



PUBLIC NOTICE

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FCC 21-100

Released: September 28, 2021

THE COMMISSION BEGINS THE PROCESS FOR AUTHORIZING 6 GHZ BAND AUTOMATED FREQUENCY COORDINATION SYSTEMS

ET Docket No. 21-352

Initial Proposals Due By: November 30, 2021
Comments on Proposals Due By: December 21, 2021

By the Commission: Commissioner Starks issuing a statement.

I. INTRODUCTION

1. As the role of the Internet has grown in nearly every industrial and commercial sector, and many of our personal and professional communications have moved online, Americans require access to the Internet anywhere and anytime, and they increasingly connect wirelessly. Unlicensed operations in the 2.4 GHz and 5 GHz bands have become indispensable for providing low-cost wireless connectivity in countless products used by American consumers. Wi-Fi, Bluetooth, Zigbee and other standards have been developed and continue to evolve to meet the growing needs for a variety of applications, many of which require high throughput rates. The need for ample and easy access to spectrum became even more evident with the onset of the COVID-19 pandemic as Americans turned to the Internet to work, attend school, receive healthcare, and stay connected with friends and family. To keep pace with these increasing demands, the Commission continuously examines spectrum needs and tries to ensure that our rules enable spectrum users to conduct their business and everyday activities.

2. In adopting the *6 GHz Report and Order*, the Commission expanded spectrum access for unlicensed devices to promote competition, innovation, and more widespread and robust connectivity. The new rules made broad swaths of the 6 GHz band (5.925–7.125 GHz) available for unlicensed broadband operations.¹ This spectrum is especially valuable for new high-bandwidth applications as it permits operation consistent with the newest standards, which specify channels as wide as 160 megahertz; channel bandwidths that are not attainable in the 2.4 GHz or 5 GHz bands. Under the 6 GHz rules, standard-power devices are required to check an automated frequency coordination (AFC) system prior to operating to avoid causing harmful interference to incumbent operations. With this *Public Notice*, the Commission hereby begins the process for authorizing standard power unlicensed operations in the 6 GHz band by inviting proposals from parties interested in operating an AFC system in accordance with the *6 GHz Report and Order*. This *Public Notice* summarizes the requirements for AFC systems as set forth in that order, describes the information that must be provided with proposals to operate an AFC system, and describes the procedures for designating AFC system operators.

¹ *Unlicensed Use of the 6 GHz Band*, ET Docket No. 18-295, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852 (2020) (*6 GHz Report and Order*).

II. BACKGROUND

3. The *6 GHz Report and Order* authorized two different types of unlicensed operations—standard-power and indoor low-power operations.² Standard-power operations, which encompass standard-power access points and fixed client devices (collectively referred to as standard-power devices in this *Public Notice*), are permitted in the 5.925-6.425 GHz and 6.525-6.875 GHz portions of the 6 GHz band and must operate under the control of an AFC system to prevent harmful interference to fixed microwave links that operate in the band.³ The standard-power devices are required to have a geolocation capability and, at least once per day, must communicate their location to an AFC system, which will provide them with the frequencies and maximum power levels at which they may operate without causing harmful interference to any microwave links.⁴ The AFC system will also prevent operation of standard-power devices in the 6.6500-6.6752 GHz band near a limited number of radio astronomy observatories.⁵

Expanded Unlicensed Use of the 6 Gigahertz Band

Device Class	Operating Bands	Maximum EIRP	Maximum EIRP Power Spectral Density
Standard-Power Access Point (AFC Controlled)	U-NII-5 (5.925-6.425 GHz) U-NII-7 (6.525-6.875 GHz)	36 dBm	23 dBm/MHz
Fixed Client (AFC Controlled)		36 dBm	23 dBm/MHz
Client Connected to Standard-Power Access Point		30 dBm	17 dBm/MHz
Low-Power Access Point (indoor only)	U-NII-5 (5.925-6.425 GHz) U-NII-6 (6.425-6.525 GHz)	30 dBm	5 dBm/MHz
Client Connected to Low-Power Access Point	U-NII-7 (6.525-6.875 GHz) U-NII-8 (6.875-7.125 GHz)	24 dBm	-1 dBm/MHz

4. The *6 GHz Report and Order* specifies how the AFC systems will determine which frequencies are available for use by standard-power devices. Once per day each AFC system is required to access the Commission's Universal Licensing System (ULS) to obtain the most up-to-date information on licensed microwave links including their transmitter and receiver locations, frequencies, bandwidths, polarizations, transmitter EIRP, antenna height, and the make and model of the antenna and equipment

² *6 GHz Report and Order*, 35 FCC Rcd at 3860, paras. 17-18.

³ *Id.* at 3862, 3923, paras. 22, 192; 47 CFR § 15.407(k)(1). Only standard-power and fixed-client 6 GHz unlicensed devices are required to operate pursuant to an AFC system. 47 CFR § 15.407(k)(1). Standard-power devices may operate outdoors and/or above the low-power indoor device power limits. Fixed client devices are intended as customer premise equipment that is permanently attached to a structure, operates only on channels provided by an AFC system, has a geolocation capability, and complies with antenna pointing angle requirements. 47 CFR § 15.403.

⁴ *6 GHz Report and Order*, 35 FCC Rcd at 3866-67, 3868, 3870, paras. 37, 40, 46; 47 CFR § 15.407(k)(8)(iv), (k)(9)(i).

⁵ *6 GHz Report and Order*, 35 FCC Rcd at 3884-85, paras. 87-88; 47 CFR § 15.407(m).

used.⁶ The AFC systems will use this information, along with the propagation models specified in the *6 GHz Report and Order*, to determine on which frequencies and at what power levels standard-power devices may operate.⁷ In making this determination, the AFC systems will ensure that the predicted interference-to-noise (I/N) ratio at any microwave receiver does not exceed -6 dB.⁸ The AFC systems must be capable of determining frequency availability for the standard-power device at the maximum permitted EIRP of 36 dBm and also at power levels as low as 21 dBm.⁹

5. The rules specify the propagation model the AFC system must use for determining frequency availability and power levels, which depends on the distance between the standard-power device and the licensed microwave station. For separation distances of 30 meters or less, the AFC system will use a free space pathloss model.¹⁰ When the separation distance is greater than 30 meters, but less than 1 kilometer, the AFC system will use the WINNER II model.¹¹ The WINNER II model is one of the most widely used and well-known channel models in the world¹² and was developed from measurements conducted by the WINNER organization, as well as results from academic literature.¹³ When using the WINNER II model, the AFC system should use site-specific information, including building¹⁴ and terrain data, for determining the line-of-sight/non-line-of-sight path component where this information is available. For evaluating paths where this data is not available, the rules specify probabilistic combining of the line-of-sight and non-line-of-sight path into a single path-loss.¹⁵ For distances greater than 1 kilometer, the AFC system will use the Irregular Terrain Model (ITM) combined with a clutter model for the local environment.¹⁶ The ITM has been widely available and accepted since the early 1980s, has been used by the Commission for interference prediction in other proceedings, and is the propagation model currently used to determine spectrum availability by the spectrum access systems (SAS) that are managing spectrum access for the 3550-3700 MHz band in the Citizens Broadband Radio Service.¹⁷

⁶ *6 GHz Report and Order*, 35 FCC Rcd at 3864-65, para. 30.

⁷ *6 GHz Report and Order*, 35 FCC Rcd at 3866-67, 3875-76, paras. 37, 65-66; 47 CFR § 15.407(k)(3), (7)(iii), (l).

⁸ *6 GHz Report and Order*, 35 FCC Rcd at 3878, para. 71; 47 CFR § 15.407(l)(2).

⁹ *6 GHz Report and Order*, 35 FCC Rcd at 3866-67, para. 37; 47 CFR § 15.407(k)(2).

¹⁰ *6 GHz Report and Order*, 35 FCC Rcd at 3875, para. 64; 47 CFR § 15.407(l)(1)(i).

¹¹ *6 GHz Report and Order*, 35 FCC Rcd at 3875-76, para. 65; 47 CFR § 15.407(l)(1)(ii).

¹² Patrick Marsch et al., “5G System Design: Architectural and Functional Considerations and Long-Term Research”, 2018, at 57.

¹³ Martin Döttling et al., “Radio Technologies and Concepts for IMT-Advanced,” 2010, at 75.

¹⁴ See, e.g., OSM building data. <https://osmbuildings.org/data/>.

¹⁵ When site-specific information regarding line-of-sight/non-line-of-sight is not available then path losses of line-of-sight (LOS) and non-line-of-sight (NLOS) paths can be combined into a single loss using the following formula: Path-loss (L) = $\sum_i P(i) * L_i = P_{LOS} * L_{LOS} + P_{NLOS} * L_{NLOS}$, where P_{LOS} is the probability of line-of-sight, L_{LOS} is the line-of-sight path loss, P_{NLOS} is the probability of non-line-of-sight, L_{NLOS} is the non-line-of-sight path loss, and L is the combined path loss. The WINNER II path loss models include a formula to determine P_{LOS} as a function of antenna heights and distance. P_{NLOS} is equal to $(1 - P_{LOS})$.

¹⁶ *6 GHz Report and Order*, 35 FCC Rcd at 3876-77, para. 66; 47 CFR § 15.407(l)(1)(iii).

¹⁷ See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Third Report and Order and First Order on Reconsideration, 30 FCC Rcd 12049, 12103, Appendix C n.1 (2015); *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, OET Bulletin No. 69 (Feb. 4, 2004), <https://transition.fcc.gov/bureaus/oet/info/documents/bulletins/oet69/oet69.pdf>; *Requirements for Commercial Operation in the U.S. 3550-3700 MHz Citizens Broadband Radio Service Band*, Wireless Innovation Forum, Document WINNF-TS-0112, at 11 (June 25, 2019), <https://winnf.memberclicks.net/assets/CBRS/WINNF-TS-0112.pdf>.

When using the ITM, the rules specify that AFC systems are to use 1 arc-second digital elevation terrain data and,¹⁸ for locations where such data is not available, use the most granular digital elevation terrain data available.¹⁹ To account for the effects of clutter, such as from buildings and foliage, the AFC system should combine use of the ITM with statistical clutter model ITU-R P.2108²⁰ for urban and suburban environments and the ITU-R P.452-16 clutter model for rural environments.²¹

6. In accordance with the *6 GHz Report and Order*, the Office of Engineering and Technology (OET) can designate one or more AFC system operators.²² AFC system operators will be required to serve for a five-year term which can be renewed by the Commission based on the operator's performance during the term.²³ If an AFC system operator discontinues service or its term is not renewed, it must transfer its database along with the information necessary to access the database to another designated AFC system operator.²⁴ AFC system operators are permitted to charge a fee for providing service to standard-power access devices.²⁵

III. AFC PROPOSALS AND APPROVAL PROCESS

7. As specified in the *6 GHz Report and Order*, OET will follow a multistep process to approve AFC systems in which each prospective AFC system operator must demonstrate its ability to perform the required functions pursuant to the Commission's 6 GHz unlicensed rules.²⁶ We request that parties interested in becoming an AFC system operator as part of the initial evaluation process submit their proposals no later than November 30, 2021. The public will then have an opportunity to review and comment on these proposals, including on each prospective operator's fitness to operate an AFC system as well as the technical and operational description of each proposed AFC system. Comments on these proposals must be submitted by December 21, 2021. OET will review all proposals submitted by November 30, 2021 concurrently and with equal priority. Proposals submitted after this date will be considered by OET, but they may not be considered concurrently with proposals submitted by November 30, 2021. For any proposal received after November 30, 2021, OET will issue a public notice announcing receipt of the proposal and establishing a period for the public to review and comment on the proposal.

¹⁸ "The 1 arc-second NED layer provides seamless coverage of the conterminous United States, Hawaii, Mexico, Canada, Puerto Rico, other territorial islands, and in limited areas of Alaska." <https://www.sciencebase.gov/catalog/item/5825a0c3e4b01fad86db66dc>.

¹⁹ Alaska 2 Arc-second Digital Elevation Models. <https://catalog.data.gov/dataset/national-elevation-dataset-ned-alaska-2-arc-second-downloadable-data-collection-national-geosp>. Digital Elevation Model (DEM) terrain files are available for areas in the United States at <https://viewer.nationalmap.gov/basic/>.

²⁰ ITU Recommendation P.2108 § 3.2 provides a statistical model for clutter loss distributions for urban and suburban environments. *Prediction of Clutter Loss*, Recommendation ITU-R P.2108-0, <https://www.itu.int/rec/R-REC-P.2108/en>.

²¹ *Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz*, Recommendation ITU-R P.452-16, https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.452-16-201507-I!!PDF-E.pdf. The AFC system should use the most appropriate clutter category for the local morphology when using ITU-R P.452-16. However, if detailed local information is not available, the "Village Centre" clutter category should be used. 47 CFR § 15.407(l)(1)(iii).

²² 47 CFR §§ 0.241(k), 15.407(k)(11); *6 GHz Report and Order*, 35 FCC Rcd at 3871, para. 51.

²³ *6 GHz Report and Order*, 35 FCC Rcd at 3872, para. 54; 47 CFR § 15.407(k)(15)(iv).

²⁴ *6 GHz Report and Order*, 35 FCC Rcd at 3872, para. 54.

²⁵ *6 GHz Report and Order*, 35 FCC Rcd at 3873, para. 56; 47 CFR § 15.407(k)(16).

²⁶ *6 GHz Report and Order*, 35 FCC Rcd at 3870-71, para. 49.

Proposals will not be considered mutually exclusive and OET will conditionally approve as many proposals as are found to satisfy all AFC system requirements.²⁷

8. Applicants who receive a conditional approval will then be required to allow access to their AFC system for a public trial period to provide interested parties an opportunity to check that it provides accurate results.²⁸ This trial period will include thorough testing, both in a controlled environment (e.g., lab testing) and through demonstration projects (e.g., field testing).²⁹ OET may also require prospective AFC system operators to attend workshops and meetings as part of the assessment process. Prospective AFC system operators must comply with all instructions from OET and must provide any requested information in a timely manner.

9. The AFC system proposals must describe how the prospective AFC system operator will comply with the requirements and core functions described in Section 15.407(k) of the Commission's rules and the *6 GHz Report and Order*.³⁰ To demonstrate compliance, we expect the proposal to include, for example:

1. AFC system operator contact information, including name, phone number and email address that Commission staff may use for all AFC system related inquiries, such as information and data requests or to provide enforcement instructions.³¹

2. A technical diagram showing the architecture of the AFC system with a brief description of its operation.

3. A description of whether the AFC system software is based on a propriety implementation or open source.³²

4. A demonstration that the prospective AFC system operator possesses sufficient technical expertise to operate an AFC system.

5. A description of the prospective AFC system operator's recordkeeping policies, including registration record retention as well as retention of historical frequency availability data.

6. A description of how the prospective AFC system operator will handle unanticipated situations that may disrupt performance of the system's required functions—ranging from exceptional cases that affect the system's ability to perform its required functions in isolated instances to cases involving the type of widespread disruption that an event like a system failure might cause.

7. A description of the methods (e.g., interfaces, protocols) that will be used for secure communication between the AFC system and its associated standard-power devices and to ensure that unauthorized parties cannot access or alter the database or the list of available frequencies and power levels sent to the standard-power devices.³³

8. If the prospective AFC system operator will not be performing all AFC functions, information on (1) the entities that will be responsible for operating other functions

²⁷ *6 GHz Report and Order*, 35 FCC Rcd at 3871, para. 49.

²⁸ *Id.*

²⁹ *Id.* OET will provide additional details on the testing process at a later date.

³⁰ *6 GHz Report and Order*, 35 FCC Rcd at 3870-71, para. 49.

³¹ *6 GHz Report and Order*, 35 FCC Rcd at 3883, para. 83 (requiring AFC operators to implement procedures to respond to requests for information from Commission personnel); 47 CFR § 15.407(k)(15)(vi).

³² The Open AFC Software Group has been established under the leadership of Broadcom, Cisco, and Facebook to develop an open source implementation of an AFC system. *Open AFC*, <https://telecominfraproject.com/open-afc/> (last visited Sept. 8, 2021).

³³ 47 CFR § 15.407(k)(13).

of the AFC system; and (2) how the Commission can ensure that all of the requirements for AFC systems in the rules are satisfied when AFC functions are divided among multiple entities.

9. A description of how the prospective AFC system operator will provide access to their AFC system for a public trial period which will include thorough testing.

10. An affirmation that the prospective AFC system operator, and any entities responsible for operating other functions of the AFC system under the control of the AFC system operator, will comply with all of the applicable rules as well as applicable enforcement mechanisms and procedures.³⁴

10. Prospective AFC system operators must file proposals, and any supplements thereto, with the Commission using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998). To be considered concurrently with the other initial proposals, proposals must be filed on or before the date indicated on the first page of this *Public Notice*. Prospective AFC system operators may request confidential treatment of information contained in their proposals consistent with Section 0.459 of the Commission's rules.³⁵ Comments regarding the AFC system proposals should also be filed using ECFS by the dates indicated on the first page of this *Public Notice*. All such filings should refer to **ET Docket 21-352**.

- 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.
- 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.
 - 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. *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>.

11. *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).

12. *Congressional Review Act*. The Commission has determined and Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs, that this rule is "non-major" under the Congressional Review Act, 5 U.S.C. § 804(2). The Commission will send a copy of this Public Notice to Congress and the Government Accountability Office pursuant to 5 U.S.C § 801(a)(1)(A).

³⁴ 47 CFR § 15.407(k); *6 GHz Report and Order*, 35 FCC Rcd at 3883, para. 83.

³⁵ 47 CFR § 0.459.

13. *Further Information.* Questions regarding this *Public Notice* may be directed to Nicholas Oros, Office of Engineering and Technology, at (202) 418-0636 or Nicholas.Oros@fcc.gov.

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**STATEMENT OF
COMMISSIONER GEOFFREY STARKS**

Re: *The Commission Begins the Process for Authorizing 6 GHz Band Automated Frequency Coordination Systems*; ET Docket No. 21-352.

Last year, after an exhaustive legal and technical analysis, the Commission unanimously took the unprecedented step of making 1200 megahertz in the 6 GHz band available for unlicensed use. Our decision has already sparked a wave of low-power products utilizing the band indoors, offering increased Wi-Fi speeds that benefit consumers and businesses that rely on unlicensed spectrum for their homes and operations. These developments are particularly important for our economic growth and to address the digital divide that continues for so many Americans.

This item is another step towards fully unleashing the potential of the 6 GHz band, by beginning the process of authorizing Automated Frequency Coordination (AFC) system operators to offer their services to parties seeking to operate in certain portions of the 6 GHz band outdoors at standard power levels. Through such AFC systems, standard power unlicensed devices will be able to coexist in the 6 GHz band with incumbent fixed microwave links and radio astronomy observatories. I look forward to reviewing the applications and continuing our progress in making unlicensed spectrum available on a non-interference basis.

Thank you to the staff of the Office of Engineering and Technology for their hard work on this item.