Before the
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, DC 20230

In the Matter of The Benefits, Challenges, and Potential Roles for the Government in Fostering the Advancement of the Internet of Things	Docket No. 170105023-7023-01 RIN 0660-XC033

COMMENTS OF QUALCOMM INCORPORATED

Qualcomm Incorporated applauds NTIA's thoughtful efforts "to champion the development of a robust IoT environment" as detailed in its "Fostering the Advancement of the Internet of Things" Green Paper.[1] Qualcomm[2] is pleased to provide further input on next steps the agency should take to continue promoting IoT growth.[3] We are engaged on multiple fronts to enable IoT technology in devices, sensors, tags, and machines, developing highly robust and power efficient wireless chipsets and technologies to support IoT applications that improve our lives and transform our homes and workplaces.[4]

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[1]   *See* Dep't of Commerce, Internet Policy Task Force & Digital Economy Leadership Team, "Fostering The Advancement Of The Internet Of Things" (Jan. 2017) ("Green Paper") at 1, *available at* https://www.ntia.doc.gov/files/ntia/publications/iot_green_paper_01122017.pdf. *See also* NTIA, "Benefits, Challenges, and Potential Roles for the Government in Fostering the Advancement of the Internet of Things," *Notice, Request for Public Comment*, 81 Fed. Reg. 19956 (Apr. 16, 2016) ("2016 Request for Comment").

[2]   These Comments refer to "Qualcomm" for ease of reference. Qualcomm Incorporated operates our patent licensing business, QTL, and owns the vast majority of our patent portfolio, while Qualcomm Technologies, Inc., QTI, its wholly-owned subsidiary, operates, along with its subsidiaries, substantially all of our products and services businesses, including our semiconductor business, QCT, and substantially all of our research and development functions.

[3]   *See* NTIA, Benefits, Challenges, and Potential Roles for the Government in Fostering the Advancement of the IoT, 82 Fed. Reg. 4313 (Jan. 13, 2017) ("2017 Request for Comment").

[4]   *See* Qualcomm Internet of Things website, *available at* https://www.qualcomm.com/solutions/internet-of-things (*last accessed* Mar. 13, 2017).

As we explained in our comments on NTIA's 2016 Request for Comment, Qualcomm has been working for more than three decades to interconnect all things (devices, tags, sensors), all places, and all people so they can use such connectivity to create new applications and services to improve business flows, generate economic efficiencies, and fuel continued growth.[5] IoT technologies are transforming our homes, our workplaces, and our lives and core sectors of our economy, and Qualcomm is helping a growing swath of industries evolve through the IoT — from manufacturing and transportation to urban planning, healthcare, and agriculture.

For each of these industries, IoT communications needs vary depending on the application or service, ranging all the way from a body-worn sensor that periodically sends a short burst of non-time and non-life-critical data on to a precision robot that requires a highly reliable and very low latency command and control link. Qualcomm is working to support these diverse IoT implementations in the most efficient and reliable way.

Qualcomm's 2016 Comments contained a lengthy description of our efforts in the IoT space. Since that time, we have continued to expand our chipset offerings to support IoT applications via the latest generation of Bluetooth and Wi-Fi,[6] and have optimized LTE for IoT applications via Cat-M1 (e-MTC - enhanced Machine Type Communications) and Cat-NB1 (NB-IoT Narrowband IoT) interfaces,[7] which are paving the way to 5G support of a massive IoT.

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[5]   *See* Comments of Qualcomm Incorporated at 2-13 (filed June 2, 2016) *available at* https://www.ntia.doc.gov/files/ntia/publications/qualcomm_comments_on_ntia_iot_rfc.pdf (*last accessed* Mar. 13, 2017).

[6]   See Qualcomm Bluetooth products, *available at* https://www.qualcomm.com/products/bluetooth; Qualcomm Wi-Fi products, *available at* https://www.qualcomm.com/products/wi-fi (*last accessed* Mar. 13, 2017).

[7]   *See* Qualcomm LTE IoT website, *available at* https://www.qualcomm.com/invention/technologies/lte/advanced-pro/lte-iot (*last accessed* Mar. 13, 2017).

Given that the IoT will comprise a broad suite of solutions aimed at satisfying diverse communication needs, Qualcomm is working with a wide-ranging group of industry partners to develop and grow these solutions. Qualcomm recommends that the U.S. Government implement an IoT policy framework that broadly supports the foundational elements delineated in our 2016 Comments that were echoed in the Green Paper by NTIA and are reiterated below, for it sets out a proven path forward to ensure the development of a robust IoT environment that benefits our economy, American consumers, and society as a whole.

I. NTIA Should Continue Opening Up Additional Spectrum For IoT And Other Uses

The Green Paper rightly recognizes that more spectrum resources will be needed to support the broad-range and growing number of IoT devices, services, and applications well into the 21st Century.[8] Qualcomm appreciates NTIA's recognition that the agency needs to continue working with the FCC and with federal agencies that use spectrum to identify and allocate more spectrum for the IoT and other wireless applications and services.

Innovative sharing approaches can be used to open up more spectrum for wireless use. Fully cleared spectrum that can be exclusively licensed for mobile broadband use will remain the gold standard because of the flexibility and highly reliable service level it offers licensees. Nevertheless, Qualcomm recognizes that the wireless industry and the U.S. Government need to consider alternative means of accessing spectrum, including sharing mechanisms that allow a spectrum band to be used for commercial wireless applications, including IoT applications, where and when the band is not being used to satisfy government needs. Any and all available spectrum that can support IoT needs should be considered closely.

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[8] *See* Green Paper at 3, 17-18, 23, 56.

The U.S. Government should explore all spectrum bands for potential use for IoT applications, but it should avoid limiting spectrum bands to IoT use only. The U.S. Government should not define service-specific spectrum, such as IoT-only usage or other specific purposes, because the consumers, technology developers, service providers, and the wireless industry at large require the flexibility to use any and all types of spectrum to support IoT services and any other wireless services. Today's wireless technologies can provide a wide range of service levels and capabilities to support any and all communications needs, and opening spectrum bands with flexible use rules gives consumers, developers, and providers necessary flexibility to meet those needs and make the most efficient and intensive use of spectrum.

All spectrum bands are needed to support IoT applications. Some IoT applications will demand ultra-high-bandwidth support and thus may work best in the millimeter wave bands, while other IoT applications will need low-power, low-duty-cycle, long-range performance and thus be best supported by the sub-3 GHz bands.[9] Without question, all spectrum bands — low-band spectrum below 6 GHz, mid-band spectrum from 6 to 20 GHz, and high-band spectrum above 20 GHz — are needed for the continued successful deployment of the IoT, enhanced mobile broadband, and mission-critical applications and services, like connected autonomous vehicles, critical infrastructure management, remote medical procedures, as well as command and control communications for drones and robotics. Qualcomm has a long history of working with the U.S. Government to open up spectrum for wireless applications, and we will continue

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[9]   *See* Green Paper at 17 ("IoT applications will leverage exciting technological advances, such as those associated with 5th generation (5G) wireless technologies, innovative unlicensed use of spectrum, low-power connectivity protocols, and others."); *id*. at 18 (noting need to access low, mid, and high-band spectrum).

this collaboration with the FCC and NTIA to open spectrum for current and future wireless applications.[10]

International harmonization is a laudable goal, but it should not limit U.S. government action to open bands for commercial use. While Qualcomm generally supports international harmonization of spectrum because it can simplify device design complexity, promote economies of scale, and enable global roaming capabilities, the U.S. should not restrict itself from considering spectrum that may not immediately lend itself to harmonization — just like the FCC has done in its *Spectrum Frontiers* proceeding.[11]

II.   NTIA Should Continue Supporting Industry-Led Standardization Efforts

Qualcomm applauds NTIA's recognition that "market forces will undoubtedly shape IoT development and innovation [and that] an industry-led, bottom-up, consensus-based approach to standards development is necessary to realize the benefits of the technology,"[12] and we hail NTIA's reaffirmation to "continue to support U.S. industry initiatives and participation in a range of standards bodies, … actively advocate for work methods that recognize the value of private sector standardization efforts, and … support greater collaboration between standards organizations."[13] Indeed, this approach to standardization is consistent with federal policies to promote commercial solutions without governmental intervention, for it has enabled the U.S. to lead the world in 4G LTE deployment and is now enabling the U.S. to lead the way on 5G.

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[10]   *See* Qualcomm 2016 Comments at 13-14.

[11]   *See, e.g.,* FCC, Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, GN Docket No. 14-177, *Report & Order and Further Notice Of Proposed Rulemaking*, FCC 16-89 (July 14, 2016).

[12]   Green Paper at 47; *id.* at 44, 58.

[13]   *Id.* at 13 ("The Department will also advocate against attempts by governments to impose top-down, technology-specific 'solutions' to IoT standardization needs."); *id.* at 15.

*Qualcomm actively participates in many industry-led, global standardization efforts,
which have been very successful in enabling the commercialization of new technologies
without governmental intervention*. We are active participants in the 3GPP organization, which
defined standards for 4G LTE and is developing 5G standards, as well as the IEEE's 802.11 Wi-
Fi standardization efforts, and the oneM2M organization that is defining an operating system for
IoT devices. Qualcomm also is actively engaged and serves on the boards of the Wi-Fi Alliance,
the Bluetooth Special Interest Group, the Thread Group, and the Homeplug Alliance, among
others, which are developing and promoting specifications and interoperability programs for IoT
connectivity technologies. Our goal is to actively work across the various standardization bodies
that touch the IoT to consolidate efforts where possible in order to maximize effectiveness and
enable broad interoperability by reducing fragmentation. NTIA's strong support of this approach
in its Green Paper is most welcome.[14]

U.S. government agencies should continue engaging with their overseas counterparts.
Qualcomm agrees with NTIA that U.S. government agencies need to continue their dialogue and
engagement on IoT advancement with their counterpart agencies in other countries, with
particular emphasis on the aforementioned priorities of spectrum allocation, industry-led
standards, and pro-competitive investment policies.[15] The use of government and private sector
joint dialogues facilitates information sharing and can help advance an IoT policy and regulatory
environment that supports U.S. goals of advancing competition and innovation.

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[14]   *See id*. at 45 ("Industry, with active participation from government [], is ideally positioned to lead
the development of technological standards and solutions to address global IoT environment opportunities
and challenges.")

[15]   *See* Green Paper at 40.

**III.   The U.S. Government Should Continue Supporting Policies That Enable
The Timely Deployment Of Wireless Infrastructure To Support The IoT**

NTIA also aptly recognizes that the IoT will place increased demands upon wireless infrastructure, and it is essential that infrastructure be able to evolve and improve along with the evolution of the IoT.[16] Network densification using small cells will play an important role in supporting the continued exponential growth in wireless devices, applications, services, and data usage, and Qualcomm has developed, and is continuing to refine, self-organizing networks that integrate small cell solutions. Therefore, it is critically important that the U.S. Government continue to implement policies to streamline the process to deploy wireless network infrastructure by implementing more efficient zoning and siting policies and approval procedures. These policies and approval processes will be essential to IoT success because the networks of tomorrow will have greatly densified and highly diversified infrastructure.
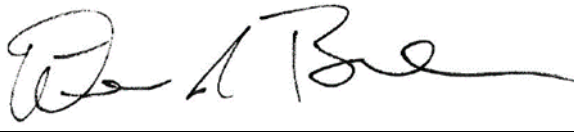
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[16]   *See* Green Paper at 20-23.

CONCLUSION

The NTIA Green Paper properly recognizes that the IoT can transform critically important sectors of our economy from housing, transportation, and urban planning to healthcare, education, and agriculture. Qualcomm completely agrees with NTIA that IoT advancement would be engendered best by "a reaffirmation rather than a reevaluation of th[e] well-established U.S. Government policy approach to emerging technologies."[17] To ensure the continued successful growth of the IoT, Qualcomm requests that NTIA follow the recommendations in Qualcomm's 2016 Comments and these supplemental Comments, which are consistent with the Green Paper's proposed path forward. We live in a very exciting time in our nation's history, and Qualcomm is aggressively researching, designing, developing, and enhancing the technologies to support next generation IoT equipment, applications, and services.

Respectfully submitted,

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[17]   Green Paper at 2.