

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
Spectrum Requirements for the Internet of Things) ET Docket No. 21-353
)
)

NOTICE OF INQUIRY

Adopted: September 29, 2021

Released: September 30, 2021

Comment Date: November 1, 2021
Reply Comment Date: November 16, 2021

By the Commission: Acting Chairwoman Rosenworcel and Commissioner Starks issuing separate statements.

I. INTRODUCTION

1. By this Notice of Inquiry, the Commission seeks comment on issues related to spectrum for the Internet of Things, as directed by Congress in the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (NDAA or the Act). Specifically, the NDAA requires the Commission to issue a notice of inquiry seeking comment on the current and future spectrum needs "to enable better connectivity relating to the Internet of Things [IoT]." In this regard, the Act instructs the Commission to seek comments that consider and evaluate various related factors that will bear on the growth of the IoT, including any regulatory barriers that may hinder the provision of spectrum needed to support uses relating to the IoT.

II. BACKGROUND

2. Broadly speaking, the IoT refers to a system of Internet-connected devices that are able to collect and transfer data. Advances in hardware, network connectivity, interoperability, and software are accelerating the development of IoT technologies. As electronic devices have become smaller, with higher data processing, more capable, and less expensive, it has become possible to expand the universe

1 William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, Pub. L. No. 116-283, § 9204(c), 134 Stat. 3388, 4801 (NDAA or the Act).

2 Id. at § 9204(c)(1).

3 Id. at § 9204(c)(2).

4 See Oracle, What is IoT, https://www.oracle.com/internet-of-things/what-is-iot/ (last visited Sept. 7, 2021); Merriam-Webster, Internet of Things, https://www.merriam-webster.com/dictionary/Internet%20of%20Things (last visited Sept. 7, 2021); IBM, Internet of Things on IBM Cloud, https://www.ibm.com/cloud/internet-of-things (last visited Sept. 7, 2021); see also U.S. Dep't of Commerce Internet Policy Task Force & Digital Economy Leadership Team, Fostering the Advancement of the Internet of Things 5-8 available at https://www.ntia.doc.gov/files/ntia/publications/iot_green_paper_01122017.pdf (noting a lack of consensus around a clear definition for IoT and electing to use the term "as an umbrella term to reference the technological development in which a greatly increasing number of devices are connected to one another and/or to the Internet.")

5 Internet of Things, Information on Use by Federal Agencies, U.S. Government Accountability Office, GAO 20-577, at 4 (2020) (GAO Report), https://www.gao.gov/assets/gao-20-577.pdf.

of Internet-connected things.⁶

3. The applications of IoT are far-reaching. In the home, IoT can be used for home automation—controlling the temperature, lighting, entertainment systems, and appliances—to create the connected home.⁷ In industrial settings, Industrial IoT (IIoT) unites assets, advanced analytics, and modern workers by using connected industrial devices to monitor, collect, exchange, and analyze insights to drive faster and better decision-making.⁸ IIoT can be used to track inventory, improve the monitoring of product quality, and automate factories to make them run more efficiently.⁹ IIoT may be deployed as a standalone network or rely on a mobile operator’s network. IoT-networked devices are used to monitor power grids.¹⁰ The IoT can also be used to collect data about the world around us; measure rainfall amounts,¹¹ monitor traffic conditions.¹² The IoT can be used to link devices worn on a person’s body, which can help improve patient monitoring and telehealth applications.¹³ IoT technologies are also developing to improve public safety¹⁴ and aid first responders, such as by providing faster field response, real-time data link with information critical to the safety and abilities of firefighters.¹⁵ The myriad use cases of IoT are helping to drive innovation in a wide variety of settings, including industrial, government, commercial, and residential.

4. While some IoT devices are connected to the Internet by wires, most require a wireless connection—whether terrestrial or space-based—to provide Internet connectivity.¹⁶ Wireless connections often are employed either to provide the IoT device with mobility, or to overcome impediments, such as

⁶ *Id.* at 5.

⁷ See, e.g., Simon Hill, *The Ultimate Guide to Setting Up Your Smart Home*, Wired, July 20, 2021, available at <https://www.wired.com/story/how-to-set-up-smart-home/> (last visited Sept. 7, 2021).

⁸ Colin Parris, *What Is the Industrial Internet of Things (IIOT)?*, GE Digital Blog, <https://www.ge.com/digital/blog/what-industrial-internet-things-iiot> (last visited Sept. 7, 2021).

⁹ See Philip Tracy, *The Top 5 Industrial IoT Use Cases*, IBM Business Operations Blog (Apr. 19, 2017), <https://www.ibm.com/blogs/internet-of-things/top-5-industrial-iiot-use-cases/> (last visited Sept. 7, 2021); see also Oracle, *What is IoT*, <https://www.oracle.com/internet-of-things/what-is-iiot/> (last visited Sept. 7, 2021).

¹⁰ See U.S. Dep’t of Energy, *Internet of Things-enabled Devices and the Grid* (June 1, 2017), <https://www.energy.gov/articles/internet-things-enabled-devices-and-grid> (last visited Sept. 7, 2021); see also Intel, *Modernize with Technologies for the Smart Grid*, <https://www.intel.com/content/www/us/en/energy/smart-grid.html> (last visited Sept. 7, 2021).

¹¹ See, e.g., Aeris, *How IoT Improves Rain Gauge Technology*, <https://www.aeris.com/news/post/how-iiot-improves-rain-gauge-technology/> (last visited Sept. 7, 2021).

¹² See, e.g., Scott Lowe, Seagate, *How IoT Can Help Smart Cities Solve Major Traffic Problems*, <https://blog.seagate.com/intelligent/iiot-can-help-smart-cities-solve-major-traffic-problems/> (last visited Sept. 7, 2021).

¹³ Ben Forgan, *How IoT Is Transforming Healthcare*, Forbes, Mar. 31, 2021, available at <https://www.forbes.com/sites/forbestechcouncil/2021/03/31/how-iiot-is-transforming-healthcare/?sh=5a80ddd467e5>.

¹⁴ Ajay Rane, *How the Internet of Things Can Improve Public Safety*, Security Magazine, Apr. 20, 2020, available at <https://www.securitymagazine.com/articles/92186-how-the-iiot-can-improve-public-safety> (last visited Sept. 7, 2021).

¹⁵ See, e.g., Aeris, *Fire Fighting with IoT*, <https://www.aeris.com/news/post/fire-fighting-with-iiot/> (last visited Sept. 7, 2021).

¹⁶ See, e.g., Senseware, *The Truth About IoT Implementations – Wireless vs. Wired*, <https://blog.senseware.co/2017/10/10/iiot-implementations-wireless-vs-wired> (last visited Sept. 7, 2021).

remote locations and high costs, that can render a wired connection impractical.¹⁷ Globally, more than 25 billion connected IoT devices are predicted to be in operation by 2030, which would contribute to the ever-increasing need for wireless connectivity.¹⁸

III. DISCUSSION

5. Pursuant to the NDAA, the Commission, in consultation with the National Telecommunications and Information Administration (NTIA),¹⁹ is required to “issue a notice of inquiry seeking public comment on the current . . . and future spectrum needs to enable better connectivity relating to the Internet of Things.”²⁰ Specifically, the Act requires that the Commission, “[i]n issuing the notice of inquiry . . . , seek comments that consider and evaluate”:

- (A) whether adequate spectrum is available, or is planned for allocation, for commercial wireless services that could support the growing IoT;
- (B) if adequate spectrum is not available for the purposes described in subparagraph (A), how to ensure that adequate spectrum is available for increased demand with respect to the IoT;
- (C) what regulatory barriers may exist to providing any needed spectrum that would support uses relating to the IoT; and
- (D) what the role of unlicensed and licensed spectrum is and will be in the growth of the IoT.²¹

Accordingly, we invite interested parties to provide comments on the issues identified above. In the remainder of this Discussion section, we summarize various relevant regulatory developments affecting the availability of spectrum that can be used for IoT purposes, and we pose more specific questions to inform comment on the four broad areas of inquiry listed above and on our overarching request for any spectrum-related information that can be used to improve connectivity to and within the growing IoT ecosystem.

6. Since the 1990s, the Commission has made a large amount of spectrum available for commercial terrestrial use through the authority granted by Congress to establish a system of competitive bidding.²² The Commission has also used its authority to make spectrum available through means other

¹⁷ See, e.g., GAO Report at 9 (discussing the Environmental Protection Agency’s use of IoT sensors in the Charles River to monitor water quality); see also *Organizations Are Turning to Technology to Save the World’s Most Threatened Animals*, NEC Insights, NEC, available at <https://www.nec.com/en/global/insights/article/2020022502/index.html> (last visited Sept. 7, 2021) (discussing using wireless IoT devices to monitor endangered species as it is not practical to use wired connections for these purposes given that animals are inherently mobile and their habitats are often in remote locations).

¹⁸ Arne Holst, *Number of Internet of Things (IoT) Connected Devices Worldwide from 2019 to 2030* (Jan. 20, 2021), <https://www.statista.com/statistics/1183457/iot-connected-devices-worldwide/> (last visited Sept. 7, 2021).

¹⁹ Pursuant to section 9204(c) of the NDAA, the Commission consulted with the National Telecommunications and Information Administration (NTIA) on this Notice of Inquiry.

²⁰ NDAA at 4801 § 9204(c)(1).

²¹ *Id.* at 4801 § 9204(c)(2). The Commission must submit a report to Congress, by “[n]ot later than 1 year after the date of enactment” of the NDAA, that “summariz[es] the comments submitted in response to the notice of inquiry.” *Id.* § 9204(c)(3).

²² 47 U.S.C. 309(j)(1). For a list of spectrum auctions, see Federal Communications Commission, *Auctions*, <https://www.fcc.gov/auctions> (last visited Sept. 7, 2021). The Commission continues to actively auction spectrum for commercial use. Earlier this year the Commission concluded Auction 107, which auctioned 280 megahertz of spectrum in the 3.7-3.98 GHz band. See <https://www.fcc.gov/auction/107>. The Commission also is required by statute to license spectrum at 3.45-3.55 GHz by the end of this year, and that auction is scheduled to begin on October 5, 2021. See *Facilitating Shared Use of the 3100-3550 MHz Band*, Second Report and Order, Order on

(continued....)

than auctions.²³ Much of this spectrum has been licensed using a flexible-use approach that permits licensees to deploy any type of wireless technology and offer any type of service within their geographic service areas.²⁴ This flexibility permits licensees to develop and execute their business plans by offering the technologies and services that consumers demand. This flexible licensing and spectrum use approach also permits licensees to adopt technologies and offer services that could support connectivity to IoT devices in addition to traditional mobile connectivity (*e.g.*, cell phones). Is the licensed spectrum that the Commission has made available or intends to make available for flexible use adequate to support the needs of the IoT? As the Commission has been making spectrum available across low, mid, and high bands, how does each band affect the types of IoT services and applications that can be offered? What technology solutions have licensees deployed or plan to deploy to meet the connectivity needs of IoT devices? Standards groups such as 3GPP, IEEE, and others are also involved with IoT development. Are these standards providing sufficient guidance for IoT implementation in already existing spectrum bands? If the growing need for IoT connectivity is not being met with the current and planned licensed spectrum resources, what steps can the Commission take to address this important use in the future? Are there any spectrum bands not currently being used or planned for IoT services that would be particularly beneficial to expanding IoT use? To the extent any desirable bands have different levels of encumbrances, including existing rules or standards for incumbent protection, what steps can be taken to make such spectrum available for IoT?

7. We also seek comment on whether we should explore possibilities for IoT outside spectrum bands being considered for commercial wireless access. Are there alternate spectrum bands which the Commission has not considered because they are not well-suited to other types of commercial wireless networks, but which would be suited to IoT deployments? Are IoT transmissions different from those of other wireless devices (*e.g.*, those requiring broadband Internet access) such that they do not require exclusive-use licenses? Similarly, does the nature of IoT open-up additional possibilities for sharing spectrum with other users that were not available for other types of commercial wireless networks? For example, are IoT transmissions sufficiently intermittent and short that they do not present a risk of harmful interference to incumbent users that other types of networks would? Notably, the Commission's framework for dynamic spectrum sharing in Citizen Broadband Radio Services (CBRS), including access to spectrum through the licensed-by-rule Generalized Authorized Access (GAA) tier has been used by some utility networks and IoT applications in the United States.²⁵ In discussing alternative spectrum bands, commenters should consider the impact on existing services, including passive services.

Reconsideration, and Order of Proposed Modification, WT Docket No. 19-348, 36 FCC Rcd 5987 (2021). Additionally, the Commission will auction spectrum in the 2.5 GHz band. *See Transforming the 2.5 GHz Band*, Report and Order, WT Docket No. 18-120, 34 FCC Rcd 5446 (2019).

²³ *See Transforming the 2.5 GHz Band, Report and Order*, WT Docket No. 18-120, 34 FCC Rcd 5446 (2019); *see also Review of the Commission's Rules Governing the 896-901/935-940 MHz Band*, WT Docket No. 17-200, 35 FCC Rcd 5183 (2020).

²⁴ The Commission has defined "flexibility" as "granting both licensed users and unlicensed device operators the maximum possible autonomy to determine the highest valued use of their spectrum, subject only to those rules that are necessary to afford reasonable opportunities for access by other spectrum users and to prevent or limit interference among multiple spectrum uses." *Spectrum Policy Task Force*, Report, ET Docket No. 02-135, at 16 (Nov. 15, 2002), <https://www.fcc.gov/document/spectrum-policy-task-force>.

²⁵ *See Alpha Wireless, Private LTE and CBRS: the Utilities Perspective*, <https://alphawireless.com/private-lte-and-cbrs-the-utilities-perspective/> (last visited Sept. 7, 2021); *Fierce Wireless, CBRS will bring change to energy and utility industries*, <https://www.fiercewireless.com/wireless/cbrs-will-bring-change-to-energy-and-utility-industries> (last visited Sept. 7, 2021); *Fierce Wireless, Industry Voices – Paolini: Why did utilities pay so much for CBRS licenses?*, <https://www.fiercewireless.com/private-wireless/why-did-utilities-pay-so-much-for-cbrs-licenses> (last visited Sept. 7, 2021).

8. We also recognize that satellite communications can play a role in IoT.²⁶ We seek comment on that role and spectrum requirements needed for IoT applications and services provided by satellites. Does the ubiquity of global coverage by some satellites impact spectrum needs for IoT? What role will satellite connectivity play in expanding IoT? Are there different IoT applications and services that are better facilitated by satellite systems as compared to terrestrial wireless communications? For example, does the latency associated with different orbits, such as low-, medium-, or high-Earth orbits, affect spectrum needs of IoT applications? Additionally, how should the Commission consider future spectrum needs for satellite IoT?

9. Fostering the development and deployment of IoT services and applications does not just require increasing availability of spectrum, however. To the extent that IoT operators wish to construct their own networks using licensed spectrum, as opposed to deploying using commercial wireless networks designed for other uses, they may need to become spectrum licensees. Are there Commission rules that could be modified to facilitate greater spectrum access for IoT deployments? How could these rules be adjusted to support the development and use of IoT on dedicated IoT networks using licensed spectrum? For example, many spectrum licenses come with buildout requirements in order to prevent the warehousing of spectrum rights and ensure wireless networks are available to as many Americans as possible. Recognizing that IoT networks are fundamentally different from other commercial wireless networks, the Commission has recently worked to establish different buildout requirements for IoT networks.²⁷ Have these efforts successfully provided for IoT use of these bands? Are there other licensing rules, such as license areas and license terms, which limit the use of IoT in these bands? What can the Commission do to make these licenses more appealing to IoT network operators? Alternatively, are there ways in which the Commission's leasing rules could be amended to make it easier for IoT operators to lease spectrum for their networks, rather than become licensees themselves? How would these changes impact other Commission requirements related to spectrum use?

10. In addition to services operating on licensed spectrum, the Commission's Part 15 rules can play an important role in connecting IoT devices. Unlicensed devices provide spectrum access with low entry barriers; that is, because no license is needed anyone using approved equipment can access the spectrum without paying license fees or obtaining spectrum rights through an auction. However, all unlicensed devices operate on a shared basis with other unlicensed devices or licensed services and operate on a non-interference basis. Unlicensed devices are not permitted to cause interference to and must accept interference from authorized services.²⁸ Unlicensed operations may occur across most of the spectrum, except in bands specifically restricted from such use.²⁹ Thus, the regulatory barriers to implement an unlicensed IoT system or connect IoT devices in the home or a business are lower provided the lack of interference protection does not pose an impediment. For example, most in-home IoT devices such as thermostats, water or gas leak detectors, and smart home controllers connect to the Internet using unlicensed Wi-Fi connections. Similarly, many factories or manufacturing facilities that have control over their property, can also connect industrial machine-to-machine IoT devices to monitor equipment, assembly lines, etc. using unlicensed devices without worrying about interference as they are the sole user in that location.

²⁶ See Satellite Industry Associations, *Satellite IoT or the Internet of Things*, <https://sia.org/satellites-services/iot-m2m/> (last visited Sept. 7, 2021).

²⁷ *3.45 GHz Second Report and Order*, 36 FCC Rcd. at 6932-33, paras. 126-28 and *Expanding Flexible Use of the 3.7-4.2 GHz Band*, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343, 2388, paras. 99-100 (2020).

²⁸ 47 CFR § 15.5(b).

²⁹ 47 CFR § 15.205.

11. In most spectrum, unlicensed operations are limited to very low power so as to keep the potential for causing harmful interference to authorized users low.³⁰ However, in several bands, unlicensed devices operate pursuant to Commission rules that allow higher power levels and greater flexibility than the general unlicensed device radiated emission limits.³¹ In some other bands, unlicensed devices can transmit with significant power but operate under technical parameters such as having to employ spectrum sensing, restrict operations to inside buildings, or have spectrum access managed by an automated system or a combination of technical and operational restrictions.³² What role have unlicensed devices played in the growth of IoT? What role is anticipated for unlicensed devices as IoT devices continue to proliferate for home and business applications? Does the lack of interference protection make unlicensed devices unsuitable for some IoT applications? Is the amount of spectrum available for use by unlicensed devices adequate to meet the needs of the IoT? Should additional spectrum be considered for unlicensed operations exclusively for IoT devices and applications? Are there unique properties of IoT devices that would be better served by targeted rule changes to the unlicensed spectrum access rules? If so, what changes would be necessary to ensure increased utility of unlicensed IoT devices.

12. We seek comment on what regulatory barriers may exist to providing any needed spectrum that would support uses relating to the IoT. Use of non-federal radio spectrum is governed by the Commission's technical and operational rules. These rules are designed to efficiently manage access to radio spectrum while preventing the occurrence of harmful interference between different spectrum users whether on an unlicensed or licensed basis. These rules may present regulatory barriers to particular IoT use cases in specific frequency bands. For example, in bands where unlicensed devices are subject to the general radiated limits,³³ the permissible power levels may be lower than what is necessary for IoT devices to communicate. Similarly, some licensed bands may have use or technical restrictions that could act as an impediment to using IoT devices.³⁴ Are there any other regulatory barriers that may exist to providing the needed spectrum access to support uses related to IoT? What steps can the Commission or other government agencies take to reduce or remove these regulatory barriers?

13. *Digital Equity and Inclusion.* Finally, the Commission, as part of its continuing effort to advance digital equity for all,³⁵ including people of color, persons with disabilities, persons who live in rural or Tribal areas, and others who are or have been historically underserved, marginalized, or adversely

³⁰ See 47 CFR § 15.209.

³¹ 47 CFR §§ 15.247, 15.407, 15.255.

³² For example, unlicensed devices in the 5250-5350 MHz and 5470-5725 MHz bands must employ Dynamic Frequency Selection to detect the presence of radar systems. 47 CFR § 15.407(h)(2). In the 5925-7125 MHz band, unlicensed access points must either access an automated frequency coordination system to determine permissible operating frequencies or be restricted to indoor operation at lower power levels. 47 CFR §§ 15.407(a)(5), 15.407(k); *Unlicensed Use of the 6 GHz Band*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852, 3860, paras. 17-18 (2020). To facilitate the development of new and innovative narrowband IoT devices, the Commission also established “a new class of ‘narrowband white space devices,’ which [are] a type of fixed or personal/portable white space device [that operates] in a bandwidth of no greater than 100 kilohertz.” *Unlicensed White Space Device Operations in the Television Bands*, Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 20-36, 35 FCC Rcd 12603, 12627 para. 64 (2020).

³³ 47 CFR §15.209.

³⁴ For example, some private mobile radio service channels are restricted to authorized bandwidths of 6 kHz and 11.25 kHz (*See* 47 CFR § 90.35) or have operational restrictions (*e.g.*, wide area operations are not permitted in the 216-220 MHz band; *See* CFR § 90.259(a)(6)).

³⁵ Section 1 of the Communications Act of 1934 as amended provides that the FCC “regulat[es] interstate and foreign commerce in communication by wire and radio so as to make [such service] available, so far as possible, to all the people of the United States, without discrimination on the basis of race, color, religion, national origin, or sex.” 47 U.S.C. § 151.

affected by persistent poverty or inequality, invites comment on any equity-related considerations³⁶ and benefits (if any) that may be associated with the issues discussed herein. Specifically, we seek comment on how topics discussed herein may promote or inhibit advances in diversity, equity, inclusion, and accessibility, as well the scope of the Commission's relevant legal authority.

IV. PROCEDURAL MATTERS

14. *Ex Parte Rules.* This proceeding shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission's *ex parte* rules.³⁷ Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b).³⁸ In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf).³⁹ Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

15. *Comment Filing Procedures.* Pursuant to sections 1.415 and 1.419 of the Commission's rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs/>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing.

³⁶ The term “equity” is used here consistent with Executive Order 13985 as the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality. *See* Exec. Order No. 13985, 86 Fed. Reg. 7009, Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (January 20, 2021).

³⁷ 47 CFR § 1.1200 *et seq.* Although the Commission's rules do not generally require *ex parte* presentations to be treated as “permit but disclose” in Notice of Inquiry proceedings, *see id.* § 1.1204(b)(1), we exercise our discretion in this instance, and find that the public interest is served by making *ex parte* presentations available to the public, in order to encourage a robust record. *See id.* § 1.1200(a).

³⁸ 47 CFR § 1.1206(b).

³⁹ 47 CFR § 1.49(f).

- Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street, NE, Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19.⁴⁰

16. *Availability of Documents.* Comments, reply comments, and *ex parte* submissions will be publicly available online via ECFS. These documents will also be available for public inspection during regular business hours in the FCC Reference Information Center, when FCC Headquarters reopen to the public.

17. *People with Disabilities.* To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer and Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (TTY).

18. *Additional Information.* For additional information on this proceeding, contact Kevin Holmes, Office of Engineering and Technology, at Kevin.Holmes@fcc.gov or (202) 418-0564.

V. ORDERING CLAUSES

19. Accordingly, IT IS ORDERED, pursuant to Sections 1, 303(g), and 403 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 303(g), and 403, section 9204 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, and Section 1.430 of the Commission's rules, 47 CFR § 1.430, that this NOTICE OF INQUIRY IS ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

⁴⁰ See *FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy*, Public Notice, 35 FCC Rcd 2788 (2020), <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.

**STATEMENT OF
ACTING CHAIRWOMAN JESSICA ROSENWORCEL**

Re: *Spectrum Requirements for the Internet of Things*, ET Docket No. 21-353.

It's still early days in the Internet of Things. But by the end of the decade, we expect to have more than 20 billion connected devices in the world around us. Already we are seeing IoT devices enhancing the performance and safety of our power grid. We have IoT sensors monitoring everything from water levels in soil for rural agriculture to traffic in cities to reduce congestion. Closer to home, we've got video systems to keep watch on our homes, thermostats you can control with your mobile phone, and intelligent air purifiers to help combat allergies and asthma.

This is exciting, but again, it's only the start. Because as 5G wireless systems and low Earth orbiting satellites expand the availability of high-speed and high-capacity networks, we can expect the pace of innovation to increase. Of course, for this to happen we need to make sure that adequate spectrum is available for all of this activity. That is because most IoT devices connect wirelessly, whether over licensed or unlicensed airwaves or terrestrial or space-based systems.

Congress saw this very clearly and in the National Defense Authorization Act directed us to open an inquiry into the spectrum required to support the growth of IoT technologies. This is what we do here today. We ask how we can ensure spectrum availability keeps pace with demand. We seek comment on addressing regulatory barriers that may inadvertently impede access to spectrum for IoT deployments. We also ask about the role licensed and unlicensed operations play in the growth and development of IoT. These are important questions and I hope and expect the record will produce thoughtful answers.

STATEMENT OF COMMISSIONER GEOFFREY STARKS

Re: *Spectrum Requirements for the Internet of Things*, ET Docket No. 21-353

The Internet of Things is transforming our economy and our way of life. The American Smart Home market, which involves connected devices ranging from thermostats to doorbells and security systems, is on track to generate [\\$29 billion](#) this year. IoT has enabled doctors and hospitals to monitor patient health via connected medical devices, rather than requiring an in-person exam. Businesses have rapidly integrated Industrial IoT into their operations to track manufacturing processes and machinery in real-time. Farmers are using precision agriculture to increase efficiency and save resources. I'm particularly excited about how cities like my hometown of Kansas City have installed IoT sensors integrated with AI to reduce traffic congestion and energy consumption. Indeed, earlier this month, Congresswoman Yvette Clarke introduced [legislation](#) to renew the Department of Transportation's Smart City challenge, which would award grants to communities that integrate IoT technologies into city planning initiatives and demonstrate how they can mitigate transportation challenges and improve safety and sustainability.

These are all impressive developments, and this proceeding is an important step towards ensuring that adequate and appropriate spectrum is available for IoT to realize its full potential. Even as we address this important issue, however, we must acknowledge that many Americans will not realize the benefits of IoT; until broadband service is available and affordable to everyone, those without broadband will be left behind during the IoT revolution. That's why my number one priority at the Commission remains addressing the problem of internet inequality and the digital divide. The growing importance of the Internet of Things is one more example of why the Commission must continue to focus on connecting all Americans.

Moreover, as I've discussed previously, as IoT becomes dominant in various sectors, it will eliminate many jobs that are predominantly occupied by women or people of color. For example, increased automation and digitalization in manufacturing, agricultural supply chains, and inventory management can eliminate jobs held disproportionately by these groups. Thus, even as we encourage IoT's growth, we must also acknowledge and address the need to train and reskill our fellow Americans so they can fill the jobs of tomorrow. This will require a whole-of-nation approach to continue to build the skilled workforce our modern economy needs.

Thank you to the staff in OET for their hard work on this item.