

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of )  
Expanding Flexible Use in Mid-Band Spectrum ) GN Docket No. 17-183  
Between 3.7 and 24 GHz )  
)

**COMMENTS OF T-MOBILE USA, INC.**

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**COMMENTS OF T-MOBILE USA, INC.**

T-Mobile USA, Inc. (“T-Mobile”),<sup>1/</sup> submits these comments in response to the Notice of Inquiry<sup>2/</sup> seeking comment on opportunities for flexible use of spectrum between 3.7 and 24 GHz for wireless broadband services. T-Mobile applauds the Commission for initiating the NOI as a first step towards making additional spectrum available to facilitate the deployment of fifth generation (“5G”) mobile wireless broadband technologies. The 3.7-4.2 GHz band and parts of the 5.925-7.125 GHz band, which the NOI identifies for possible wireless broadband use, are prime candidates for 5G, and the Commission should promptly initiate a rulemaking proceeding designating that spectrum for licensed mobile wireless broadband operations. The Commission should, on its own and in cooperation with the National Telecommunications and Information Administration (“NTIA”), identify other mid-band spectrum that can be made available for commercial use.

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

<sup>2/</sup> *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket 17-183, Notice of Inquiry, FCC 17-104 (rel. Aug. 3, 2017) (“NOI”).

## I. INTRODUCTION AND SUMMARY

T-Mobile, including the MetroPCS brand, offers nationwide wireless voice, text, and data services to 69.6 million subscribers.<sup>3/</sup> In the second quarter of 2017, T-Mobile added 1.3 million net customers – marking seventeen straight quarters of adding more than 1 million customers every quarter.<sup>4/</sup> T-Mobile also saw continued growth in postpaid phone customers – with postpaid net additions expected to lead industry for the sixth consecutive quarter<sup>5/</sup> – and continued success at MetroPCS.<sup>6/</sup> Moreover, T-Mobile is continuing to deploy and expand new technologies. It recently announced that it will begin to roll out 5G technology using the 600 MHz spectrum it acquired as a result of the Commission’s incentive auction.<sup>7/</sup>

T-Mobile strongly supports the Commission’s efforts to make additional licensed spectrum available to meet the well-documented, expanding demand for mobile wireless broadband capacity. And, as Commissioner O’Rielly recently recognized, it is appropriate that

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<sup>3/</sup> See T-Mobile News Release, *T-Mobile Delivers Record Results In Q2 2017, Un-Carrier Performing At Peak Levels Across The Board*, (July 19, 2017, 4:05 PM), <http://investor.t-mobile.com/file/Index?KeyFile=389520474> (“T-Mobile July News Release”).

<sup>4/</sup> See *id.*

<sup>5/</sup> See *id.*

<sup>6/</sup> See *id.*

<sup>7/</sup> T-Mobile News Release, *Maintaining US Leadership in 5G with Smart Spectrum Policy* (June 30, 2017), <https://newsroom.t-mobile.com/news-and-blogs/5g-mid-band-spectrum.htm> (announcing that it will roll out 5G in 600 MHz spectrum); see also T-Mobile News Release, *T-Mobile Ready to Rock New Spectrum With First 600 MHz LTE Smartphone & 5G-Ready Network Gear* (Aug. 31, 2017), <https://newsroom.t-mobile.com/news-and-blogs/tmobile-600mhz.htm> (“Just two weeks after launching the world’s first 600 MHz LTE sites, T-Mobile today announced it will carry the LG V30 – the world’s first smartphone to support 600 MHz LTE. And the Un-carrier unveiled the latest location to go live with its new super spectrum in Scarborough, Maine. On top of that, T-Mobile announced that, beyond lighting up these new airwaves on LTE at breakneck pace, the Un-carrier is simultaneously laying a foundation for true nationwide 5G with breakthrough new equipment from Ericsson that supports both LTE and 5G.”).

those efforts are now focused on mid-band spectrum.<sup>8/</sup> Indeed, international efforts are well underway to make mid-band spectrum available for 5G operations, and the United States must do the same to ensure its continued leadership in mobile wireless broadband.<sup>9/</sup>

The 3.7-4.2 GHz band is particularly well-suited to meet those needs. It provides a balance of capacity and coverage and has the potential to accommodate the wide bandwidths associated with 5G technology. It is also adjacent to the 3.5 GHz band and other spectrum that offers an opportunity to create a very large block of licensed spectrum that will help meet future needs. Existing operations in the 3.7-4.2 GHz band are limited and declining and can be accommodated by other technologies, or in other spectrum bands through a relocation process funded by new licensees. In particular, the Commission should examine the shared use of the 7.1-8.4 GHz band by fixed service (“FS”) licensees with government operations to facilitate the relocation of FS operations from other bands being considered for mobile broadband.

While designating the 3.7-4.2 GHz band for licensed wireless mobile broadband, as the NOI suggests, is an important first step, there are other steps that the Commission can take to provide additional mid-band 5G capacity. The NOI also seeks comment on the 5.925-7.125 GHz band. That spectrum can also support 5G operations. Part of that band may be appropriate for licensed operations, while other segments may be dedicated for unlicensed wireless broadband, with appropriate protection for incumbent operations. Non-federal spectrum not identified in the NOI – such as the 4.9 GHz band, 12.2-12.7 GHz band, and several FS bands – should be evaluated as well. Finally, while this proceeding focuses on non-federal spectrum that can be

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<sup>8/</sup> See Remarks of FCC Commissioner Michael O’Rielly Before the CBRS Alliance, at 2 (Aug. 1, 2017), [https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-346028A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-346028A1.pdf) (“Commissioner O’Rielly CBRS Remarks”).

<sup>9/</sup> *Id.*

used for mobile wireless broadband technologies, the Commission should continue its work with the NTIA to identify federal spectrum that can be repurposed for non-federal operations without jeopardizing the critical work of federal agencies. Evaluating the 4.2-4.4 GHz band, in particular, would allow the creation of a licensed band of 700 megahertz between 3.7 and 4.4 GHz.<sup>10/</sup> Beginning these efforts now will help ensure the United States' continued leadership in the development of next generation networks and technologies across all spectrum ranges.

## **II. ADDITIONAL MID-BAND SPECTRUM IS NEEDED TO MEET GROWING DEMAND AND CREATE ECONOMIC AND JOB GROWTH**

The value of spectrum as a driver of the U.S. economy – contributing jobs and making the U.S. a more effective global competitor – is well-documented.<sup>11/</sup> Identifying new spectrum for wireless broadband services is vitally important to continue the U.S. leadership in the wireless industry and the accompanying economic growth it produces. Indeed, “wireless has become Americans’ preferred communications platform,”<sup>12/</sup> and studies estimate that roughly 396 million mobile devices are currently in use.<sup>13/</sup> The public’s demand for wireless broadband

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<sup>10/</sup> And as noted below, legislative and regulatory action may make the band 3.1 GHz to 4.2 GHz available for mobile wireless broadband. Combined with the 4.2-4.4 GHz band and changes as proposed by T-Mobile to the 3.5 GHz band, that may make 1300 megahertz of spectrum usable for 5G operations.

<sup>11/</sup> See *INFOGRAPHIC: Licensed Spectrum – A Vital Resource for the American Economy*, CTIA, <https://www.ctia.org/docs/default-source/default-document-library/brattle-spectrum-value-infographic.pdf> (last visited Sept. 29, 2017); *Licensed Spectrum: Creating Jobs*, CTIA, <https://ctia.org/industry-data/facts-and-infographics-details/fact-and-infographics/licensed-spectrum-creating-jobs> (last visited Sept. 29, 2017); see also Roger Entner, *The Wireless Industry: Revisiting Spectrum, The Essential Engine of US Economic Growth*, RECON ANALYTICS (April 2016), <https://www.ctia.org/docs/default-source/default-document-library/entner-revisiting-spectrum-final.pdf>.

<sup>12/</sup> Meredith Attwell Baker, *Op-Ed: The FCC’s Mid-Band Spectrum Vote is Key for America’s 5G Leadership*, WIRELESS WEEK (July 31, 2017, 11:51 am), <https://www.wirelessweek.com/article/2017/07/op-ed-fccs-mid-band-spectrum-vote-key-americas-5g-leadership>.

<sup>13/</sup> *Wireless Snapshot 2017*, CTIA, <https://www.ctia.org/docs/default-source/default-document-library/ctia-wireless-snapshot.pdf> (“Wireless Snapshot 2017”).

has increased dramatically over the last five years.<sup>14/</sup> A significant increase in data usage can be attributed to smartphones, which generate, on average, nearly four gigabytes of data per phone each month,<sup>15/</sup> while T-Mobile customers use well over the average at more than six gigabytes per month over licensed spectrum.<sup>16/</sup> Mobile devices have become the sole way in which twelve percent of Americans access the Internet in their homes.<sup>17/</sup> In fact, over half of Americans no longer use traditional landlines and only use mobile devices for connectivity.<sup>18/</sup> Consumers, on average, spend over two and half hours each day on mobile devices – twice the amount of time spent at a desktop computer – accessing data-intensive applications, such as video and the Internet for communication and entertainment.<sup>19/</sup> Consumers’ mobile device use is driving an ever-increasing demand for mobile network capacity.

The need for spectrum and the economic opportunities it creates, including the need to make spectrum available in low, mid, and high frequency bands, has been widely recognized by lawmakers. Earlier this year, the Senate passed the MOBILE NOW Act, which would direct the Commission and NTIA to make 255 megahertz of spectrum below 6 GHz available for mobile and fixed wireless broadband use; require an assessment of spectrum in the 31.8-33.4 GHz, 71-

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<sup>14/</sup> CISCO, VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE, 2016–2021 (Feb. 7, 2017), <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html> (“Mobile data traffic has grown 18-fold over the past 5 years.”). In 2016, the number of mobile wireless connections grew by five percent. *See Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 17-69, ¶ 19 (rel. Sept. 27, 2017).

<sup>15/</sup> Wireless Snapshot 2017; *see also id.* (“With smartphones generating 102 times more data than a current basic mobile device, the continued rise in smartphone ownership is a driving force behind the significant increase in data traffic across wireless networks.”).

<sup>16/</sup> *See NPD Connected Intelligence: Data Consumption Report Q4 2016*, THE NPD GROUP (Jan. 2017), available with subscription at <http://connected-intelligence.com/>.

<sup>17/</sup> Wireless Snapshot 2017.

<sup>18/</sup> *Id.*

<sup>19/</sup> *Id.*

76 GHz, and 81-86 GHz bands for mobile or fixed terrestrial wireless operations; mandate that the Commission initiate a rulemaking proceeding covering certain millimeter wave bands; and require the Commission and NTIA to examine the potential use of spectrum between 3.1 GHz and 3.5 GHz and 3.7 and 4.2 GHz for commercial wireless services.<sup>20/</sup> This demonstrates the widespread support for the types of initiatives the Commission has undertaken to make additional spectrum available for mobile broadband.

T-Mobile applauds the Commission's efforts to move aggressively to make spectrum available in low, mid, and high bands. With the highly successful incentive auction,<sup>21/</sup> the Commission made available a significant amount of 600 MHz low-band spectrum, and T-Mobile is rolling out services in the band in record time.<sup>22/</sup> This low-band spectrum provides a solid wide-area coverage layer. The Commission also has an active proceeding to provide spectrum in high bands,<sup>23/</sup> which has the potential to provide massive capacity in denser environments.

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<sup>20/</sup> S.19, 115th Cong. (2017).

<sup>21/</sup> *The Broadcast Television Incentive Auction Closes; Reverse Auction And Forward Auction Results Announced; Final Television Band Channel Assignments Announced; Post-Auction Deadlines Announced*, Public Notice, DA 17-314 (rel. Apr. 13, 2017), [https://apps.fcc.gov/edocs\\_public/attachmatch/DA-17-314A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DA-17-314A1.pdf).

<sup>22/</sup> See T-Mobile News Release, *T-Mobile Lights Up World's First 600 MHz LTE Network at Breakneck Pace* (Aug. 16, 2017), <https://newsroom.t-mobile.com/news-and-blogs/cheyenne-600-mhz.htm> ("T-Mobile today announced it has begun lighting up its new 600 MHz LTE network — leveraging the massive haul of super-premium low-band spectrum won in the government broadcast incentive auction concluded earlier this year. The announcement comes only two months after the Un-carrier received its spectrum licenses from the FCC."); see also T-Mobile News Release, *T-Mobile Ready to Rock New Spectrum With First 600 MHz LTE Smartphone & 5G-Ready Network Gear* (Aug. 31, 2017), <https://newsroom.t-mobile.com/news-and-blogs/tmobile-600mhz.htm> ("T-Mobile plans to continue deploying LTE on 600 MHz at a record-shattering pace, starting in rural America and markets across more than 1.2 million square miles where the spectrum will be clear this year. The Un-carrier is on track to accomplish in six months what would normally be a two-year process from auction to consumer availability.").

<sup>23/</sup> *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, ¶ 18 (2016).



This proceeding fills the missing piece to satisfy the need for mid-band spectrum, which provides a balance of capacity and coverage. The Commission has recognized the need for wireless providers to have access to a mix of spectrum assets in low, mid, and high bands.<sup>24/</sup> As the Commission notes, mid-band spectrum is well-suited for mobile wireless broadband because of its propagation characteristics (*i.e.*, wide coverage, low latency, and high reliability) and its proximity to the spectrum designated for the Citizens Broadband Radio Service (“CBRS”) and the unlicensed spectrum in the 5 GHz band.<sup>25/</sup> This proceeding presents an important opportunity to address the deficiency in mid-band spectrum availability, meet the needs of wireless providers for mid-band spectrum, and fulfill the Commission’s outstanding obligations to identify spectrum that can be used for mobile wireless broadband operations.

### **III. THE COMMISSION SHOULD DESIGNATE THE 3.7-4.2 GHz BAND FOR LICENSED WIRELESS BROADBAND USE**

The Commission seeks comment on the use of the 3.7-4.2 GHz band for mobile wireless broadband.<sup>26/</sup> As discussed below, that band is ideal for licensed mobile wireless broadband use.

Spectrum in the 3 GHz band generally is being evaluated internationally for 5G services, including licensed wireless broadband uses.<sup>27/</sup> For instance, several countries in Europe and Asia

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<sup>24/</sup> *Policies Regarding Mobile Spectrum Holdings*, Report and Order, 29 FCC Rcd 6133, ¶ 18 (“As providers deploy next-generation mobile networks, the engineering properties and deployment capabilities of the mix of particular spectrum bands in providers’ holdings have become increasingly important.”); *see also* Commissioner O’Rielly, *A Mid-Band Spectrum Win in the Making*, FCC (July 10, 2017, 2:30 PM), <https://www.fcc.gov/news-events/blog/2017/07/10/mid-band-spectrum-win-making> (“Next generation wireless networks will require high, mid and low band spectrum.”).

<sup>25/</sup> NOI ¶ 6.

<sup>26/</sup> *Id.* ¶¶ 1, 6.

<sup>27/</sup> *See, e.g.*, Commissioner O’Rielly CBRS Remarks at 2 (explaining that “the international focus on 5G spectrum has now shifted to the mid bands that carry more data than low bands, but propagate farther than millimeter wave. And the 3.5 GHz band is in the spotlight, right in the middle of the frequencies being considered”).

are targeting mid-band spectrum for 5G deployments.<sup>28/</sup> In Asia, China,<sup>29/</sup> Japan,<sup>30/</sup> Singapore,<sup>31/</sup> Hong Kong,<sup>32/</sup> South Korea,<sup>33/</sup> and India<sup>34/</sup> have all begun work to make 3 GHz band spectrum available for 5G.<sup>35/</sup> In Europe, the radio spectrum policy advisory group to the European

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<sup>28/</sup> See Meredith Atwell Baker, *The FCC's Mid-Band Spectrum Vote is Key for America's 5G Leadership*, WIRELESS WEEK (July 31, 2017), <https://www.wirelessweek.com/article/2017/07/op-ed-fccs-mid-band-spectrum-vote-key-americas-5g-leadership>.

<sup>29/</sup> China is seeking comment on plans to use the 3.3-3.6 GHz band for 5G. See *China Issues Plan to Use 3300-3600 MHz, 4800-5000 MHz for 5G*, FIERCEWIRELESS (June 7, 2017), [http://www.fiercewireless.com/wireless/china-issues-plan-to-use-3300-3600-mhz-4800-5000-mhz-for-5g?mkt\\_tok=eyJpIjoiT0RVM016QTBOR0poTkdaaCIslInQiOiJkcCtCUkxpT2E2d0dkRUFJVXJyaE1XQnFINEJyXC9LNFllcitSZVRxSW1YVEZ4N3BIWVp1OW9rcjhEMHdzYXJDZnNtaW1obm9pQmlGQkYrdXoxUmJtclpuNGVabll4cUw2UEE0Z3UzODZnemRYTVM0MFcxZWNXZlhzRXpCQWRrOFMifQ%3D%3D&mrkid=4599669&utm\\_medium=nl&utm\\_source=internal](http://www.fiercewireless.com/wireless/china-issues-plan-to-use-3300-3600-mhz-4800-5000-mhz-for-5g?mkt_tok=eyJpIjoiT0RVM016QTBOR0poTkdaaCIslInQiOiJkcCtCUkxpT2E2d0dkRUFJVXJyaE1XQnFINEJyXC9LNFllcitSZVRxSW1YVEZ4N3BIWVp1OW9rcjhEMHdzYXJDZnNtaW1obm9pQmlGQkYrdXoxUmJtclpuNGVabll4cUw2UEE0Z3UzODZnemRYTVM0MFcxZWNXZlhzRXpCQWRrOFMifQ%3D%3D&mrkid=4599669&utm_medium=nl&utm_source=internal).

<sup>30/</sup> Japan allocated and licensed spectrum in the 3.5 GHz band for mobile broadband and identified and issued a public consultation considering use of the 3.6-4.2 GHz band for 5G operations. Kuniko Ogawa, Director for Land Mobile Communications Division, Ministry of Internal Affairs and Communications, *Presentation on Japan's Radio Policy to Realize 5G in 2020* (June 28, 2016) (“Ogawa Presentation”), [http://www.gsma.com/spectrum/wp-content/uploads/2016/08/MIC\\_Spectrum-for-5G-MIC-Kuniko-OGAWA.pdf](http://www.gsma.com/spectrum/wp-content/uploads/2016/08/MIC_Spectrum-for-5G-MIC-Kuniko-OGAWA.pdf).

<sup>31/</sup> Singapore issued a public consultation on 5G identifying the 3.4-3.6 GHz band for mobile use. Info-Communications Media Development Authority of Singapore, *Consultation Paper on 5G Mobile Services and Networks*, (rel. May 23, 2017), <https://www.imda.gov.sg/~media/imda/files/inner/pcdg/consultations/consultation%20paper/public%20onsultation%20on%205g%20mobile%20services%20and%20networks/5g-public-consultation.pdf?la=en>.

<sup>32/</sup> Hong Kong intends to issue a public consultation on re-allocating the 3.4-3.7 GHz band for 5G mobile services. Office of the Communications Authority of Hong Kong, *Consultation Paper on Proposed Change in the Allocation of the 3.4-3.7 GHz Band from Fixed Satellite Service to Mobile Service* (rel. July 27, 2017), [http://www.coms-auth.hk/filemanager/en/content\\_711/cp20170727\\_e.pdf](http://www.coms-auth.hk/filemanager/en/content_711/cp20170727_e.pdf).

<sup>33/</sup> South Korea intends to auction spectrum in the 3.4-3.7 GHz band in 2018. *Spectrum for 4G and 5G*, QUALCOMM, 22 (Aug. 2017), <https://www.qualcomm.com/media/documents/files/spectrum-for-4g-and-5g.pdf> (“*Spectrum for 4G and 5G*”).

<sup>34/</sup> The Department of Telecom in India has proposed to hold an auction of the 3.3-3.4 GHz band and 3.4-3.6 GHz band, and has sought the recommendations of the Telecom Regulatory Authority of India (TRAI). Telecom Regulatory Authority of India, *Consultation Paper on Auction of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300-3400 MHz and 3400-3600 MHz bands* (Aug. 28, 2017), [http://www.trai.gov.in/sites/default/files/Spectrum\\_CP\\_28082017.pdf](http://www.trai.gov.in/sites/default/files/Spectrum_CP_28082017.pdf). The TRAI has issued a public consultation on the issue, in which it states that the 3425-3600 MHz band is available for access service, as the 3400-3425 MHz band is identified for use in the Indian Regional Navigation Satellite System. *Id.*

<sup>35/</sup> See Dean Brenner, *Discussing 5G spectrum on Capitol Hill*, QUALCOMM (July 20, 2017), <https://www.qualcomm.com/news/onq/2017/07/20/discussing-5g-spectrum-capitol-hill> (“*Discussing 5G*”); *The Communications Authority's Work Plan for Making Available Additional Radio Spectrum to Meet the Demand of Public Mobile Services Towards 2020 and Beyond*, Press Release,

Commission released an analysis concluding in part that it considers the 3.4-3.8 GHz band to be the primary band suitable for introduction of 5G services in Europe.<sup>36/</sup> In keeping with this analysis, European countries have begun to take action to make the 3 GHz band available for 5G.<sup>37/</sup> Germany plans to allocate spectrum at 3.6 GHz for 5G operations next year.<sup>38/</sup> And the United Kingdom, along with Japan, is evaluating whether to make available significantly more than 150 megahertz for 5G deployment.<sup>39/</sup> Designating the 3.7-4.2 GHz band for licensed mobile wireless operations in the U.S. would be consistent with these international efforts.<sup>40/</sup> In

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COMMUNICATIONS AUTHORITY (Mar. 21, 2017), [http://www.coms-auth.hk/en/media\\_focus/press\\_releases/index\\_id\\_1423.html](http://www.coms-auth.hk/en/media_focus/press_releases/index_id_1423.html). In addition, the Emirates Integrated Telecommunications Company (“Du”) of the United Arab Emirates will launch 5G commercial services in the band by 2019. Waheed Abbas, *Du Plans Rollout of 5G by 2019*, KHALEEJ TIMES (Aug. 2, 2017), <https://www.khaleejtimes.com/business/telecom/du-plans-rollout-of-5g-by-2019>.

<sup>36/</sup> See EUROPEAN COMMISSION, RADIO SPECTRUM POLICY GROUP, STRATEGIC ROADMAP TOWARDS 5G FOR EUROPE, 3 (2016), [http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion\\_5G.pdf](http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf).

<sup>37/</sup> The United Kingdom is auctioning the 3.4 GHz band for 5G mobile use and has proposed making the 3.6-3.8 GHz band available for mobile services including 5G; Ireland recently auctioned spectrum in the 3.4-3.8 GHz band for 5G deployment; Italy will begin auctioning spectrum in the 3.6-3.8 GHz band for 5G by 2018; and Germany announced a 5G plan that includes making the 3.5 GHz band available in 2018. See *Ofcom sets rules for mobile spectrum auction*, OFCOM (July 11, 2017), <https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2017/ofcom-sets-rules-for-mobile-spectrum-auction>; OFCOM, IMPROVING CONSUMER ACCESS TO MOBILE SERVICES AT 3.6 TO 3.8 GHz (rel. Oct. 6, 2016), [https://www.ofcom.org.uk/\\_data/assets/pdf\\_file/0035/91997/3-6-3-8ghz-consultation.pdf](https://www.ofcom.org.uk/_data/assets/pdf_file/0035/91997/3-6-3-8ghz-consultation.pdf); *Five Winning Bidders in ComReg’s 3.6 GHz Band Spectrum Award*, Press Release, COMMISSION FOR COMMUNICATIONS REGULATION (May 22, 2017), <https://www.comreg.ie/five-winning-bidders-comregs-3-6-ghz-band-spectrum-award/>; *Spectrum for 4G and 5G* at 19; Federal Ministry of Transport and Digital Infrastructure, *5G-Strategie für Deutschland* (2017), [http://www.bmvi.de/SharedDocs/DE/Anlage/Presse/098-dobrindt-5g-strategie.pdf?\\_\\_blob=publicationFile](http://www.bmvi.de/SharedDocs/DE/Anlage/Presse/098-dobrindt-5g-strategie.pdf?__blob=publicationFile); Scott Bicheno, *Germany Unveils its Cunning Plan for 5G*, TELECOMS.COM (July 13, 2017), <http://telecoms.com/483379/germany-unveils-its-cunning-plan-for-5g/>.

<sup>38/</sup> See *German Spectrum Allocation 2018: Wholesale Obligation Back in the Licenses*, Jeffries (Aug. 1, 2017); *Spectrum for 4G and 5G*, OFCOM, <https://www.ofcom.org.uk/consultations-and-statements/category-2/opportunities-for-spectrum-sharing-innovation> (last visited Sept. 29, 2017).

<sup>39/</sup> See *Spectrum for 4G and 5G*; see also Ogawa Presentation; *Discussing 5G* (discussing how Japan has also issued a public consultation considering use of the 4.0-4.2 GHz band for 5G operations).

<sup>40/</sup> See NOI ¶ 6, note 9 (“While the U.S. has pushed ahead with efforts to free new spectrum at both low and high frequencies, we lag behind other countries in so-called ‘mid-band’ spectrum—the range of frequencies between 3 GHz and 7 GHz.”) (citing Senator John Thune’s letter to Chairman Pai).

order for the U.S. to continue to be a leader in 5G development, it should signal a similar determination. Global harmonization in the band will produce a robust equipment market, to the benefit of U.S. consumers of mobile wireless broadband products and services.<sup>41/</sup>

In addition to promoting internationally harmonized spectrum use, designation of mid-band spectrum in the U.S. for mobile wireless broadband will complement wireless carriers' use of spectrum in adjacent bands. Some of that spectrum is already allocated for wireless mobile broadband, and other adjacent band spectrum may be made available in the future. For example, the 3.7-4.2 GHz band is immediately adjacent to the 3.5 GHz band. Designating the 3.7-4.2 GHz band for licensed mobile broadband, along with the 3.5 GHz band, can create a contiguous band of 650 megahertz of spectrum, which is critical to developing technologies that rely on wider bandwidths.<sup>42/</sup> As noted above, legislation has been introduced that would direct the Commission to evaluate other segments of the 3 GHz band – beginning at 3.1 GHz – for wireless broadband.<sup>43/</sup> Regardless of whether that legislation becomes law, the Commission should evaluate these bands to make as large a block as possible available for licensed services.<sup>44/</sup>

And while the Commission has made some mid-band capacity available for wireless mobile broadband, more is needed. In particular, T-Mobile has demonstrated that the already-allocated 3.5 GHz band can be useful for 5G services if the Commission acts favorably on its

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<sup>41/</sup> One example of the types of technology being developed for mid-band spectrum is Huawei's announcement that it achieved 32 Mbps using a 200 megahertz channel in C-band. Juan Pedro Tomás, *Huawei Hits 32 Gbps in Phase Two of 5G Testing*, RCR WIRELESS NEWS (Oct. 2, 2017), <https://www.rcrwireless.com/20171002/5g/huawei-phase-two-5g-testing-tag23>.

<sup>42/</sup> See T-Mobile USA, Inc. Petition for Rulemaking, GN Dkt. No. 12-354, RM-11789, at 5-7 (filed June 19, 2017) ("3.5 GHz Petition for Rulemaking").

<sup>43/</sup> S.19, 115th Cong. (2017).

<sup>44/</sup> As noted below, T-Mobile recommends that NTIA and Commission cooperate to evaluate the potential use of the band 4.2-4.4 GHz for 5G operations, possibly creating 1300 megahertz of contiguous spectrum for wireless mobile broadband.

petition for rulemaking,<sup>45/</sup> but there are significant limitations on use of the spectrum due to incumbent operations that will remain in the band on a primary basis. T-Mobile and others have suggested changes to the rules governing the 3.5 GHz band that will promote use of that spectrum, which T-Mobile continues to believe can be an important component of the mid-band spectrum landscape.<sup>46/</sup>

Even if the full 150 megahertz of spectrum in the 3.5 GHz band is made available for licensed services on an unencumbered basis, it would still be less mid-band spectrum than other countries are seeking to make available for 5G services and insufficient to meet long term mobile wireless broadband requirements, and significant restrictions will continue to limit the band's potential. Exclusion zones prohibit CBRS service in the band in many parts of the country.<sup>47/</sup> While the scope of the exclusion zones has been reduced from what was originally proposed, the red portion of the map below illustrates the population centers covered by the current exclusion zones in the U.S. – over 40% of the U.S. population.

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<sup>45/</sup> 3.5 GHz Petition for Rulemaking at 8-9.

<sup>46/</sup> See 3.5 GHz Petition for Rulemaking; see also CTIA Petition for Rulemaking, GN Dkt. No. 12-354, RM-11788 (filed June 16, 2017); Letter from Dean R. Brenner, Senior Vice President, Spectrum Strategy & Technology Policy, and John W. Kuzin, Vice President and Regulatory Counsel, Qualcomm, Inc. to Marlene H. Dortch, Secretary, FCC, GN Dkt. No. 12-354 (filed June 19, 2017).

<sup>47/</sup> In 2015, the Commission “establish[ed] Exclusion Zones along the coast and around designated ground-based radar facilities, consistent with NTIA’s recommendations” to ensure compatibility between incumbent federal operations and CBRS users. *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550- 3650 MHz Band*, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959, ¶ 259 (2015) (“3.5 GHz R&O and FNPRM”).



Even after exclusion zones are converted to protection zones,<sup>48/</sup> Environmental Sensing Capability will restrict operation of the 3.5 GHz band at any time to manage interference and protect radar operations, effectively relegating use of the 3.5 GHz within protection zones to secondary status.<sup>49</sup> The incumbent use and power restrictions of the 3.5 GHz band are unique to the U.S., making it even more critical for other parts of the 3 GHz band to be available for *exclusive*, mobile licensed 5G services.

Dedication of the 3.7-4.2 GHz band for wireless broadband can also satisfy a variety of wireless broadband applications. As the Commission is aware, the Broadband Access Coalition recently requested that the Commission permit point-to-multipoint operations in the 3.7-4.2 GHz

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<sup>48/</sup> *Id.* ¶ 262.

<sup>49</sup> In addition, use of the 3.5 GHz band is burdened by power and use limitations associated with Category A and Category B antennas, particularly in comparison with other terrestrial wireless spectrum. The current rules limit effective isotropic radiated power outdoors to 30 dBm/10 MHz for Category A Citizen Broadband Radio Service Devices (“CBSDs”) and 47 dBm/10 MHz for Category B CBSDs. 47 C.F.R. § 96.41(b). Category B antennas can use higher power and power spectral density, but must be professionally installed outdoors. These power restrictions will hinder carriers’ ability to fully use the spectrum and limit the coverage that cell sites can achieve. *See, e.g.,* Verizon Petition for Reconsideration, GN Docket 12-354, at 4 (filed July 23, 2015) (“Without a reasonable increase in the power limits, there is a serious risk that the adopted power limit will impose costs that will slow investment in the new band by substantially driving up the costs of deploying small cell networks.”).

band.<sup>50/</sup> T-Mobile objects to grant of that request because of, among other reasons, its potential limiting effect on other uses of the spectrum.<sup>51/</sup> A far better approach is for the Commission to make the 3.7-4.2 GHz band available for wireless broadband using its preferred flexible service approach, under which licensees can deploy any operations they wish consistent with the technical rules in the band.<sup>52/</sup> The rules governing the 3.7-4.2 GHz band can be structured to permit *any* use permitted by the Table of Allocations.

#### **IV. THERE IS LIMITED INCUMBENT USE OF THE 3.7-4.2 GHz BAND**

As the Commission notes, the 3.7-4.2 GHz band is currently allocated for Fixed Satellite Service (“FSS”) and FS operations. There is no need to preserve the 3.7-4.2 GHz band for those uses. FSS operations in the band are declining. Applications for FSS C-Band licenses have significantly decreased for nearly three decades.<sup>53/</sup> And, as has been documented by the Fixed Wireless Communications Coalition, the use of the band by satellite operations is overstated,

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<sup>50/</sup> Broadband Access Coalition, Petition for Rulemaking, RM-11791, at 1 (filed June 21, 2017) (“Broadband Access Coalition Petition for Rulemaking”).

<sup>51/</sup> Comments of T-Mobile USA, Inc., RM-11791, at 2 (filed Aug. 7, 2017).

<sup>52/</sup> In recent proceedings, the Commission found that licensees and the marketplace should determine the uses of the band that best satisfied the public interest. For example, in the *Spectrum Frontiers* and 3.5 GHz/CBRS proceedings, the Commission recognized the benefits of making additional spectrum available for *flexible* use. In the *Spectrum Frontiers* proceeding, the Commission found that flexible use is necessary “given the convergence between fixed and mobile technologies, [and] attempting to define separate bundles of fixed and mobile rights might create unnecessary complexity and be inconsistent with the underlying technologies.” See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, ¶¶ 77, 38 (2016). And in the 3.5 GHz rulemaking, the Commission clarified that the band is “designed to allow new, innovative operations access to flexible, fungible spectrum.” *3.5 GHz R&O and FNPRM*, ¶ 138; see also *id.* ¶ 44 (“By adopting a flexible access model across the entire band, we aim to create a versatile 150 megahertz band for shared wireless broadband use that can adapt to market and technological opportunities.”).

<sup>53/</sup> Broadband Access Coalition Petition for Rulemaking at 15 (filed June 21, 2017) (“Applications for new licenses have declined from a peak of about 463 in 1999 to 90 or fewer in all but one year from 1998-2009, and to 37 or fewer in each year since 2010. New earth station registrations have also steadily declined and license renewals have trended downward.”) (internal citations omitted).

both because users often do not cancel authorizations,<sup>54/</sup> and because of the use of full-band, full-arc coordination.<sup>55/</sup>

There are other alternatives to continued use of the 3.7-4.2 GHz band for satellite operations. For instance, some FSS operators could migrate to a fiber-optic based deployment. Long-haul fiber infrastructure in the U.S. is robust, consisting of 273 cities, 2411 links, and 542 conduits, by some estimates.<sup>56/</sup> Satellite providers can also take advantage of the expansive fiber-optic network at a relatively low cost.<sup>57/</sup> For instance AT&T's use of the band to distribute video programming by its DirecTV subsidiary could be significantly reduced by capturing content at just a few rural sites and transporting the content via fiber to urban areas as needed. This approach appears to be viable for a number of licensees that have a large number of satellite receive facilities in urban areas. It is not practical for mobile operators to coexist with large numbers of satellite receivers in these urban areas, and given the alternatives available, the Commission's focus should be on clearing FSS operations in these areas to free the band for mobile broadband.

Further, as the NOI notes, there is little remaining use of the band for FS (microwave) operations.<sup>58/</sup> There are only 119 FS licenses in the band, as FS use of the band has been in a

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<sup>54/</sup> Fixed Wireless Communications Coalition Inc., Request for Modified Coordination Procedures in Bands Shared Between the Fixed Service and the Fixed Satellite Service, RM-11778, at 1-2 (Oct. 11, 2016).

<sup>55/</sup> See, e.g., *id.* at 5 (“In an FSS downlink band, full-band, full-arc coordination bars an FS applicant from every frequency the band over a wide area – even if the earth station is not receiving on those frequencies and has no plans to.”); see also Comments of Fixed Wireless Communications Coalition, RM-11791, at 2 (filed Aug. 7, 2017) (“[A]ny efficient use of the [3.7-4.2 GHz] band is predicated on eliminating the extreme inefficiencies of FSS full-band, full-arc coordination.”).

<sup>56/</sup> Durairajan, *et al.*, *InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure* (2015), [http://pages.cs.wisc.edu/~pb/tubes\\_final.pdf](http://pages.cs.wisc.edu/~pb/tubes_final.pdf).

<sup>57/</sup> *Id.*

<sup>58/</sup> NOI ¶ 15.



“steep decline over the past 20 years as common carriers migrated to fiber or other FS bands”<sup>59/</sup> and, like FSS use of the band, microwave operations may also be overstated because of users’ tendency not to cancel authorizations.<sup>60/</sup>

For both FS and FSS users, the Commission can employ a range of tools to ensure that the 3.7-4.2 GHz band is available for mobile wireless broadband use. As it did with incumbent operations in the Personal Communications Service (“PCS”) and AWS-1 band, the Commission could require that auction winners pay for the relocation of incumbent operations to comparable facilities.<sup>61/</sup> As noted above, for satellite systems, that may mean more limited use of earth stations, sited in remote areas, with an increased use of fiber-optic networks for backhaul. Remaining satellite stations can be located in remote areas where the impact on mobile wireless broadband systems will be limited. For these and a limited number of other earth stations, the Commission may wish to consider the type of protection provided for incumbent users in the 1695-1710 MHz band.<sup>62/</sup> For FS licensees, that may mean relocation to other bands. T-Mobile

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<sup>59/</sup> *Id.* ¶ 15 (internal citations omitted).

<sup>60/</sup> Prior to making the band available for wireless broadband use, the Commission should review the ULS database for the 3.7-4.2 GHz band to ensure that it is accurate.

<sup>61/</sup> *See, e.g.,* Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, 118 Stat. 3986 (codified as amended in scattered sections of 4 U.S.C.) (establishing the Spectrum Relocation Fund, which was first used in the AWS-1 auction to allow federal agencies to recover costs associated with relocating from the 1710-1755 MHz band); *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, Third Report and Order and Memorandum Opinion and Order, ET Docket No. 92-9, ¶ 2 (1993); *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, First Report and Order and Third Notice of Proposed Rulemaking, ET Docket No. 92-9, ¶ 24 (1992).

<sup>62/</sup> *See Amendment of the Commission’s Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, GN Docket No. 13-185, Report and Order, ¶ 19 (2014) (“[O]perations in the [1695-1710 MHz] band will be subject to successful coordination with Federal incumbents in the 27 Protection Zones that we are adopting based on NTIA’s endorsement of the CSMAC WG1 Final Report.”); *see also Portal Opens for AWS-3 Spectrum Sharing Coordination*, NTIA (Nov. 16, 2015), <https://www.ntia.doc.gov/blog/2015/portal-opens-aws-3-spectrum-sharing-coordination>).

suggests below that the Commission examine the use of the 7.1-8.4 GHz band for shared government/non-government operations, which may be an appropriate spectrum band for relocated FS licensees.

## **V. INCUMBENT OPERATIONS IN THE 5.925-6.425 GHz BAND MUST BE PROTECTED**

The Commission seeks comment on potential wireless broadband use in the 5.925-6.425 GHz band, which is allocated for non-federal FSS and FS use on a primary basis.<sup>63/</sup> The Commission notes reasons why the lower 6 GHz band may be appropriately designated for unlicensed operations. T-Mobile appreciates the Commission's efforts to make additional unlicensed spectrum available. T-Mobile remains a significant user of unlicensed spectrum and supports making spectrum available for both licensed and unlicensed operations. As T-Mobile has noted in the past, it has pioneered approaches to use unlicensed spectrum in combination with, and in support of, licensed operations.<sup>64/</sup> T-Mobile was also the first national wireless provider to make use of LTE-U, which operates in unlicensed 5 GHz spectrum.<sup>65/</sup>

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<sup>63/</sup> NOI ¶ 26.

<sup>64/</sup> See, e.g., Comments of T-Mobile USA, Inc., ET Dkt. No. 15-105, at 2-3 (filed June 11, 2015) (discussing T-Mobile's unlicensed technology innovations) ("T-Mobile LTE-U Comments"). For instance, T-Mobile was the first carrier to offer its customers cutting-edge technologies like nationwide Voice over LTE ("VoLTE") and next-generation Wi-Fi calling, and T-Mobile's LTE network now supports 61% of its voice traffic with VoLTE. See *id.*; T-Mobile News Release, *The Un-remitting Uncarrier Network* (Oct. 21, 2016) ("T-Mobile October News Release"), <https://newsroom.tmobile.com/news-and-blogs/unremitting-uncarrier-network.htm>. T-Mobile was also the first carrier to launch a number of other unlicensed technology innovations, introducing calling over Wi-Fi in 2007 with HotSpot @Home™ and worldwide Wi-Fi calling in 2014, which allows T-Mobile customers to make free Wi-Fi calls to the United States from anywhere outside the country where they have Wi-Fi. See T-Mobile LTE-U Comments; T-Mobile October News Release. In 2014, T-Mobile also released Un-carrier 7.0 "Wi-Fi Un-leashed," a program that ensured all new smartphones in T-Mobile stores are capable of Wi-Fi calling and texting and that all T-Mobile customers are able to obtain a Wi-Fi calling and texting capable smartphone. See T-Mobile LTE-U Comments at 2-3.

<sup>65/</sup> Press Release, *T-Mobile Completes Nation's First Live Commercial Network Test of License Assisted Access (LAA)* (June 26, 2017), <https://newsroom.t-mobile.com/news-and-blogs/lte-u.htm>.

The Commission notes, however, the significant presence of incumbent users in the 5.925-6.425 GHz band – including FS licensees that use the spectrum for critical communications needs.<sup>66/</sup> Currently, FS operations in the band are used “to support a variety of critical services such as public safety (including backhaul for police and fire vehicle dispatch), coordination of railroad train movements, control of natural gas and oil pipelines, regulation of electric grids, and backhaul for commercial wireless traffic.”<sup>67/</sup> T-Mobile agrees with the Commission that any unlicensed devices that utilize the 5.925-6.425 GHz band must protect incumbent services in the band, and must not interfere with these licensed operations.<sup>68/</sup> Before the Commission reallocates the spectrum, it must be satisfied that incumbent operations will be adequately protected. While T-Mobile recognizes that operations under Part 15 are on a non-interference basis – Part 15 spectrum users cannot cause harmful interference to licensed operations (and may not claim protection from primary operations) – the Commission should ensure that there is a firm technical foundation on which to conclude that unlicensed operations will not cause harmful interference to primary operations and should adopt appropriate technical and operational limits to protect the significant number of incumbent users and primary operations in the band.

**VI. THE COMMISSION SHOULD CONSIDER DESIGNATING ALL OR A PORTION OF THE 6.425-7.125 GHz BAND FOR LICENSED MOBILE BROADBAND USE**

The Commission asks whether the 6.425-7.125 GHz band, which is currently allocated for non-federal FS and FSS use on a primary basis, can be used for mobile broadband services.<sup>69/</sup>

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<sup>66/</sup> NOI ¶ 25.

<sup>67/</sup> *Id.*

<sup>68/</sup> *Id.* ¶ 27.

<sup>69/</sup> *Id.* ¶¶ 32, 36.

T-Mobile urges the Commission to consider making some or all of this band available for licensed mobile broadband use. While the 3.7-4.2 GHz is an important first step to support licensed mobile wireless broadband, additional spectrum is needed to support 5G services. Even assuming the designation of the 3.7-4.2 GHz band for wireless broadband, there will be only 500 megahertz of spectrum designated for that purpose. For the same reasons that the 3.7-4.2 GHz band is well-suited for wireless broadband, the Commission should consider the 6.425-7.125 GHz for that use also.

As the Commission notes, there is limited use of the band for FSS and FS operations.<sup>70/</sup> For FSS and FS operations, T-Mobile recommends the type of approach suggested above for the 3.7-4.2 GHz band, under which auction winners would be responsible for relocating incumbent licensees to comparable facilities, with potential limited shared use of the spectrum for FSS operations in remote areas. T-Mobile notes that its own use of microwave facilities in the 6 GHz band is limited; approximately 96% of its sites are connected via fiber. Other incumbents can take advantage of the same opportunities with auction winners underwriting the cost of relocating to fiber or other alternatives. As noted below, T-Mobile suggests that the Commission evaluate the use of the 7.1-8.4 GHz band for shared government/non-government use and that relocated microwave systems be relicensed in that spectrum.

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<sup>70/</sup> *Id.* ¶ 33 (“FSS operations in the 6.425-7.125 GHz band (earth-to-space) are less intensive than in the 5.925-6.425 GHz band. In the 6.615-6.687 GHz band, currently the only Commission authorization is for feeder links for one radionavigation satellite. FSS operations in the 6.700-7.075 GHz band (space-to-Earth) are limited by rule to feeder links for NGSO MSS in the space-to-Earth direction, while in the band 7.025-7.075 GHz such operations are further limited to two grandfathered satellite systems. Currently there are about 65 FSS earth station licenses in the 6.425-7.075 GHz band. One foreign-licensed FSS space station is authorized for U.S. market access in the Earth-to-space direction in the 6.725-7.025 GHz band.”). *Id.* ¶ 35 (“For fixed operations, FS licensees in the 6.525-6.875 GHz and 6.875-7.125 GHz bands may be authorized to operate point-to-point microwave links on paired channels assigned in specified bandwidths ranging from, respectively, 400 kilohertz to 30 megahertz and 5 megahertz to 25 megahertz.”).

Certain incumbent mobile operations in the 6.425-7.125 GHz band can be eliminated or accommodated for potential mobile wireless broadband use. Broadcast Auxiliary Service (“BAS”) and Cable Television Relay Service (“CARS”) allocations in the band were made when there were few other options available for broadcast and cable network entities to transmit television signals. However, alternative options exist today and will continue to increase as new wireless options, including 5G, are introduced. For example, as an alternative to traditional electronic news gathering, some television broadcast news stations are using aggregated licensed and unlicensed spectrum to capture and deliver content. To facilitate this approach, companies are providing commercial-ready options, such as network convergence platforms, that combine Wi-Fi with commercial wireless networks.<sup>71/</sup> Moreover, there is other spectrum – in the 2 GHz and 12.7-13.2 GHz bands – that are available for BAS and CARS use.<sup>72/</sup> In the NOI, the Commission notes that its licensing records show that there are roughly 800 BAS and CARS licenses in the band.<sup>73/</sup> The Commission should grandfather current uses but decline to renew current licenses and adopt an appropriate transition framework.

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<sup>71/</sup> See *Network Convergence Platform for Mobile Operators*, CARNEGIE TECHNOLOGIES, [https://www.carnegietechnologies.com/mobile-operators/?gclid=Cj0KCQjwruPNBRCKARIsAEYNXIjTbXX2a0V8PktEd9RXOWQCfFM61imOZobZXI6LNral7kY2\\_YEjD4kaAltWEALw\\_wcB](https://www.carnegietechnologies.com/mobile-operators/?gclid=Cj0KCQjwruPNBRCKARIsAEYNXIjTbXX2a0V8PktEd9RXOWQCfFM61imOZobZXI6LNral7kY2_YEjD4kaAltWEALw_wcB) (last visited Sept. 19, 2017); see also *Multiply your Internet Speed & Reliability by bonding up to 12 broadband modems*, MUSHROOM NETWORKS, [https://www.mushroomnetworks.com/marketing/broadband\\_bonding\\_mushroom/?utm\\_source=google&utm\\_medium=cpc&utm\\_campaign=Boosting-generic-line\\_Aggregation&utm\\_content=Bond-your-WAN-connections](https://www.mushroomnetworks.com/marketing/broadband_bonding_mushroom/?utm_source=google&utm_medium=cpc&utm_campaign=Boosting-generic-line_Aggregation&utm_content=Bond-your-WAN-connections) (last visited Sept. 19, 2017).

<sup>72/</sup> See 47 C.F.R. §§ 74.602; 78.18.

<sup>73/</sup> NOI ¶ 34 (“The Commission’s licensing records reflect that 139 BAS, 26 CARS, and 243 Part 101 licenses are issued for mobile operations in the 6.425-6.525 GHz band, and 346 BAS, 19 CARS, and 38 Part 101 licenses are issued for mobile operations in the 6.875-7.125 GHz band.”).

## VII. THE COMMISSION SHOULD EXAMINE OTHER BANDS FOR WIRELESS BROADBAND USE

The Commission seeks comment on whether there are other bands between 3.7 and 24 GHz that should be considered for expanded wireless mobile broadband use, and, specifically, the characteristics that make the particular bands ideal for wireless broadband.<sup>74/</sup>

### A. Federal Spectrum

Much of the spectrum between 3.7 and 24 GHz is allocated for federal operations. The Commission should therefore continue to work with NTIA and federal agencies to identify spectrum that can be made available for non-Federal use through consolidation of government operations, more efficient Federal use, and other means.

4.2-4.4 GHz. T-Mobile recommends that the Commission work with NTIA to assess the potential use of the 4.2-4.4 GHz band. Past NTIA studies identified the possibility of relocating existing operations from that band, and making the 4.2-4.4 GHz band available for commercial use.<sup>75/</sup> Past work of the International Civil Aviation Organization (“ICAO”) demonstrated that the entire band may not be needed for radio altimeter operations.<sup>76/</sup> The Commission should encourage NTIA to resume evaluation of the band and seek input from industry and federal agencies to study the feasibility of reducing the amount of spectrum used for altimeters, thereby

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<sup>74/</sup> *Id.* ¶ 37.

<sup>75/</sup> See *An Assessment of the Near Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, and 4200-422- MHz, 4380-440 MHz Bands*, 2-6 (2010), [https://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation\\_11152010.pdf](https://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation_11152010.pdf); *NTIA Fact Sheet on Spectrum Plan and Timetable, Fast Track Evaluation*, [https://www.ntia.doc.gov/legacy/reports/2010/SpectrumFactSheet\\_11152010.pdf](https://www.ntia.doc.gov/legacy/reports/2010/SpectrumFactSheet_11152010.pdf).

<sup>76/</sup> Claude Pichavant, *Use of 4200-4400 MHz Radio Altimeter Band 4* (International Civil Aviation Organization, Aeronautical Communications Panel, Working Paper No. ACP-WGW24/WP-04). While the ICAO Working Paper stated that the entire 4.2-4.4 GHz band is not used for radio altimeter purposes, it asserted that the remainder of the band may be required as a guard band. In view of more advanced operations, NTIA should examine whether guard bands continue to be needed.

freeing spectrum for commercial wireless broadband operations, to demonstrate that wireless broadband operations will not interfere with incumbent aeronautical services in the band.<sup>77/</sup> Reallocating the 4.2-4.4 GHz band would create an opportunity for a contiguous licensed spectrum between 3.7 GHz and 4.4 GHz.

7.125-8.400 GHz. The Commission should work with NTIA to make this band available for federal/non-federal sharing.<sup>78/</sup> Future non-federal use of the band may be for FS operations, which are highly coordinated and can therefore protect, to the extent required, federal operations. And if the band is made available for FS use, it can accommodate FS operations that will be relocated from any parts of the 5.925-7.125 GHz band where future licensed wireless broadband operations are authorized. To the extent that federal users must be relocated within the band to accommodate shared use by non-federal licensees, the costs of those efforts can be reimbursed from the Spectrum Relocation Fund.<sup>79/</sup>

## **B. Non-Federal Spectrum**

4.940-4.990 GHz. The Commission should consider use of the 4.9 GHz band (4.940-4.990 GHz) for wireless broadband. The 4.9 GHz band has been historically underutilized and “fallen short of its potential.”<sup>80/</sup> The 4.9 GHz band is allocated for fixed and mobile public

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<sup>77/</sup> FOURTH INTERIM PROGRESS REPORT ON THE TEN-YEAR PLAN AND TIMETABLE AND PLAN FOR QUANTITATIVE ASSESSMENTS OF SPECTRUM USAGE at 25, U.S. DEP’T OF COMMERCE (June 2014), [https://www.ntia.doc.gov/files/ntia/publications/fourth\\_interim\\_progress\\_report\\_final.pdf](https://www.ntia.doc.gov/files/ntia/publications/fourth_interim_progress_report_final.pdf).

<sup>78/</sup> Federal use of the band is already shared between fixed point-to-point operations and other functions. *Federal Spectrum Use Summary – 30 MHz – 3000 GHz*, NTIA OFFICE OF SPECTRUM MANAGEMENT, 52-57 (2010), [https://www.ntia.doc.gov/files/ntia/Spectrum\\_Use\\_Summary\\_Master-06212010.pdf](https://www.ntia.doc.gov/files/ntia/Spectrum_Use_Summary_Master-06212010.pdf).

<sup>79/</sup> Because the 7.125-8.400 GHz band itself would not be auctioned, modification of the provisions of the National Telecommunications and Information Administration Organization Act that govern the Spectrum Relocation Fund may be required.

<sup>80/</sup> *Amendment of Part 90 of the Commission’s Rules*, WP Docket No. 07-100, Fourth Report and Order and Fifth Further Notice of Proposed Rulemaking, 27 FCC Rcd 6577, ¶16 (2012) (“4.9 GHz Fifth Further Notice”).

safety services, such as point-to-multipoint services and wireless local area networks.<sup>81/</sup> When the spectrum was allocated in 2002,<sup>82/</sup> the Commission envisioned the band being used as a “complement the 700 MHz public safety broadband spectrum.”<sup>83/</sup> In light of the deployment of the National Public Safety Broadband Network and the underutilization of the band by public safety, the Commission should evaluate whether that spectrum is still required to meet public safety needs on an exclusive basis. T-Mobile recognizes that there is an ongoing proceeding regarding the 4.9 GHz band, which has been open for nearly a decade.<sup>84/</sup> Opening the spectrum for commercial operations would help drive investment in the band and provide valuable broadband capacity, and it could also increase the utility of the spectrum for public safety.

12.2-12.7 GHz. There is also a pending request before the Commission to make greater use of the 12.2-12.7 GHz band.<sup>85/</sup> In June 2016, the Multichannel Video Data and Distribution (“MVDDS”) 5G Coalition filed a petition for rulemaking asking the Commission to adopt rules that would permit MVDDS licensees to use the 12.2-12.7 GHz band to provide two-way mobile broadband service.<sup>86/</sup> Assuming the Commission can resolve interference, the Commission can auction any terrestrial rights to operate in the 12 GHz band pursuant to Section 309(j) of the Communications Act instead of awarding those rights to MVDDS licenses who have not, to date, done anything with the spectrum despite the flexibility the Commission has provided.<sup>87/</sup>

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<sup>81/</sup> NOI ¶ 9, note 12.

<sup>82/</sup> 4.9 GHz Fifth Further Notice at ¶16.

<sup>83/</sup> *Id.* ¶ 47.

<sup>84/</sup> *See id.* ¶ 2.

<sup>85/</sup> *See* MVDDS 5G Coalition, Petition for Rulemaking, RM-11768 (filed Apr. 26, 2016) (“MVDDS 5G Coalition 12.2-12.7 GHz Petition for Rulemaking”); *see also* Comments of T-Mobile, RM-11768 (filed June 8, 2016) (“T-Mobile 12.2-12.7 GHz Comments”).

<sup>86/</sup> MVDDS 5G Coalition 12.2-12.7 GHz Petition for Rulemaking at 7.

<sup>87/</sup> T-Mobile 12.2-12.7 GHz Comments at 6-10.



*Other FS Bands.* As part of the evaluation of FS use of the 6 GHz band, the Commission may also wish to assess use of other FS bands, such as 7 GHz, 11 GHz, 18 GHz and 23 GHz. The level of use of these bands vary and further consideration of the needs of FS users should drive the Commission's evaluation of whether FS spectrum use can be consolidated in fewer bands, making spectrum available for mobile wireless broadband use.

### **VIII. THE COMMISSION CAN TAKE OTHER ACTIONS TO PROMOTE GREATER USE OF SPECTRUM BETWEEN 3.7 AND 24 GHz**

*Updating Allocations to Reflect Technological Progress.* The Commission seeks comment on how developing technologies may enable spectrum to be used more efficiently and intensively.<sup>88/</sup> As noted above, the needs for some services in the 3.7-24 GHz band have changed. While it may have been necessary to designate specific frequencies for CARS and BAS operations in the past, those needs are being increasingly fulfilled by wireless carriers using commercial spectrum or on unlicensed frequencies. The need to reserve spectrum for CARS and BAS may no longer exist. Similarly, as demonstrated above, the nation's fiber network is more robust now than ever (and continues to expand). The need for spectrum for microwave and satellite use may also therefore be diminished, making it feasible to reallocate or share that spectrum for mobile wireless broadband operations.

*Full Evaluation of Incumbent Use of Spectrum.* The Commission can promote more intense use of mid-band spectrum by conducting a complete evaluation of use of the spectrum in the bands. As noted above, the Commission's licensing records likely contain an inaccurate picture of the use of spectrum by FSS and FS users both because of licensees' tendency not to

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<sup>88/</sup> NOI ¶ 40.

cancel authorizations and “over-coordination” of proposed use. A more thorough analysis of how the spectrum is used will lead to spectrum availability.

*Relocation of Incumbent Users.* As noted above, T-Mobile suggests that the Commission use a variety of tools to accommodate existing users in the mid-band spectrum, including relocating those licensees to comparable facilities, with auction winners underwriting the costs of modifying incumbents’ operations. This process has been used successfully in the past and can be used in the mid-bands. While T-Mobile supported the Commission’s use of incentive auctions to relocate broadcast licensees from the 600 MHz band, the same mechanism may not be appropriate for mid-band spectrum. For example, there may be multiple FS licensees using the same frequency in the same geographic area. Eliminating a particular licensee – especially with limited bandwidth – will not make a meaningful amount of spectrum available for re-licensing. The approach that T-Mobile suggests – relocation and limited sharing – will be more effective in creating opportunities for use of mid-band spectrum for mobile wireless broadband use.

## **IX. CONCLUSION**

T-Mobile appreciates the Commission’s efforts to make additional spectrum, including mid-band spectrum, available for wireless broadband services. Utilizing mid-band frequencies will be necessary to support networks that will feature the benefits that 5G will offer. While the 3.7-4.2 GHz band is poised to meet those needs, the Commission should evaluate additional mid-band spectrum bands, to facilitate this growth.

Respectfully submitted,

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