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
	)	

COMMENTS OF THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION

The Telecommunications Industry Association applauds the Commission for beginning an inquiry into opening higher-frequency bands, including millimeter-wave bands, for mobile broadband applications. TIA believes that millimeter-wave spectrum will play a role in next-generation wireless networks, and will be an additional tool to help continue U.S. leadership in the provision of mobile broadband services. TIA also believes that many of the same principles for spectrum policy management that apply in lower bands continue to hold force in higher-frequency bands, including the need for predictability, flexibility, efficiency, priority, and global coordination.

As the Commission begins its inquiry, it should avoid a one-size-fits-all approach to different millimeter-wave spectrum bands, and should be open to various spectrum access models – licensed, unlicensed, licensed shared access (LSA), etc. – in different bands. The Commission should prioritize bands in which large, contiguous blocks of spectrum are available, appropriately protect and consider the needs of existing services including their growth potential, and begin collecting data regarding international practices to enable better global harmonization in any bands eventually opened for mobile broadband. Finally, the Commission's policies in this area should be driven by industry developments, including consideration of bands beyond those identified in the Notice of Inquiry if needed.

I. Guiding Principles for Millimeter-Wave Spectrum Policy

First and foremost, TIA believes that the same general principles for developing a good national spectrum policy continue to apply in the context of millimeter-wave spectrum. TIA's general spectrum principles call for regulators to provide:

- *Predictability.* To drive investment by commercial and government users alike, spectrum allocations need to be predictable. Identifying demand and changes in demand, understanding the pace of radio technology development by platform, and long-term planning are all essential parts of a spectrum policy that can provide predictability for both commercial and government users.
- *Flexibility.* For commercial allocations, flexible use policies consistent with baseline technical rules that are technology-neutral have proven to be the best approach.
- *Efficiency.* Policies should encourage more efficient use of spectrum where technically and economically feasible.
- *Priority.* In cases where band sharing is technically and economically possible, policies must advance good engineering practice to best support an environment that protects those with superior spectrum rights from harmful interference.[1]

Avoiding a one-size-fits-all-approach. When applying these principles to millimeter-wave spectrum, the Commission should avoid a one-size-fits-all approach. Good spectrum policy decisions need to be made on a band-by-band basis, depending on the particular propagation characteristics of a band, existing service allocations, and existing incumbent services within a band. The Commission's Notice of Inquiry ("NOI") specifically mentions a

[1] *See* Comments of the Telecommunications Industry Association to the White House Office of Science and Technology Policy, March 20, 2014, *in response to* FR Doc. No. 2014-03413, at 2-3, http://www.tiaonline.org/sites/default/files/pages/TIA%20OSTP%20Comments%203-20-2014.pdf

significant number of bands from 24 GHz up to 70-90 GHz and beyond, while even more bands beyond those mentioned may already be the subjects of various research and development efforts. In adopting service rules, it is essential that each band receive case-by-case attention, rather than having the agency attempt to formulate overly general policies for millimeter-wave spectrum as a whole.

A mixture of access models. TIA believes that a mixture of spectrum access models will best help unleash the potential of millimeter-wave spectrum. These could include licensed, unlicensed, licensed shared, or various alternative approaches to spectrum access, including those already deployed or under consideration, as well as access models yet to be developed. There is a significant amount of spectrum potentially available for mobile broadband in bands at 24 GHz or above, and if used carefully, there should be sufficient opportunities for the Commission to allow technological and marketplace innovation through a variety of different access models.

Large bandwidths. As the Commission explores various millimeter-wave bands for mobile broadband applications, it should pay particular attention to the need for larger bandwidths. In particular, the agency should prioritize any opportunities for providing large blocks of contiguous spectrum. Carrier aggregation under LTE is always becoming more difficult, and aggregation of spectrum from several hundred MHz to even 1 GHz may be essential to promote next-generation wireless networks.

Protections for existing services. Even in the millimeter-wave bands, the Commission is by no means writing on a blank slate. Satellite and other operations are currently active or planned in many of the bands mentioned by the Commission in the NOI, or in other millimeter-wave bands. The needs of existing services should be appropriately addressed as part of any

case-by-case evaluation of a particular band for mobile broadband use, including the ability of current operators to expand their services and innovate in the bands.

Global harmonization. Global harmonization remains critically important to enable efficiencies of scale in product development and manufacturing, while also promoting roaming ability. TIA urges the Commission to begin gathering and compiling data on international and global millimeter-wave spectrum allocations and utilization; in some cases (such as LMDS) international coordination for existing satellite operations has at times been less than ideal. Global coordination at an early stage can avoid such problems, and/or allow the Commission to prioritize bands where international misalignments are less likely.

II. The Commission Should Follow Industry's Lead Regarding Band-Specific Developments.

As the Commission moves forward in this area, it should generally allow industry efforts and technological developments to drive its policy decisions, rather than starting with any pre-conceived notions regarding which band or bands need attention first. Of course, TIA is very appreciative that the Commission has taken note of trials currently being conducted by many TIA member companies in millimeter-wave bands.[2] However, the technical and policy implications, as well as the harmonization potential of those particular bands, have not yet been fully explored. In short, experimental activities are but one input in a multi-parameter process, and the success or failure of those activities should not receive undue emphasis.

We highlight below a small sampling of millimeter-wave research and development currently taking place. However, while the NOI identifies several possible bands for millimeter-wave spectrum development, the Commission must be open to considering other bands:

[2] *See* NOI ¶¶ 11-12.

- 28 GHz. Ericsson has demonstrated the ability to establish reliable wireless links by combining multiple reflected signals.[3] Samsung has conducted trials in South Korea, and has demonstrated 28 GHz systems with data rates of 7.5 Gbps while stationary and 1.2 Gbps in a vehicle travelling at over 100 km/h.[4]
- 38-39 GHz. Intel is exploring developing chipsets to support mobile access.[5] Samsung and the U.S. Army have funded field trials by NYU and the University of Texas.[6]
- 60 GHz. Qualcomm has recently developed a chipset for multi-gigabit Wi-Fi, or "WiGig."[7] Intel is similarly exploring developing WiGig chipsets.[8]
- 72 GHz. Nokia has conducted ray-tracing computer simulations.[9] Google recently applied to do some experiments in the 70 and 80 GHz range.[10]

III. Future Mobile Broadband Technologies Will Rely on Various Technologies and Spectrum Bands, Including Lower-Band and Millimeter-Wave Spectrum.

Millimeter-wave spectrum could play an important role in future mobile broadband wireless networks. While the future of technology is very difficult to predict, future wireless

[3] Ericsson, *Re-Think Non-Line-Of-Sight*, 2013, http://www.ericsson.com/res/docs/2013/rethink-non-line-of-sight.pdf

[4] Samsung, *Samsung Electronics Sets 5G Speed Record at 7.5Gbps, Over 30 Times Faster than 4G LTE*, October 15, 2014, http://www.samsung.com/uk/news/local/samsung-electronics-sets-5g-speed-record-at-7-5gbps-over-30-times-faster-than-4g-lte

[5] *See* NOI ¶ 12 & n. 31.

[6] *See* NOI ¶ 11.

[7] Qualcomm, *WiGig: wireless connectivity at incredible speeds*, November 6, 2014, https://www.qualcomm.com/news/onq/2014/11/06/wigig-wireless-connectivity-incredible-speeds; *see also* Dong Ngo, *Qualcomm and Wilocity mix Wi-Fi and WiGig, demo first Tri-band consumer products*, CNet.com, Jan. 8, 2013, http://www.cnet.com/news/qualcomm-and-wilocity-mix-wi-fi-and-wigig-demo-first-tri-band-consumer-products/

[8] *See* NOI ¶ 12 & n. 31.

[9] *See* NOI ¶ 12 & n. 32.

[10] *See* Mike Dano, *Google to test millimeter wave transmissions in 71-76 GHz and 81-86 GHz bands*, Oct. 16, 2014, http://www.fiercewireless.com/tech/story/google-test-millimeter-wave-transmissions-71-76-ghz-and-81-86-ghz-bands/2014-10-16

networks are likely to rely upon some combination of new spectrum, leveraging existing spectrum, heterogeneous approaches, the use of small cells, and increased spectrum sharing. All will combine to affect the ultimate design and deployment of future networks.

As mobile broadband networks progress, we will continue to see networks focus on traditional benchmarks such as increased speed and reduced latency, where millimeter-wave spectrum may play an important role. In addition, new measures such as network reliability, robustness, and security could play a larger role, particularly as wireless usage paradigms extend beyond phones and tablets to embrace appliances, vehicles, health care applications, widely distributed sensor networks, etc. Furthermore, future networks are likely to be characterized by elements such as advanced antenna solutions, ultra-lean design, spectrum flexibility, the possible convergence of access and backhaul networks, and larger bandwidths.[11]

Ultimately, future networks seem unlikely to be based upon a single wireless standard (*e.g.*, LTE or WiMax) or particular type of spectrum (*i.e.*, VHF, UHF, SHF / centimeter-wave or EHF / millimeter-wave). Rather, future broadband networks may emerge as a suite of inter-related standards and protocols all working harmoniously, with the selection of particular technological tools being dependent on specific use cases.[12] Millimeter-wave spectrum will have a significant role to play, and will be an important new tool among several in the toolbox.

The need for more low-band spectrum. Many of the technologies for next-generation wireless networks discussed above will rely upon lower-band spectrum. Indeed, some of the new technologies may be inherently incompatible with millimeter-wave deployments due to the latter's unique propagation characteristics – for example, millimeter-wave spectrum seems

[11] *See* Ericsson Review, *5G radio access*, June 18, 2014, *available at* http://www.ericsson.com/res/thecompany/docs/publications/ericsson_review/2014/er-5g-radio-access.pdf

[12] *See* Qualcomm, *5G and Wireless Broadband Evolution*, May 13, 2014, *available at* http://johannesbergsummit.com/wp-content/uploads/sites/6/2013/11/Smee-Qualcomm_5G_Johannesburg_2014.pdf

inherently unsuited to macrocell applications due to range issues. Therefore, even as the Commission begins to explore opening millimeter-wave spectrum for commercial broadband applications, the agency must continue to make additional lower-band spectrum available for commercial mobile broadband as appropriate.

Global developments. TIA recognizes that other countries have begun moving forward on millimeter-wave spectrum issues, and TIA supports the FCC's efforts to begin examining technical and policy issues related to millimeter-wave spectrum. For reasons of maintaining global competitiveness and to encourage further innovation, the U.S. ICT industry would benefit from near-term policy development – and the increased regulatory certainty that will hopefully result – regarding various millimeter-wave spectrum bands.

IV. Conclusion

TIA appreciates the Commission launching this Notice of Inquiry at this time. The time is right to begin exploring the potential use of millimeter-wave spectrum for mobile broadband, even as much more work remains to be done in making lower-band spectrum available. TIA looks forward to continued work with the Commission on these important issues in the years ahead.

Respectfully submitted,

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