

**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
)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band)	RM-11664

COMMENTS OF T-MOBILE USA, INC.

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T-Mobile USA, Inc. (“T-Mobile”)¹ submits these comments in response to the October 17, 2014 Notice of Inquiry issued by the Commission in the above-referenced proceeding.² In the notice, the Commission begins to examine the potential for the provision of mobile radio services in the bands above 24 GHz. This inquiry takes place within the context of broader efforts to develop technical standards for Fifth Generation (“5G”) mobile services. 5G holds enormous potential for consumers and the wireless industry—it will increase speeds, have lower latency, and help connect devices to the “Internet of things.”

T-Mobile agrees with the Commission that, as technologies continue to evolve, the frequency bands above 24 GHz have potential for the provision of mobile radio services. When the Commission establishes licensing and authorization mechanisms for mobile operations above 24 GHz, exclusive use licenses will strike the right balance between the benefits of competition and the efficiencies of scale and scope needed to justify investments in the band. T-Mobile looks

¹ T-Mobile USA, Inc. is a wholly owned subsidiary of T-Mobile US, Inc., a publicly traded company.

² Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, *Notice of Inquiry*, GN Docket No. 14-177, RM-11664, FCC 14-154 (rel. Oct. 17, 2014) (“*NOI*”).

forward to working with the Commission to advance a regulatory framework that enables productive use of the spectrum above 24 GHz.

I. INTRODUCTION AND SUMMARY

T-Mobile commends the Commission's efforts to make additional spectrum, including spectrum above 24 GHz, available for mobile services. Identifying additional spectrum is critical to meet carriers' growth requirements, as smartphones, tablets, and other mobile devices have been a major driver of increased spectrum usage. For example, one report estimated that 65 percent of all Americans owned a smartphone in 2013.³ Further, mobile data traffic grew 77 percent from 2012 to 2013 in North America, and these numbers can only be expected to continue their steady rise.⁴ Identifying new spectrum for the provision of mobile services is, and will remain, vitally important for the wireless industry. T-Mobile applauds the Commission's efforts to identify additional spectrum for mobile and help carriers deliver top quality wireless service to consumers.

Higher frequency spectrum such as the bands above 24 GHz could potentially be used for the provision of mobile services. The characteristics of this high frequency spectrum make it attractive for addressing network capacity issues in congested areas. However, this spectrum would need to be used in combination with lower band spectrum to provide optimum service and coverage to consumers. In addition, any new 5G technologies will need to coexist with today's 4G technological landscape. To promote the development of new technologies and optimize use

³ Jon Fingas, Engadget, *Two-thirds of Americans Now Have Smartphones*, <http://www.engadget.com/2014/02/11/two-thirds-of-americans-now-have-smartphones/> (Feb. 11, 2014).

⁴ Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013-2018 at 4 available at http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.pdf (Feb. 5, 2014).

of this spectrum for mobile services, the Commission should favor an exclusive-use licensing regime. Such a regime will allow all users to unlock the full potential of the spectrum above 24 GHz.

II. FUTURE TECHNOLOGICAL DEVELOPMENTS COULD FOSTER THE DEPLOYMENT OF MOBILE SERVICES USING BANDS ABOVE 24 GHZ.

Frequency bands above 24 GHz are used today to support mobile services through backhaul and are potentially suitable for advanced mobile services in the future.⁵ Industry and technical groups are beginning to examine the use of higher frequencies sometimes known as millimeter wave (mmW) bands for mobile use. In addition, a number of initiatives have been established to define and develop 5G. Organizations are meeting to discuss the framework and manufacturers have been conducting laboratory trials.⁶ 5G mobile services offer enormous potential for consumers, with the prospect of being considerably faster and substantially exceeding the capacity of existing mobile technologies.

Any 5G mobile technologies that are developed will be complementary to—not a replacement for—4G technologies. The two technologies will need to coexist to give consumers the premium quality mobile services they crave. LTE is still in the early stages of its lifecycle, which for cellular technologies has historically been approximately 20 years from launch to peak penetration.⁷ And LTE continues to evolve further, for example, through LTE-Advanced

⁵ *NOI* ¶ 46.

⁶ GSMA Intelligence, *Understanding 5G: Perspectives on Future Technological Advancements in Mobile*, at 18-20 (Dec. 2014) *available at* https://gsmaintelligence.com/files/analysis/?file=141208-5g.pdf&utm_campaign=GSMA%20PUBLISHES%20NEW%20REPORT%20OUTLINING%205G%20FUTURE&utm_medium=email&utm_source=Eloqua (“GSMA 5G Report”); *NOI* ¶¶ 7-10.

⁷ GSMA 5G Report at 21.

technologies being used to improve the consumer experience. T-Mobile has already launched carrier aggregation, a widely used technique of the LTE Advanced standard, to create wider channels and produce more capacity and faster speeds.⁸ Clearly, LTE still has a rich roadmap in the years ahead.

T-Mobile applauds the FCC for investigating how to bring new spectrum to market and agrees with the *NOI*'s statement that this proceeding is not a substitute for the Commission's efforts to make lower frequency spectrum available for mobile services, but rather is a supplement to those efforts.⁹ The initiation of this proceeding does not diminish the vital importance of conducting a successful Incentive Auction and continuing to establish future mobile allocations below 3.6 GHz. One of the issues on which the FCC seeks comments is the extent that the viability of mobile service above 24 GHz is dependent on having complementary access to mobile services in lower frequency bands.¹⁰ The answer is that access to both higher and lower band spectrum is extremely important.

The high band spectrum discussed in this proceeding could serve as a complement to carriers' holdings in the lower bands. Access to spectrum below 1-GHz is a competitive-game changer. The Commission has recognized the need for multiple service providers to have access to below-1-GHz spectrum to "preserve and promote competition in the mobile wireless

⁸ See Phil Goldstein, "T-Mobile Will Work with Nokia Networks to Launch LTE Carrier Aggregation," Fierce Wireless (Oct. 1, 2014), <http://www.fiercewireless.com/story/t-mobile-will-work-nokia-networks-launch-lte-carrier-aggregation/2014-10-01>.

⁹ *NOI* ¶ 2.

¹⁰ *NOI* ¶ 17.

marketplace.”¹¹ Low-band spectrum provides high quality coverage over larger geographic areas, has superior propagation through adverse climates and terrains, and is better suited for in-building penetration and building out wireless systems, particularly in rural areas.¹²

The characteristics of spectrum above 24 GHz also lead to the conclusion that this spectrum will need to be used strategically in conjunction with lower band spectrum. The Commission correctly notes that radio signals in bands above 24 GHz provide coverage only over short distances, and the atmospheric absorption characteristics of these bands further restricts coverage.¹³ That means that this spectrum is best used to address capacity issues in specific urban and suburban areas for mobile services. Such a solution would be deployed and used similar to a “hot spot,” providing greater network capacity to mobile users in dense, high traffic areas. In addition, the fact that above 24 GHz spectrum propagates shorter distances than low-band spectrum reduces the potential cell sizes achievable. Accordingly, spectrum in bands above 24 GHz does not solve coverage issues and best serves as a complement to existing bands.

Finally, continued research by the industry will be necessary to determine how to integrate this spectrum into wide area networks. This very high frequency spectrum will be challenging to integrate into devices and infrastructure. To overcome the unfavorable channel conditions at these frequencies, highly directional and adaptive transmissions are necessary. This requires large array antennas at the base station and device, which has strong implications on the receiver design. In addition, vendors are continuing to explore the challenges of implementing

¹¹ Policies Regarding Mobile Spectrum Holdings, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, *Report and Order*, 29 FCC Rcd 6133 ¶ 256 (2014).

¹² *Id.* at ¶ 32.

¹³ *NOI* ¶ 34.

nomadic non-line-of-sight networks in this band and the results of this research will be needed to inform regulatory developments. For instance, because of the poor propagation in the band, the FCC may have to adopt non-traditional power and emission limits. Similarly, analysis of how signals between point-to-point and mobile networks interact may permit – or exclude – simultaneous use of the band for these two distinct services. Creating seamless interworking between 5G and legacy technologies is going to require integration effort. In short, the regulatory treatment of the band should be guided by the experience of equipment vendors in using new technologies to exploit the potentials of the band.

III. EXCLUSIVE USE LICENSES SHOULD BE FAVORED IN THE FCC’S LICENSING REGIME IN THE BANDS ABOVE 24 GHZ.

The Commission seeks comment on the licensing scheme for the bands above 24 GHz, noting that it “must assign rights in a way that maximizes the utility of the spectrum, minimizes the potential for interference among co- and adjacent-channel users, and allows flexibility for licensees to meet the needs of their end users.”¹⁴ To promote these goals, the Commission should continue to employ its light-touch, technology-neutral approach to licensing. The framework that is ultimately adopted should provide a clear and stable regulatory environment in order to encourage investment in the band.

Exclusive use licensing in the spectrum above 24 GHz would facilitate the greatest spectrum use. First, by licensing vacant spectrum by auctioning exclusive rights to geographic service areas, the FCC would be extending the status quo for these bands to mobile services. This would be a simple and clear path forward for use of the spectrum. Second, exclusive licenses would be the most useful to licensees. As the FCC notes, individual base stations in

¹⁴ *NOI* ¶ 88.

bands above 24 GHz will have very small coverage areas.¹⁵ Licensees will therefore be incentivized to obtain licenses with a large amount of bandwidth (between 500 MHz and 1 GHz) in a small area to address capacity issues. This use case is best achieved via exclusive-use licenses. Finally, as T-Mobile has noted before, clear, exclusive use spectrum is the most effective way for carriers to deploy services to consumers.¹⁶ Exclusive use licenses would provide the certainty that carriers need to invest in devices and infrastructure to support use of this spectrum. Major differences exist between the spectrum allocated to 5G technologies and the lower band spectrums. Operators may need to invest in new infrastructure to use the 5G spectrum, and exclusive use licenses would promote this investment.

In addition, incumbent licensees currently licensed to provide fixed service should be able to begin mobile operations in these bands.¹⁷ These licensees should not have to participate in another auction to use their existing spectrum. Incumbents are also poised to make beneficial use of the spectrum in a quick time period. Incumbents are best positioned to determine how to achieve mobility by coordinating fixed and mobile uses of the spectrum in their license areas. The Commission should create a regulatory environment where these incumbent licensees can seamlessly and easily begin mobile uses.

If the Commission determines not to use exclusive use licensing throughout the selected bands, another sound alternative is to license spectrum below 60 GHz and allow unlicensed use of spectrum above 60 GHz. Indeed, the spectrum above 60 GHz is unlicensed now. This portion of spectrum could be a good location to try out use of innovative spectrum access mechanisms.

¹⁵ *NOI* ¶ 89.

¹⁶ *See, e.g.*, Comments of T-Mobile, GN Docket No. 12-354, at 3 (filed July 14, 2014); Comments of T-Mobile, GN Docket No. 12-354 at 4, 8-10 (filed Feb. 20, 2013).

¹⁷ *See NOI* ¶ 88.

The Commission recently suggested a similar approach in the proceeding on use of the 3550-3650 MHz band. In that proceeding, the Commission proposed to apply real-time spectrum database management to shared tiers of service using a dynamic spectrum access system, noting that the spectrum could be an ideal “innovation band,” well suited to exploring the next generation of shared spectrum technologies and driving greater productivity and efficiency in spectrum use.¹⁸ The spectrum above 60 GHz has the potential to function in the same manner and spur innovation, leading to more efficient use of the spectrum by multiple users.

Further, if the FCC determines that exclusive licensing is not feasible for all of the spectrum under 60 GHz, the FCC could explore a 3-tiered dynamic spectrum access system for use of this band.¹⁹ The first tier would be composed of incumbents, conducting licensed operations. The incumbents would receive protection from harmful interference from the other users. In the second tier, the Commission would allow licensed opportunistic non-interfering use of the license area on a secondary basis outside of the licensees’ operations. Finally, the third tier would be a general authorization for unlicensed use. Unlicensed users would operate subject to the restriction that they could not create harmful interference to other users. A three-tiered dynamic spectrum access mechanism would ensure that the full potential of the spectrum above 24 GHz is maximized for a broad range of users.

The Commission also invites discussion on licensing areas and channel bandwidth.²⁰

With the technology specification still in the early stages, it would be prudent for the

¹⁸ See Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, *Further Notice of Proposed Rulemaking*, 29 FCC Rcd 4273, ¶ 3 (2014).

¹⁹ *NOI* ¶ 97.

²⁰ See *NOI* ¶¶ 32, 91.

Commission to wait on making license area determinations until the technology matures. The regulatory decisions for this spectrum should be driven by how the technology develops. Likewise, when the Commission has enough information to promulgate technical rules on channel bandwidths, it is important that the multiple bands available for 5G services do not result in technology fragmentation. Once more is known about the technology specifications and how it will be used, the Commission can more accurately determine how to maximize efficient use of the spectrum by enacting appropriate technical rules.

IV. CONCLUSION

T-Mobile appreciates the Commission's efforts to make additional spectrum, including the frequency bands above 24 GHz, available for mobile services. To exploit the full potential of this spectrum, the Commission should rely predominantly on exclusive use licenses. Doing so will provide a clear and stable regulatory environment for all entities that encourages investment and results in delivering enhanced services to consumers.

Respectfully submitted,

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