless Telecommunications Bureau and Office of Engineering and Technology Announce Agenda for Workshop to Discuss the Creation of a Spectrum Access System in the 3.5 GHz Band*, Public Notice, 29 FCC Rcd. 174 (2014).

²⁰ *See, e.g.,* Reply Comments of Google Inc. on the Further Notice of Proposed Rulemaking, GN Docket No. 12-354, Aug. 15, 2014, App. B (Declaration of Preston Marshall, Ph.D.).

frequencies.²¹ Freeing spectrum in the 5350-5470 MHz band for unlicensed use will also require some level of dynamic sharing with a variety of incumbent users.²²

The high-frequency bands are especially suitable for shared and unlicensed use. The high-frequency bands represent an opportunity to develop further the sharing practices and expansion of unlicensed use that will be required for the Commission to meet the growing demand for wireless capacity. As the Commission recognizes in the *Notice*, “most of the candidate bands above 24 GHz are already shared, and most likely, will continue to be shared by other services.”²³ For instance, Local Multipoint Distribution Service (LMDS) bands already share spectrum with satellite services in the 27.5-28.35 GHz and 29.1-29.25 GHz bands. Similarly, a number of government and commercial services share the 37-38.6 GHz and 42-42.5 GHz bands, and the *Notice* recognizes that “sharing arrangements [will need to be established] to promote the development of innovative commercial wireless services” in these frequencies.²⁴ Federal-commercial coordination is well-established in the 70, 80, and 90 GHz bands as well.²⁵ Therefore, the foundation for sharing the high-frequency bands is already firmly constructed.

²¹ Steve Donohoe, *Comcast, NCTA Cheer 5 GHz Wi-Fi Order*, FIERCECABLE, Mar. 31, 2014, <http://www.fiercecable.com/story/comcast-ncta-cheer-fcc-5-ghz-wi-fi-order/2014-03-31>.

²² See *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 1769, ¶ 2 (2013) (proposing to allow unlicensed use of the 5350-5470 MHz band).

²³ *Notice* ¶ 46.

²⁴ See *Notice* at ¶ 66.

²⁵ See *Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, Report and Order, 18 FCC Rcd. 23318 (2003); *Allocations and Service Rules for*

Moreover, even if each of the bands discussed in the *Notice* were home to only one type of use today, the existing services would still need to be accommodated as new commercial uses are introduced, whether through sharing or reallocation. Given the difficulties of relocating existing services,²⁶ it is likely that sharing will provide the fastest path to enabling intensive wireless broadband use in these bands.

From a technical perspective, sharing the high-frequency bands is relatively easy to accomplish. While much of the research cited in the *Notice* focuses on non-line-of-sight conditions,²⁷ the propagation and atmospheric absorption characteristics of these bands make them well-suited to line-of-sight operations that can be mapped and protected with relative ease.²⁸ Moreover, highly directional antennas are typically required to achieve significant range, which reduces interference to other users. In some cases, these bands are already used for highly directional point-to-point operations. The bands' relatively high frequencies also facilitate use of low-cost, physically small, adaptive multi-antenna systems, which make it more economical to share spectrum among services that traditionally have been considered incompatible.

the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands, Memorandum Opinion and Order, 20 FCC Rcd. 4889 (2005).

²⁶ For example, the National Telecommunications and Information Administration recently estimated that it could take ten years and cost \$4.6 billion to clear federal incumbents from the 1755-1780 MHz band. See National Telecommunications and Information Administration, Initial Estimated Costs and Timelines for the 1755-1780 MHz Band (May 12, 2014), available at http://www.ntia.doc.gov/files/ntia/publications/initial_estimated_costs_and_timelines_1755-1780_mhz_band_05-12-2014.pdf.

²⁷ See *Notice* ¶¶ 11-12.

²⁸ See *Notice* ¶ 5.

Similarly, these bands represent an important opportunity for supporting unlicensed and lightly licensed access to spectrum. As the Commission has frequently recognized,

[u]nlicensed devices complement licensed services and serve a wide range of consumer needs. They contribute tens of billions of dollars to our economy annually, not only through the sales of unlicensed products themselves, but also through collateral commercial activities that they facilitate.²⁹

Thus, unlicensed spectrum and services bring “economic and consumer benefits, including greater broadband innovation and increased access for broadband services. Additionally, unlicensed spectrum poses low barriers to entry, allowing any party to operate unlicensed devices or provide wireless broadband services.”³⁰

Unlicensed or lightly licensed use is already permitted in many of the bands discussed in the *Notice*, including the 57-64 GHz band³¹ and the 70 and 80 GHz bands.³² The Commission should consider expanding unlicensed and lightly licensed access in the high-frequency bands, in addition to the role more traditional license structures may play.

III. The high-frequency bands are well-suited to supporting experimentation and innovative uses.

While the Commission’s *Notice* appears to focus primarily on the deployment of terrestrial mobile broadband, the high-frequency bands could be useful for a variety of non-traditional uses that do not already enjoy reserved spectrum and, therefore, may be

²⁹ *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd. 6567, ¶ 271 (2014).

³⁰ *Id.*

³¹ *Notice* ¶ 71.

³² *Notice* ¶ 78.

public interest priorities. As noted, these frequencies' shorter wavelengths enable the use of small antennas to achieve substantial gain—thereby allowing directional communications from a lightweight device over significant distances. In addition, the wider channels available at higher frequencies allow for higher data rates in signal-to-noise constrained or power-constrained use cases.

The bands could, for example, be useful for offering broadband access via airborne platforms such as high-altitude balloons or unmanned aerial vehicles, where deployment of terrestrial networks is uneconomic.³³ The bands are also likely to be useful for the continued development of new terrestrial technologies. For instance, some machine-to-machine applications will rely on this band for backhaul, hub-to-device, or device-to-device communications. The Wi-Fi Alliance has already developed the 802.11ad (Wi-Gig) standard to support backhaul transmissions in the 60 GHz band. The standard enables communications over hundreds of meters and could support a wide variety of monitoring applications. The bands likewise are well suited for wireless High-Definition Multimedia Interface (HDMI) transmissions, which simplify the deployment of high-definition video in the home. The bands similarly could be used for

³³ The International Telecommunication Union has adopted several high-altitude platform station (HAPS) allocations above 24 GHz. The frequencies authorized for HAPS by the ITU are 27.5-28.35 GHz, 31.0-31.3 GHz, 47.2-47.5 GHz, and 47.9-48.2 GHz. See International Telecommunication Union (ITU), Final Acts WRC-97, art. S5.552A (Geneva, 1997), *available at* http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002F4001PDFE.pdf; ITU, Final Acts WRC-2000, art. S5.537A, S5.543A (Istanbul, 2000), *available at* http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002E4001PDFE.pdf; ITU, Final Acts WRC-03, art. S5.537A, S5.543A (Geneva, 2003), *available at* http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002D4005PDFE.pdf; ITU, Final Acts WRC-07, art. S5.537A, S5.543A (Geneva, 2007), *available at* http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002C4006PDFE.pdf. The ITU's endorsement of HAPS use in these bands indicates the suitability of deploying HAPS at higher frequencies.

the next generation of unlicensed broadband services—whether these are complements to existing Wi-Fi networks, thereby allowing increased offloading from licensed spectrum, or entirely new technologies and innovations.

Conclusion

The Commission's flexible and balanced spectrum policy has fueled the wireless economy, and there is much more to do. The Commission should further its successful approach by enabling innovative uses in the high-frequency bands above 24 GHz.

Respectfully submitted,



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