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March 5, 2019

Marlene H. Dortch Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20510

Re: ***Spectrum Horizons*, First Report and Order Draft, FCC-CIRC1903-01**
ET Docket 18-21

Dear Ms. Dortch:

The mmWave Coalition ("mmWC" or the "Coalition") is pleased to respond to the First Report and Order Draft ("*Draft R&O")* issued in the above-captioned proceeding.[1] By this letter, the mmWC thanks the Commission for its timely proposed adoption of a "First Report and Order" and respectfully requests that the Commission recognize in that forthcoming order certain outstanding issues to be addressed in a Further Notice of Proposed Rulemaking ("FNPRM"), in order to further advance the enormous potential for spectrum bands above 95 GHz.

INTRODUCTION AND SUMMARY

The Coalition has been an active participant in this proceeding, filing Comments,[2] Reply Comments,[3] and Supplemental Comments.[4] Due to the federal/non-federal ("G/NG") user sharing status of virtually all the spectrum involved in this proceeding, we also filed comments with NTIA in its National Spectrum Strategy Request for Comments addressing G/NG sharing issues and cross-filed those comments[5] in this proceeding.

The Coalition compliments the Commission on the timeliness of the *Draft R&O* and its schedule for a vote barely 12 months after the release of the NPRM. This short turnaround time

[1] The mmWC is a group of innovative companies and universities united in the objective of removing regulatory barriers to technologies using frequencies ranging from 95 GHz to 275 GHz. The Coalition does not limit itself to supporting any particular use or technology but rather it is working to create a regulatory structure in the United States for these frequencies that would encompass all technologies and all possible uses, limited only by the constraints of physics, innovation, and the imagination. A list of Members and principals of the Coalition are listed in an Attachment to these Comments. For more information, please visit http://mmwavecoalition.org/.

[2] Comments of mmWC, Docket 18-21, filed May 2,2018 ("mmWC Comments").

[3] Reply Comments of mmWC, Docket 18-21, filed May 17, 2018 ("mmWC-Reply").

[4] Supplemental Comments of mmWC, Docket 18-21, field Nov. 30, 2018 ("mmWC Supplement").

[5] Comments of mmWC on NTIA National Spectrum Strategy RFC, Docket No. 181130999-8999-01, filed Jan. 22, 2019 ("mmWC NTIA Comments"); Letter from Prakash Moorut, mmWave Coalition, to Marlene Dortch, FCC, ET Docket 18-21, RM-11795 (filed Jan. 30, 2019) (cross-filing the mmWC NTIA Comments).

highlights the present Commission's commitment to timely implementation of new technology, as this improves the ability of the United States to compete globally.[6]

While we agree overwhelmingly with the findings and conclusions in the *Draft R&O*, there were several issues in the record that are omitted in that document. Therefore, in this letter, we request that the Commission state its intention to issue an FNPRM in the near term to address certain outstanding topics that mmWC has raised during this proceeding. Specifically, below we discuss five main issues that should be addressed in an FNPRM: (1) licensed spectrum for fixed and mobile use; (2) contiguous spectrum blocks of 20 GHz or more; (3) greater regulatory certainty for obtaining authority for terahertz spectroscopy; (4) coordination with NTIA to strike a better balance to protect passive services above 95 GHz while still allowing for other uses and capital investments that will bring about new services and applications in the spectrum; and (5) RF safety rules above 100 GHz.

By addressing these critical issues in an FNPRM, the Commission could continue its momentum to unlock the true potential of spectrum bands above 95 GHz.

TOPICS URGED FOR A TIMELY FNPRM

- **Licensed Spectrum for fixed and mobile use**

In the *Draft R&O*, the Commission recognizes that spectrum bands above 95 GHz are "potentially suitable for licensed use."[7] While we welcome the availability of unlicensed spectrum in the *Draft R&O*, we request that the Commission also address the need for licensed spectrum which were included in the NPRM and addressed in our comments as well as in the comments of others.[8] In today's spectrum environments, licensed and unlicensed spectrum and new allocations for them exist side by side and are complementary. The immediate need for licensed spectrum is for point-to-point applications for cellular backhaul and fixed communications systems and do not need area licensing as mobile applications do. However, we also foresee the eventual use of these spectrum bands for mobile use under appropriate service rules for responsible sharing with fixed users.

- **Large Contiguous Bandwidth of 20 GHz or more**

In our prior submissions, the mmWC advocated for at least one large contiguous block of spectrum of 20 GHz or more, especially for Fixed Service ("FS") links, to supplement the large use of fiber optics technology for both mobile backhaul and fixed communications systems.[9]

While we do not expect FS links to replace the ubiquitous fiber optic communications links that are the backbone of today's mobile and fixed telecommunications infrastructure, there is a need for a radio-based alternative in many situations. Such FS links would be used, for example, where the higher installation costs of fiber are not economically practical due to local situations, when there is a limited time duration need for capacity, or for emergency restoration of capacity where installation time is of the essence, especially in disasters where fiber installation could be time consuming. Furthermore, with the advent of 5G millimeter wave mobile systems, we urge the Commission to also

[6] Professor Theodore S. Rappaport, Future Wireless Technologies: mmWave, THz and beyond, Video Presentation, Sep. 27, 2018, available at https://www.youtube.com/watch?v=RAv8eYYbaw4.
[7] *Draft R&O* at ¶ 2.
[8] mmWC Comments at pp. 4-8.
[9] *Id.* at p. 4-8, mmWC Reply at p. 5, mmWC Supplement at p. 2-6.

consider such contiguous bandwidth allocations of 20 GHz or more at frequencies above 100 GHz for mobile use.

The *Draft R&O* only addresses unlicensed spectrum but even that spectrum is limited in bandwidth, comparable to bands already allocated below 95 GHz. For example, the spectrum at 71-76 GHz and 81-86 GHz has been available under the "licensed light" provisions of Part 101, Subpart Q since 1995. Both of these bands are 5 GHz wide, yet the new unlicensed bands in this *Draft R&O*, shown below, do not provide bandwidths that make operating well-above 95 GHz particularly desirable compared to lower bands:

Unlicensed Band in *Draft R&O*	**Bandwidth (GHz)**
116-123 GHz	7
174.8-182 GHz	7.2
185-190 GHz	5
244-246 GHz	2

Table 1: Unlicensed bands in *Draft R&O*

As Table 1 demonstrates, all of the new bands are less than 7.2 GHz and these are only marginally wider than the bands that have been available since 2003. In view of higher implementation costs at the new frequencies as in any new technology, equipment in these bands may not offer any economic advantages given the limited bandwidth.

The *NPRM* in this proceeding stated[10] that Japan has had an 18 GHz wide band at 116 GHz to 134 GHz since 2014, but the *NPRM* neither proposed it nor gave any reasons why this was not feasible. If the 116-134 GHz band is nevertheless determined to not be feasible, we urge the Commission to work with NTIA and industry to identify a comparable band (or bands) that can at least be used in US urban areas without radio astronomy facilities in the same band. We also believe the use of directional beamforming in terrestrial networks for 5G will enable mobile spectrum allocations above 100 GHz in the future.

- **Regulatory Certainty for Terahertz Spectroscopy Device Certifications**

The *NPRM* acknowledged the potential utility of this very short-range wide-bandwidth noncommunications technology but also indicated that the Commission was using a "case by case" approach for determining where equipment proposed for Part 18 equipment authorization was acceptable, and asks whether the Commission should "establish a more certain regulatory approach".[11] We believe greater certainty is critical. The *Draft R&O* states again that this technology is promising, but neither adopts nor proposes rules with any level of transparency.[12] Rather, under the *Draft R&O*, the Commission would continue to impose a "case by case" review that does not afford applicants any

[10] *Spectrum Horizons; James Whedbee Petition for Rulemaking to Allow Unlicensed Operation in the 95-1000 GHz Band*, ET Docket No. 18-21, RM-11795, Notice of Proposed Rulemaking and Order, FCC 18-17, at ¶ 12 (rel. Feb. 28, 2018) ("*NPRM*").
[11] *NPRM* at ¶ 62.
[12] *Draft R&O* at ¶ 3.

notice regarding the criteria that their application is being considered.

We renew our request for clear and transparent rules on this technology which is already being marketed in the U.S. and abroad. The mmWC urges that the Commission either agree with the interpretation of Part 18 that several manufacturers are currently using to self-certify their terahertz spectroscopy, or propose in an FNPRM an approach that will provide greater certainty for this valuable technology.[13]

- **US246 Reform for Frequencies Above 95 GHz is Needed to Improve Transparency while Protecting Passive Systems**

In prior submissions in this proceeding, the mmWC has advocated for an alternative formulation of US246 to protect vital passive systems, without a bright-line ban on additional innovative uses of the spectrum that could be shown not to harm such passive operations.[14] The present US246 starts with these words "No station shall be authorized to transmit in the following bands" and then lists 23 bands, 10 of which are above 95 GHz. In the past 2 decades, US246 has been amended twice to relax partially the protection of 2 bands – showing that changes are possible with FCC and NTIA consensus. mmWC reiterates that the impact of the US246 prohibitions above 95 GHz is much more severe than in lower spectrum. The opportunity cost associated with this total ban was not considered when this approach was chosen decades ago. We continue to urge that the phrase, "No station shall be authorized…," be replaced in the case of spectrum above 95 GHz with a transparent, performance-based protection goal based on 6 existing ITU-R recommendations for protection of passive systems.[15] This issue should be reviewed with NTIA and addressed in an FNPRM is parallel with NTIA deliberations

We urge the Commission begin discussions with NTIA to examine alternative formulations of US246 that balance the protection of passive systems with the opportunity costs to NG spectrum use. We further ask that the Commission acknowledge this effort in the adopted the finalized text of the *Draft R&O*.

- **Quantitative RF Limits above 100 GHz**

In the mmWC Comments,[16] we pointed out that the Commission's RF safety rules first adopted in 1986 have no quantitative provisions above 100 GHz[17] even though these rules are based on an IEEE standard[18] that extends to 300 GHz. In contrast to the U.S., Europe[19]and Canada[20] have rules up to 300 GHz.[21] This lack of certainty in the rules significantly increases regulatory risks for a developer

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[13] mmWC NTIA Comments at p. 12-13.
[14] mmWC Supplement at pp. 6-10; mmWC NTIA Comments at p. 10.
[15] mmWC NTIA Comments at p. 20.
[16] mmWC Comments at p. 11-12; mmWC -Reply at p. 6-7.
[17] 47 C.F.R. §1.1310(e); These rules also do not cover frequencies below 100 kHz but there is virtually no commercial interest in such extremely low frequencies.
[18] IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE Std C95.1-1992, 1992.
[19] European Agency for Safety and health at Work, Directive 2013/35/EU - electromagnetic fields (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02013L0035-20130629).
[20] Health Canada's Radiofrequency Exposure Guidelines (http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/EH/EH/Section13Final06062013.pdf).
[21] *See* T. Wu, et. al., "Safe for Generations to Come: Considerations of Safety for Millimeter Waves in Wireless

of millimeter wave technology in general and for technology for the four new bands included in the *Draft R&O* - all of which are above 100 GHz.

Such risks include a litigation risk that the equipment authorization grant without an environmental impact statement violates the National Environmental Protection Act,[22] inability to ask for federal preemption of local ordinances on RF safety of such systems, and difficulty in defending tort claims of alleged injury from RF radiation above 100 GHz.

As presently drafted, manufacturers or importers of transmitters under the new unlicensed rules would be the only manufacturers of transmitters not subject to an applicable RF safety standard. The increased regulatory and litigation risk resulting from such absence is a significant disincentive for capital formation and product development under the unlicensed rules in the *Draft R&O*. We urge the Commission to address this matter promptly in an FNPRM.

CONCLUSION

We thank the Commission for the timely progress it is making in authorizing use of spectrum above 95 GHz. We urge that the Commission commit to issuing an FNPRM in the near future that addresses the topics enumerated above.

Respectfully submitted,

mmWAVE COALITION

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Communications, "IEEE Microwave Magazine, Vol. 16, No. 2, March 2015, pp. 65-84; T. Wu, et. al., "The Human Body and Millimeter-Wave Wireless Communication Systems: Interactions and Implications," 2015 IEEE International Conference on Communications (ICC), Jun. 2015.

[22] 42 U.S.C. §§ 4321-4335.

ATTACHMENT

MEMBERS AND PRINCIPALS OF THE MMWAVE COALITION

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