



# PUBLIC NOTICE

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## OET ANNOUNCES CONDITIONAL APPROVAL FOR 6 GHZ BAND AUTOMATED FREQUENCY COORDINATION SYSTEMS

ET Docket No. 21-352

By the Acting Chief, Office of Engineering and Technology:

### I. INTRODUCTION

1. The Office of Engineering and Technology (OET) conditionally approves thirteen entities to operate automated frequency coordination (AFC) systems to manage access to 6 GHz band spectrum by standard-power unlicensed devices: Broadcom, Google, Comsearch, Sony Group, Kyrio, Key Bridge Wireless, Nokia Innovations, Federated Wireless, Wireless Broadband Alliance, Wi-Fi Alliance (WFA), Qualcomm, Plume Design, and RED Technologies. This conditional approval begins the next phase of the process toward full commercial operations. As these thirteen entities continue to develop their AFC systems, the next step in the approval process will entail testing to verify that they operate in accordance with the Commission's rules. Testing protocols are still under development and more information will be provided in future releases. OET will approve for commercial operations those AFC systems that successfully complete testing.

### II. BACKGROUND

2. On April 23, 2020, the Commission adopted a Report and Order and Further Notice of Proposed Rulemaking (*6 GHz Report and Order*) that made broad swaths of the 6 GHz band (5.925–7.125 GHz) available for expanded unlicensed operations, including broadband operations.<sup>1</sup> The *6 GHz Report and Order* adopted rules for two different types of unlicensed operations—standard-power operations and low-power indoor operations.<sup>2</sup> For standard-power operations, standard-power access points and fixed client devices operate under the control of AFC systems in two portions of the 6 GHz band—the U-NII-5 band (5.925-6.425 GHz) and the U-NII-7 band (6.525-6.875 GHz).<sup>3</sup> The U-NII-5 and U-NII-7 bands are heavily used by licensed point-to-point microwave systems.<sup>4</sup> In addition, the 6.65-6.6752 GHz portion of the U-NII-7 band is used for radio astronomy observations at a limited number of

<sup>1</sup> *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*).

<sup>2</sup> *Id.* at 3860, paras. 17-18.

<sup>3</sup> 47 CFR § 15.407(k)(1); *6 GHz Report and Order*, 35 FCC Rcd at 3860, 3862, 3923, paras. 17-18, 22, 192. 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. *Id.* § 15.407(a)(4). A fixed client device is “intended as customer premise equipment that is permanently attached to a structure, operates only on channels provided by an AFC, has a geolocation capability, and complies with antenna pointing angle requirements.” 47 CFR § 15.403.

<sup>4</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3855, para. 7.

observatories.<sup>5</sup> The AFC systems will manage access to spectrum by the standard-power access points and fixed client devices to prevent harmful interference from occurring to the microwave systems and radio observatories.<sup>6</sup>

### 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) U-NII-7 (6.525-6.875 GHz)	30 dBm	5 dBm/MHz
Client Connected to Low-Power Access Point	U-NII-8 (6.875-7.125 GHz)	24 dBm	-1 dBm/MHz

3. The *6 GHz Report and Order* specified a multi-stage process laying out the steps that OET must follow to approve AFC systems.<sup>7</sup> The first requirement directed OET to issue a public notice soliciting proposals from prospective AFC system operators while providing an opportunity for the public to comment on the proposals.<sup>8</sup> OET is then directed to conditionally approve applicants who demonstrate their AFC systems will comply with all AFC requirements.<sup>9</sup> The conditionally approved AFC systems are then required to provide a test system that will be subject to a public trial period.<sup>10</sup> The trial period will include testing, both in a controlled environment (e.g., lab testing) and through demonstration projects (e.g., field testing), to provide interested parties an opportunity to check that the AFC systems provide accurate results.<sup>11</sup>

4. On September 28, 2021, the Commission issued a Public Notice requesting proposals from prospective AFC system operators.<sup>12</sup> The Public Notice requested that applicants submit their proposals by November 30, 2021, to become part of the initial evaluation process. AFC system operator

<sup>5</sup> *Id.* at 3884, para. 87.

<sup>6</sup> 47 CFR § 15.407(l), (m); *6 GHz Report and Order*, 35 FCC Rcd at 3862, para. 22.

<sup>7</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3870-71, para. 49.

<sup>8</sup> *Id.*

<sup>9</sup> *Id.* at 3871, para. 49.

<sup>10</sup> *Id.*

<sup>11</sup> *Id.*

<sup>12</sup> *The Commission Begins the Process for Authorizing 6 GHz Band Automated Frequency Coordination Systems*, ET Docket No. 21-352, Public Notice, FCC 21-100, 2021 WL 4500447, at \*1, \*3, \*4, paras. 2, 7, 10 (Sept. 28, 2021).

applications received after that date would still be considered, but they may not be considered concurrently with those received by the deadline. Members of the public were invited to comment on the proposals by December 21, 2021. In response to the Public Notice, the Commission received fourteen applications to operate AFC systems.<sup>13</sup> The Commission also received 8 comments regarding the applications.<sup>14</sup> Between January 27, 2021, and February 10, 2021, OET staff held meetings with representatives of each of the fourteen applicants and requested that they provide additional information regarding their applications.<sup>15</sup> Thirteen of the applicants provided supplemental information, while one applicant, Amdocs, withdrew its application.<sup>16</sup>

### III. CONDITIONAL APPROVAL OF AFC SYSTEMS

5. Based on review of the AFC proposals and the supplemental information, OET conditionally approves the thirteen pending applicants to operate AFC systems, subject to the conditions described below. These applicants have sufficiently demonstrated that they have the technical capability and knowledge to operate AFC systems and may take steps to move to the testing phase of the AFC system approval process. Our approval of these AFC system applications is subject to the following conditions:

- Each conditionally approved AFC operator must comply with all current and future Commission rules, instructions, and procedures.
- Each conditionally approved AFC operator must comply with all instructions issued by OET pursuant to section 0.241(k) of the Commission's rules.<sup>17</sup>
- All conditionally approved AFC operators must attend workshops and meetings convened by the Commission or OET. Workshop or meeting topics may include: (1) AFC system development and operations; (2) AFC system testing and certification procedures; or (3) other topics relevant to the ongoing development of the AFC systems.
- If a conditionally approved AFC system operator relies on third party or proprietary specifications or protocols for its AFC system, these specifications or protocols must be consistent with the relevant Commission rules.<sup>18</sup> All such specifications and protocols must be provided to, and will be reviewed by, OET to ensure consistency with the Commission's rules.
- Each conditionally approved AFC system operator must undertake steps to have its AFC system undergo lab testing. OET will issue guidance on the lab testing in a forthcoming Public Notice;
- Each conditionally approved AFC system operator must undertake steps to have its AFC system undergo demonstration projects. OET will issue guidance on the demonstration project(s) in a forthcoming Public Notice;
- Each conditionally approved AFC system operator must respond to all inquiries from OET staff during OET's examination of the testing data and make any modifications to its AFC system requested by OET staff as part of the testing process;

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<sup>13</sup> See the 14 applications to operate AFC systems filed in ET Docket No. 21-352 between October 28, 2021, and November 11, 2021.

<sup>14</sup> APCO International; the Utilities Technology Council and Edison Electric Institute; Wi-Fi Alliance; Dynamic Spectrum Alliance; Verizon; AT&T Services; Apple, Broadcom et al.; and the Fixed Wireless Communications Coalition (FWCC) filed comments in ET Docket No. 21-352 on December 21, 2021.

<sup>15</sup> See the *ex parte* notices of the 14 AFC system applicants in ET Docket No. 21-352 filed between January 28, 2022, and February 16, 2022.

<sup>16</sup> See the supplemental filings of the 12 applicants in ET Docket No. 21-352 between February 2, 2022 and April 14, 2022. Amdocs March 25, 2022 *Ex Parte* at 1.

<sup>17</sup> 47 CFR § 0.241(k).

<sup>18</sup> Each conditionally approved AFC system operator states that it relies on current or future Wi-Fi Alliance and WinnForum specifications as part of their proposals. To the extent that any AFC system operators modify their AFC systems to reflect any revisions to existing Wi-Fi Alliance or WinnForum standards, such modifications must also be consistent with Commission rules.

- Each conditionally approved AFC operator may not make their AFC system available for commercial operations until it receives final approval from OET.
- Each conditionally approved AFC operator must promptly respond to any requests for information or direction from the Commission, including the Enforcement Bureau.<sup>19</sup>

#### IV. ISSUES RAISED BY COMMENTERS

6. Commenters raise a number of issues concerning the sufficiency of the AFC system applications in general, as well as allege specific deficiencies in the applications. We have examined each of these claims and, as discussed in more detail below, find that commenters do not provide a convincing basis to deny conditional approval to any of the thirteen pending AFC system applications.

##### 1. Sufficiency of Applications

7. Several commenters claim that the AFC system applications do not provide sufficient details to enable a full and thorough evaluation. For example, AT&T faults the applications for failing to describe how the proposed AFC systems will comply with the requirements of section 15.407(k) of our rules.<sup>20</sup> AT&T complains that applicants “merely certify that they will comply” or “intend to comply” with these requirements.<sup>21</sup> Even after AFC applicants filed supplemental information as requested by OET, AT&T continues to claim that the applicant’s statements “fall far short of providing an adequate basis” for stakeholders to evaluate the proposals and for OET to conclude those proposals comply with the Commission’s rules.<sup>22</sup> The Utilities Technology Council and the Edison Electric Institute (UTC/EEI) claim that the AFC proposals are insufficient because they just respond to the ten issues listed in the Public Notice and do not demonstrate compliance with all of the requirements in the Commission’s rules.<sup>23</sup> UTC/EEI, assert that the AFC system proposals are a “plan to create a plan” and do not specifically demonstrate how each AFC system will comply with the requirements in section 15.407(k) of the Commission’s rules with substantial verifiable technical information.<sup>24</sup> Verizon criticizes the explanations many of the proposals provide for the requested technical diagram showing the architecture of the AFC, claiming that they are not detailed enough to show that the AFC proposals are technically feasible.<sup>25</sup>

8. We find that the information provided by the AFC applicants in their proposals and in their supplemental filings is sufficient to conclude that their proposed AFC systems will likely comply with the Commission’s rules. We note that many of the requirements specified in our rules are straightforward to meet, such as the information the AFC systems are required to receive from standard-power devices, the length of time information will be retained, and the requirement to obtain technical information from the Commission’s licensing database on a daily basis. For these requirements, no useful purpose would be served by requiring the AFC applicants to provide further explanation. For example, for the requirement that the AFC systems receive certain information from the standard-power devices, receiving information that is transmitted over the internet is well known and additional explanation is not needed. Compliance with the requirement that information be retrained by the AFC systems for a particular period of time is trivial—i.e. the AFC system just needs to avoid deleting the information from its database until the time period has expired. Accessing the Commission’s licensing database daily is also straightforward as

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<sup>19</sup> See 47 CFR § 15.407(k)(15)(vi); *6 GHz Report and Order*, 35 FCC Rcd at 3883, para. 83.

<sup>20</sup> AT&T Services Comments at 14.

<sup>21</sup> AT&T Services Comments at 14; *see id.* at 14-16.

<sup>22</sup> AT&T Services April 26, 2022 *Ex Parte* ET Docket No. 21-352, at 2.

<sup>23</sup> Utilities Technology Council and the Edison Electric Institute Comments at 3-4.

<sup>24</sup> *Id.* at 5 (internal quotation marks omitted).

<sup>25</sup> Verizon Comments at 10.

access to this database is readily available from the Commission's website.<sup>26</sup> Because complying with these requirements is straightforward, it is sufficient for the AFC applicants to just state that they will comply with these requirements. We also note that applicants for Commission authorizations (such as an application to operate an AFC system) are subject to enforcement action if they fail to make truthful and accurate statements in any written statement of fact.<sup>27</sup> Meeting other requirements that are more complex, such as implementing the specified propagation models, will be verified through the testing process. It is important to note that at this time we are merely granting conditional approval; final approval that will permit commercial operation is contingent on each AFC applicant successfully demonstrating proper operation and compliance with all rules and requirements through a rigorous testing process. As the scope of this instant conditional approval is limited, and some of the operational requirements can only be verified through testing, we find that there is no need that the proposals before us provide details on how each requirement will be fulfilled. It is sufficient that the necessary requirements are acknowledged and that each applicant has a plan to meet these requirements. Final verification that all requirements are sufficiently met will be done at the testing stages of the approval process.

9. Many commenters also express concern that many of the AFC proposals rely on external documents from the WFA or the WinnForum that can be changed by these organizations at any time and do not establish particular requirements for AFC system operators.<sup>28</sup> We do not share this concern. First, we note that any specifications or protocols developed by WFA or WinnForum and relied upon by an AFC operator must be in conformance with the Commission's rules, and we are requiring as a condition for approving the AFC proposals that any such specification or protocol must be consistent with the relevant Commission rules. OET staff will review these specifications and protocols and will make the organizations and AFC applicants aware in the unlikely event that any departs from the Commission's rules. Second, if an AFC operator does develop its system to conform to any of these specifications and protocols, it is under no obligation to change its system if any are changed in the future. The obligation on each AFC system is to continue to comply with the Commission's rules.

## 2. Responsibility for Standard-power Device Operations

10. Several commenters raise concerns relating to standard-power device functions. In particular, AT&T finds fault with numerous sections of the WFA's AFC Device under Test (DUT) Plan developed for testing standard-power devices.<sup>29</sup> Specifically, AT&T asserts that the test plan omits procedures for testing the security of the connection between a standard-power device and an external

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<sup>26</sup> FCC, *Public Access Files Database Downloads*, <https://www.fcc.gov/wireless/data/public-access-files-database-downloads> (last visited June 16, 2022). A description of downloading 6 GHz band incumbent licensing data can be found in *Incumbent Fixed Service Data in the U.S. U-NII 5 & 7 Bands*, WinnForum, WINNF-TR-1008, 5-7 (Jan. 5, 2021), [https://www.wirelessinnovation.org/assets/work\\_products/Reports/winnf-tr-1008-v1.0.0%206%20ghz%20incumbent%20data%20technical%20report.pdf](https://www.wirelessinnovation.org/assets/work_products/Reports/winnf-tr-1008-v1.0.0%206%20ghz%20incumbent%20data%20technical%20report.pdf).

<sup>27</sup> 47 CFR § 1.17.

<sup>28</sup> Utilities Technology Council and the Edison Electric Institute Comments at 4; AT&T Comments at 16; AT&T Services April 26, 2022 *Ex Parte* ET Docket No. 21-352, at 5-8. The Wi-Fi Alliance is an international organization of companies in the Wi-Fi industry. Wi-Fi Alliance, *Who We Are*, <https://www.wi-fi.org/who-we-are> (last visited May 4, 2022). The Wi-Fi Alliance is developing a set of specifications for AFC systems and standard-power devices. Wi-Fi Alliance, *Coordination specification and compliance development to accelerate Wi-Fi 6E* (June 30, 2021), <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-further-automated-frequency-coordination-specification-and>. The Wireless Innovation Forum (WinnForum) is an international group of telecommunications equipment manufacturers, vendors, research labs, academic institutions, and service providers. WinnForum, *About the Wireless Innovation Forum*, [https://www.wirelessinnovation.org/about\\_the\\_forum](https://www.wirelessinnovation.org/about_the_forum) (last visited May 4, 2022). The WinnForum has developed a set of technical specifications related to 6 GHz AFC systems and standard-power devices. WinnForum, *Forum Work Products*, <https://6ghz.wirelessinnovation.org/work-group-products> (last visited May 4, 2022).

<sup>29</sup> AT&T Services Comments at 18-19 (discussing the *AFC Device (AFC DUT) Compliance Test Plan*, Wi-Fi Alliance, Version 1.0.6).

geo-location source; the true, complete, and good faith provision of registration information to the AFC system by the standard-power devices; automatic determination of geo-location information by the standard-power devices; and the requirement that standard-power devices check frequency availability daily.<sup>30</sup> Verizon claims that many of the AFC proposals do not provide sufficient information to validate the data and data transfer parameters between the AFC system and standard-power devices.<sup>31</sup> Verizon states that no proposal adequately addresses location accuracy; how to deal with uncertainty when calculating the likelihood of interference; and details for other parameters, such as maximum permissible power, FCC ID, serial number, and antenna gain, beamwidth, orientation, and elevation.<sup>32</sup> FWCC requests that AFC operators adopt protocols to verify that the location data reported by standard-power devices is correct, such as checking that the location is in the United States, or to identify devices that change location repeatedly and rapidly, are excessively concentrated, or are located in a way inconsistent with terrain.<sup>33</sup> APCO states that the applications do not address how compliance with the geolocation requirements for standard-power devices will be evaluated and how AFC operators will account for inaccurate uncertainty estimates.<sup>34</sup>

11. We decline to delay the conditional approval of the proposed AFC systems because of perceived insufficiencies in industry-developed test plans for standard-power devices. Because the AFC system applicants are not manufacturers of standard-power devices, it is not within their purview to demonstrate how standard-power devices will comply with the Commission's rules or describe how these devices will be tested; that function falls to the Commission's equipment approval process. Under the Commission's rules, standard-power devices are required to be tested by an FCC-recognized accredited lab and approved by a Telecommunication Certification Body.<sup>35</sup> The equipment approval process will ensure that standard power devices comply with the requirements cited by commenters. The details of such testing will be specified by OET and will not necessarily follow the approach set forth in the Wi-Fi Alliance AFC DUT Test Plan.

12. Commenters suggest that the AFC systems should validate the data provided by the standard-power devices. However, such validation by an AFC system is not always necessary and there are practical limitations regarding the amount of validation an AFC system can actually accomplish. For example, as a practical matter, an AFC system will not generally be able to determine if the location estimate, height estimate, or FCC ID provided by the standard-power device is accurate. While the AFC systems can conduct error checks for some parameters, such as checking whether the reported location is within the United States,<sup>36</sup> others are not able to be checked and the AFC system is dependent on the reliability of the data provided by each standard power device. Other suggestions, such as checking whether standard-power devices change location rapidly or are excessively concentrated, may be of limited utility because the rules do not specify limits on how frequently devices may be moved or on how many may be located in a particular area. Moreover, when devices are moved, they are required, prior to operating, to obtain a new set of available frequencies for their location. As noted, standard-power devices will be thoroughly tested during the certification process; this testing will ensure that the

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<sup>30</sup> *Id.*

<sup>31</sup> Verizon Comments at 9.

<sup>32</sup> *Id.* at 9-10.

<sup>33</sup> FWCC Comments at 5; *see also* AT&T Services Comments at 11.

<sup>34</sup> APCO Comments at 3.

<sup>35</sup> 47 CFR §§ 2.907(a), 2.915, 2.948(e), 2.950(a), 15.201(b); *Accredited Testing Laboratory Program Roles and Responsibilities*, Office of Engineering and Technology, KDB Publication 974614 D01, at 1 (Apr. 2, 2019), [https://apps.fcc.gov/kdb/GetAttachment.html?id=koP7QuHnAbqrT0URaUjRBw%3D%3D&desc=974614%20D01%20Accredited%20Test%20Lab%20Roles%20and%20Resp%20v05r01&tracking\\_number=44684](https://apps.fcc.gov/kdb/GetAttachment.html?id=koP7QuHnAbqrT0URaUjRBw%3D%3D&desc=974614%20D01%20Accredited%20Test%20Lab%20Roles%20and%20Resp%20v05r01&tracking_number=44684) .

<sup>36</sup> 47 CFR § 15.407(k)(14) requires AFC system to implement the terms of international agreements with Mexico and Canada.

standard-power devices provide reliable information to the AFC systems.

13. Regarding APCO and Verizon's concern for how the AFC operators will account for the uncertainty of the location estimates, we note that the AFC applicants have addressed this issue in their supplemental filings. The Commission's rules require that standard-power devices report their geographic location and location uncertainty, with a confidence level of 95%, to the AFC system.<sup>37</sup> Qualcomm, Wi-Fi Alliance, Comsearch, RED Technologies, and Federated Wireless indicate that their AFC systems will perform interference calculations at a grid of points that are no greater than 1 arc-second (less than 30 meters) apart in the horizontal plane and 5-meters in elevation within the reported uncertainty region and will determine frequency availability using the most restrictive point.<sup>38</sup> Other AFC system applicants describe similar techniques without describing the grid spacing in both the horizontal and vertical planes.<sup>39</sup> The remaining AFC system applicants state that they will use the method being developed by the WinnForum, which appears to be identical to the method described by Qualcomm, the Wi-Fi Alliance, RED Technologies, and Federated Wireless, according to the descriptions given by the applicants.<sup>40</sup>

14. We find that the described method to account for location uncertainty, which involves making interference calculations at a grid of points in the region of uncertainty, is an appropriate approach. OET will review the specification that WinnForum is developing on this subject to ensure it is appropriate once it is finalized. Also, as with other requirements, adherence to our rules will be verified during the testing process.

### 3. Testing

15. AT&T, Verizon, UTC/EEI, and FWCC criticize the AFC applications for not providing details of how the AFC systems will be tested.<sup>41</sup> For lab testing, AT&T suggests that AFC system applicants provide details on the application programming interface (API) to be used for the test, any registration requirements to use the API, the test scripts, and a log of modifications to the AFC systems made during the test.<sup>42</sup> For field testing, AT&T asks that the AFC system applications contain a description of the test locations, standard-power devices to be used, coordination requirements for each location, test scripts, and a log of modifications made to the AFC system during the field trials.<sup>43</sup> AT&T

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<sup>37</sup> 47 CFR § 15.407(k)(9)(i).

<sup>38</sup> Qualcomm Automated Frequency Coordination System Operator Application: Responses to Supplemental Questions, ET Docket No. 21-352, at 6 (filed Feb. 28, 2022); Wi-Fi Alliance Feb. 22, 2022 *Ex Parte* ET Docket No. 21-352, at 6; Supplement to Comsearch Proposal to be Approved as an Automated Frequency Coordination Operator, ET Docket No. 31-352, at 10 (filed March 1, 2022); Supplement to the Proposal by RED Technologies SAS to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band, ET Docket 21-352, at 6 (filed Nov. 26, 2021); Supplement to the Proposal by Federated Wireless to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band, ET Docket No. 21-352, at 12 (filed Feb. 9, 2022).

<sup>39</sup> Broadcom Feb. 24, 2022 *Ex Parte* ET Docket No. 21-352, at 3; Kyrio Feb. 25, 2022 *Ex Parte* ET Docket No. 21-352, at 1-2 (Kyrio specified a 1 arc second grid in the horizontal plane but no vertical spacing); Supplement of Plume Design, Inc. To Proposal for Approval as an Automated Frequency Coordination System Operator, ET Docket No. 21-352, at 10 (filed Feb. 28, 2022); Wireless Broadband Alliance Feb. 28, 2022 *Ex Parte* ET Docket No. 21-352, at 5-6.

<sup>40</sup> Supplement to Proposal from Sony Group Corporation to Serve as an Automated Frequency Coordination System Operator, ET Docket No. 21-352, at 5 (filed Feb. 24, 2022); Google Feb. 28, 2022 *Ex Parte* ET Docket No. 21-352, at 2; Response to Commission Questions Regarding Nokia's Proposal to be Approved as an Automated Frequency Coordination (AFC) System Operator, ET Docket No. 21-352, at 5 (filed April 14, 2022).

<sup>41</sup> AT&T Services Comments at 25-28; Utilities Technology Council and Edison Electric Institute Comments at 6-7; FWCC Comments at 9.

<sup>42</sup> AT&T Services Comments at 26-27.

<sup>43</sup> AT&T Comments at 27-28.

also suggests that AFC system applicants be prepared to offer coordination to standard-power devices for interested parties to conduct testing anywhere in the United States.<sup>44</sup> Verizon suggests selecting one or more representative real-world microwave links for testing purposes and that stakeholders should be able to exercise the AFC systems to determine if the results meet expectations.<sup>45</sup> UTC/EEI insist that incumbent licensees must be allowed full transparency into the operation of the AFC systems through field and lab testing and that access to an API, where a black box generates some results, is insufficient.<sup>46</sup> UTC/EEI asks OET to establish detailed field and lab test requirements that allow all parties visibility into the operation of the AFC systems and that agreement by all potential AFC operators to this testing protocol should be required.<sup>47</sup> FWCC asks that details of the proposed testing be provided in advance to allow interested parties to propose additional testing, if necessary, and suggests that the Commission use the spectrum access system (SAS) testing requirements from the Citizens Broadband Radio Service (CBRS) band as a guide to the AFC system testing.<sup>48</sup>

16. The AFC system applicants are not responsible for creating the testing process or for describing how testing will be conducted. Instead, the Commission in the *6 GHz Report and Order* tasked OET with conducting a review process for AFC systems that includes testing and we have required the AFC system applicants to conduct testing as a requirement of their conditional approval.<sup>49</sup> Therefore, OET will issue guidance on a testing process for the conditionally approved AFC systems that AFC systems will have to successfully complete before being approved for commercial operations. Consequently, the fact that the AFC system applicants have provided little details on testing is not a reason to delay the conditional approval of the proposed AFC systems.

17. Industry efforts, including from WFA and WinnForum, are focused on creating an AFC system lab test plan and test vectors as well as developing criteria and a process for approving test labs.<sup>50</sup> Because this input can be valuable in guiding the Commission, we will not specify a plan for testing the AFC systems at this time as we await these groups to finalize their work in this area. While we will give due consideration to suggestions regarding lab testing developed by industry, we emphasize that a final test plan is subject to our approval, which is contingent on our satisfaction that it provides a comprehensive and appropriate AFC test process.

18. APCO request that the Commission suspend the rules permitting unlicensed operations in the 6 GHz band and conduct a rulemaking as requested in a Petition for Rulemaking and a Request for Stay that it and others filed.<sup>51</sup> According to APCO, that petition and request claim that real-world testing has shown that the assumptions in the *6 GHz Report and Order* regarding the risk of interference occurring

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<sup>44</sup> *Id.* at 28.

<sup>45</sup> Verizon Comments at 14.

<sup>46</sup> UTC/EEI Comments at 7.

<sup>47</sup> *Id.*

<sup>48</sup> FWCC Comments at 9-10.

<sup>49</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3871, para. 49.

<sup>50</sup> The Wi-Fi Alliance has informed OET that they are working on a revision of their AFC System (SUT) Compliance Test Plan. They published the most recent version of the test plan on April 14, 2021. *Wi-Fi Alliance AFC System (SUT) Compliance Test Plan Version 1.1*, April 14, 2021, <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-further-automated-frequency-coordination-specification-and>. The WinnForum submitted a draft lab approval process into the docket of this proceeding that they indicate is being balloted by their members. *Wireless Innovation Forum Authorized AFC System Test Lab Requirements*, WinnForum, ET Docket 21-352, filed April 22, 2022.

<sup>51</sup> APCO Comments at 4; APCO International May 31, 2022 *Ex Parte* ET Docket 18-295, at 4.

are incorrect.<sup>52</sup> While APCO acknowledges that its petition relies on low-power indoor device testing, it claims that the testing calls into question the assumptions made for the risk of interference from standard-power devices as well.<sup>53</sup> The Petition for Rulemaking and Request for Stay refer to low-power indoor device testing conducted by Southern Company for such devices that are located along the path of a particular microwave link.<sup>54</sup> The record developed regarding the AFC system proposals does not provide any comments that indicate that an AFC system using the propagation models specified in the Commission's rules would permit standard-power devices to operate at any of the locations at which the Southern Company testing was conducted or at the device power levels used in the testing. Thus, the record lacks sufficient information to conclude that the Southern Company testing has any relevance regarding the effectiveness of the AFC systems in preventing harmful interference from occurring. Therefore, we see no reason to pause the AFC system approval process based on the Petition for Rulemaking and Request for Stay or the test results upon which they rely. Moreover, we note that this issue is beyond the scope of this instant action, which is solely focused on whether to conditionally approve AFC systems to implement the rules the Commission adopted. The appropriate venue to address the service rules and the potential for a device to cause harmful interference is through the rulemaking process.

#### 4. Security

19. Several commenters raise issues related to AFC system security, standard power device configuration, and the connection between the standard power devices and the AFC systems. AT&T claims that no applicant has addressed the section 15.407(k)(8)(v)<sup>55</sup> requirement that standard-power devices incorporate security measures to prevent the devices from accessing AFC systems not approved by the FCC.<sup>56</sup> AT&T also points out that this requirement is not addressed in WFA's standard-power device test plan.<sup>57</sup> According to AT&T, if AFC systems can be spoofed, the microwave links will have no protection.<sup>58</sup> AT&T also complains that while WFA's "Device Interface Specification" provides that AFC systems will be authenticated using a public key certificate framework, the specification does not explain who can issue or revoke certificates, the security of the process for obtaining certificates, how a certificate is determined to reflect a valid AFC system authorization, or why the specification lists this requirement as untestable.<sup>59</sup>

20. Verizon asserts that most proposals only minimally address security and requests that the FCC acquire additional information from the AFC system operators to evaluate whether the AFC systems will be secure.<sup>60</sup> Although Verizon recognizes that the AFC system proposals assert that they will be

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<sup>52</sup> APCO Comments at 4.

<sup>53</sup> *Id.*

<sup>54</sup> Petition for Rulemaking of Utilities Technology Council, Edison Electric Institute, et al., ET Docket No. 18-295, at 4-5 (filed Dec. 7, 2021) (citing Letter from Larry Butts, Manager, Telecom Engineering, Southern Company Services, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission in ET Docket No. 18-295 and GN Docket No. 17-183 (filed June 23, 2021) and Attachment A: Test Report on the Effects of 6 GHz Unlicensed RLAN Units on Fortson to Columbus Microwave Link June 21, 2021); Request for Stay of Utilities Technology Council, Edison Electric Institute, et al., ET Docket No. 18-295, at 2 (filed Dec. 7, 2021).

<sup>55</sup> 47 CFR § 15.407(k)(8)(v).

<sup>56</sup> AT&T Comments at 10; AT&T Services April 26, 2022 *Ex Parte*, ET Docket No. 18-295, at 14-15.

<sup>57</sup> AT&T Comments at 11 (discussing the *AFC DUT (AFC DUT) Compliance Test Plan*, Draft Version 1.0.6, Wi-Fi Alliance, at 6 (dated Nov. 22, 2021)).

<sup>58</sup> *Id.*

<sup>59</sup> AT&T Comments at 11 (discussing the *AFC System to AFC Device Interface Specification*, Version 1.1, Wi-Fi Alliance, at 10 (dated Nov. 29, 2021)).

<sup>60</sup> Verizon Comments at 11.

secure, it claims that applicants did not discuss how those systems will detect uncertified firmware changes, unauthorized upgrades, hacking, or tampering. Verizon points out that the FCC ID does not identify the firmware version so if a device's firmware is altered, the AFC system has no way of validating that the device continues to comply with the Commission's rules.<sup>61</sup> As a reference, Verizon points to past occurrences where 5 GHz U-NII equipment was modified without authorization and resulted in interference to the Federal Aviation Administration's Terminal Doppler Weather Radar.<sup>62</sup> To prevent a similar problem from occurring in the 6 GHz band, Verizon asserts that the AFC should be able to determine whether a device has been illegally modified.<sup>63</sup> Verizon advocates that the Commission seek additional information from AFC operators on how the AFC system and AFC data will be secured.<sup>64</sup> According to Verizon, the FCC and WinnForum should define a mechanism for ensuring security against unauthorized devices and WinnForum should leverage mechanisms from CBRS to standardize protection of the link between the access points and AFC systems.<sup>65</sup>

21. FWCC notes that several AFC applicants discuss using security protocols, such as two-factor authentication, for their systems and accounts and encourages all AFC operators to implement these measures.<sup>66</sup> FWCC advocates that AFC systems and standard-power devices confirm they are communicating with a counter-party authorized by the Commission.<sup>67</sup> APCO expresses concern that AFC operators have not addressed the cyber protections that they intend to employ to prevent AFCs from becoming tools for effectively shutting down critical communication systems.<sup>68</sup>

22. We conclude that the AFC system applicants have provided sufficient information to assure us that both the AFC systems and the communications link between the standard-power devices and AFC systems will be secure. Regarding the security of the AFC systems, most of the applicants have indicated that their AFC systems will be hosted by a commercial cloud hosting service and that these services employ the latest well-established security measures such as encryption and controlled access.<sup>69</sup> Even those applicants who have not indicated they will use a cloud service indicate they will use tools to secure their AFC systems, such as encryption, access controls, compliance audits, and/or physical security for

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<sup>61</sup> *Id.*

<sup>62</sup> *Id.* at 12 (citing *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, First Report and Order, 29 FCC Rcd 4127, 4130-31 ¶¶ 11-12 (2014)); *see also* AT&T Services April 26, 2022 *Ex Parte*, ET Docket No. 18-295, at 15 (incorrectly claiming that Verizon observed White Space Devices were hacked causing interference to Doppler Weather Radar).

<sup>63</sup> Verizon Comments at 11.

<sup>64</sup> Verizon Comments at 13.

<sup>65</sup> Verizon May 16, 2022 *Ex Parte*, ET Docket No. 21-352, at 3.

<sup>66</sup> FWCC Comments at 6.

<sup>67</sup> FWCC Comments at 6.

<sup>68</sup> APCO comments at 3.

<sup>69</sup> Broadcom Inc. Proposal to be Approved as an Automated Frequency Coordination System Operator at 12; Comsearch Proposal to be Designated as a 6 GHz Automated Frequency Coordination System Operator at 7; Proposal by RED Technologies for Operating an AFC System at 14; Proposal of Sony Group Corporation to Serve as an Automated Frequency Coordination System Operator at 6; Kyrio Proposal to Serve as an Automated Frequency Coordination System Operator at 11-12; Key Bridge Wireless Proposal to Administer an Automated Frequency Coordination System at 9-10; Proposal of Wi-Fi Alliance at 9; Qualcomm Incorporated Application to be Authorized as 6 GHz Band Automated Frequency Coordination System Operator at 7; Plume Design Inc. ("Plume") Proposal for Approval as an Automated Frequency Coordination System Operator at 9; Proposal by Federated Wireless, Inc. to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band at 14-15.

their data centers.<sup>70</sup> We also note that commenters have not suggested specific measures that AFC systems should take to secure their AFC systems or proposed specific questions the applicants should answer regarding security of the AFC systems. Based on the information provided in the proposals and supplemental filings, we are confident that the applicants are aware of the applicable security issues and have plans in place to ensure that the AFC systems and the data they maintain will be adequately secured.

23. As to the security of the communications link between the standard-power devices and AFC systems, all of the applicants have indicated that their AFC systems will implement the Wi-Fi Alliance's AFC System to AFC Device Interface Specification.<sup>71</sup> This specification stipulates the use of Transport Layer Security ("TLS") version 1.2 or higher to perform mutual authentication and provide encryption and integrity protection for the communication link between an AFC device and the AFC system.<sup>72</sup> TLS is a widely used cryptographic protocol that is used to secure internet applications such as email, instant messaging, and secure website access.<sup>73</sup> As TLS has been successfully used for secure communications over the internet, we find that its use provides an appropriate level of security for the communication link between the AFC systems and standard-power devices.

24. Regarding AT&T's concern that AFC system applicants have not addressed the requirement that standard-power devices include security measures to prevent them from accessing unauthorized AFC systems, we point out that this is a device-specific function that must be implemented by the device manufacturers and thus, is not a function that can be performed by the AFC systems. Standard-power device manufacturers will be required to show that their devices satisfy this requirement during the equipment certification process. Given that AT&T's concern must be addressed by the standard-power device and not the AFC, it does not provide any grounds to delay the conditional approval of the proposed AFC systems.

25. Similarly, Verizon's claim that AFC systems should be able to determine whether standard-power devices have been hacked or are running unauthorized firmware relates to the functioning of the standard-power devices; not the AFC. There is no apparent means for the AFC systems to determine whether a standard-power device's firmware has been modified or if the standard-power device has been hacked. This device level security issue is addressed by the Commission's rules which require U-NII device manufacturers to implement security features to prevent third parties from reprogramming devices

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<sup>70</sup> Google Proposal to be Approved as an Automated Frequency Coordination System Operator at 8-9; Proposal of Nokia to be Approved as an Automated Frequency Coordination System Operator at 7-8; Wireless Broadband Alliance Ltd. Application to Become an Automated Frequency Coordination (AFC) System Operator at 16.

<sup>71</sup> Broadcom Inc. Proposal to be Approved at an Automated Frequency Coordination System Operator at 12; Comsearch Proposal to be Designated as a 6 GHz Automated Frequency Coordination System Operator at 8; Proposal by RED Technologies for Operating an AFC System at 7; Proposal of Sony Group Corporation to Serve as an Automated Frequency Coordination System Operator at 5-6; Kyrio Proposal to Serve as an Automated Frequency Coordination System Operator at 5; Key Bridge Wireless Proposal to Administer an Automated Frequency Coordination System at 6; Proposal of Wi-Fi Alliance at 10; Qualcomm Incorporated Application to be Authorized as 6 GHz Band Automated Frequency Coordination System Operator at 2; Plume Design Inc. ("Plume") Proposal for Approval as an Automated Frequency Coordination System Operator at 4; Proposal by Federated Wireless, Inc. to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band at 8, 15; Google Proposal to be Approved as an Automated Frequency Coordination System Operator at 10; Proposal of Nokia to be Approved as an Automated Frequency Coordination System Operator at 4; Wireless Broadband Alliance Ltd. Application to Become an Automated Frequency Coordination (AFC) System Operator at 8.

<sup>72</sup> Wi-Fi Alliance Supplemental filing at 3, (February, 22 2022); *AFC System to AFC Device Interface Specification*, Version 1.0, Wi-Fi Alliance, at 10; *The Transport Layer Security (TLS) Protocol Version 1.2*, Internet Engineering Task Force(IETF), Network Working Group, Request for Comments :5246( August 2008) <https://tools.ietf.org/html/rfc5246>. See also, *The Transport Layer Security (TLS) Protocol Version 1.3*, Internet Engineering Task Force, Network Working Group, Request for Comments :8446( August 2018) <https://tools.ietf.org/html/rfc8446>.

<sup>73</sup> Transport Layer Security, [https://en.wikipedia.org/wiki/Transport\\_Layer\\_Security](https://en.wikipedia.org/wiki/Transport_Layer_Security).

to operate outside of the parameters for which the device is certified.<sup>74</sup> OET has issued guidance indicating that applications for U-NII device certification must describe the security measures implemented to ensure that the U-NII devices cannot be modified for any RF-related software changes by third parties.<sup>75</sup> This guidance will apply to 6 GHz band standard-power devices. As with other device specific features, compliance with this requirement will be done through the equipment certification process; it is outside the scope of AFC functions and thus not a consideration for granting conditional approval.

## 5. Interference Mitigation and Enforcement

26. Several commenters raise issues related to interference mitigation and enforcement of the Commission's rules. According to AT&T, many of the AFC applications do not address the requirement that the AFC systems incorporate protocols to comply with enforcement instructions from the Commission and do not contain any real discussion of how the AFC system will discontinue access point operations in a particular area as required by the rules.<sup>76</sup> AT&T claims that it would be impractical for OET to use separate interfaces for each AFC system to enter exclusion zones for unlicensed devices and suggests that the AFC system operators work with OET to develop a web-based database to import exclusion zones into each AFC system.<sup>77</sup> AT&T also mentions that none of the AFC proposals incorporates the ability to directly communicate with microwave licensees and suggests that AFC system operators engage in good faith with microwave licensees to diagnose and remediate interference problems even if the Commission is not formally involved.<sup>78</sup>

27. Verizon points to the *6 GHz Report and Order* to claim that the Commission charged a multi-stakeholder group with addressing procedures to follow if an incumbent licensee has an interference complaint and that the group was directed to create a process to effectively address and resolve interference complaints without involving the Commission's Enforcement Bureau.<sup>79</sup> Verizon states that, to its knowledge, WinnForum has not made any progress on this issue.<sup>80</sup> Verizon requests that conditional approval not be granted to the AFC systems until this is addressed.<sup>81</sup> According to Verizon, the 6 GHz interference-protection regime would benefit from a clearly defined process for submitting interference complaints and resolution mechanisms.<sup>82</sup>

28. FWCC similarly claims that the AFC system applications have provided only the barest of details on how they will comply with the rule requirement that they "establish [. . .] protocols to comply with enforcement instructions from the Commission."<sup>83</sup> FWCC requests that the AFC operators be

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<sup>74</sup> 47 CFR § 15.407(i)(1); *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, ET Docket No. 13-49, First Report and Order, 29 FCC Rcd 4127, 4143-44, paras. 54-57 (2014).

<sup>75</sup> *Software Security Requirements for U-NII Devices*, Office of Engineering and Technology KDB Publication 594280 D02 (Nov. 12, 2015), [https://apps.fcc.gov/kdb/GetAttachment.html?id=zXtrcto6zH7oNEOO6De6g%3D%3D&desc=594280%20D02%20U-NII%20Device%20Security%20v01r03&tracking\\_number=39498](https://apps.fcc.gov/kdb/GetAttachment.html?id=zXtrcto6zH7oNEOO6De6g%3D%3D&desc=594280%20D02%20U-NII%20Device%20Security%20v01r03&tracking_number=39498).

<sup>76</sup> AT&T Services Comments at 24.

<sup>77</sup> *Id.* at 24-25.

<sup>78</sup> *Id.* at 25.

<sup>79</sup> Verizon Comments at 8.

<sup>80</sup> *Id.*

<sup>81</sup> *Id.*

<sup>82</sup> Verizon May 16, 2022 *Ex Parte*, ET Docket No. 21-352, at 3.

<sup>83</sup> FWCC Comments at 8 (quoting 47 CFR § 15.407(k)(15)(vi) (internal quotation marks omitted)).

required to describe the data they will retain regarding interference reports and discontinuance of access to the 6 GHz band by unlicensed devices and how the Commission will access that information.<sup>84</sup> It suggests creating a database that contains information on interference reports and blacklisted devices that is accessible to all AFC system operators and the Commission to assist in conducting investigations.<sup>85</sup> In addition, FWCC suggests that AFC operators and the Commission establish a process to manage blacklisting of devices and specify areas where transmissions must be limited.<sup>86</sup> FWCC also claims that AFC operators should describe how an unlicensed device can be immediately disabled since access points will typically be authorized for a 24-hour period.<sup>87</sup>

29. APCO notes that the AFC system proposals offer differing explanations for how the AFC systems will respond to reports of harmful interference.<sup>88</sup> APCO suggests that public safety agencies should not be required to report interference to individual AFC operators as they are not likely to know which AFC system is controlling a device that is causing interference.<sup>89</sup> APCO asks a series of questions regarding interference mitigation, such as what information licensees will need to provide if making an interference complaint, what process will be used to identify sources of interference, how will AFC operators account for the cost involved, whether complaints will need to identify individual devices causing interference, and whether AFC operators will be capable of having devices causing interference immediately shut down or shift frequencies.<sup>90</sup>

30. The Commission's rules require that AFC systems "[e]stablish and follow protocols to comply with enforcement instructions from the Commission, including discontinuance of standard power access point operations in designated geographic areas."<sup>91</sup> All of the AFC system applicants have indicated in either their proposals or supplemental filings that their systems will comply with enforcement instructions and are capable of meeting this requirement.<sup>92</sup> As discontinuing operation of a particular

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<sup>84</sup> *Id.*

<sup>85</sup> *Id.* at 9.

<sup>86</sup> *Id.* at 8-9.

<sup>87</sup> *Id.* at 9.

<sup>88</sup> APCO International Comments at 2; *see also* APCO International May 31, 2022 *Ex Parte* at 2 (stating that applicants' responses to supplemental questions regarding interference complaints "fail to provide a clear answer").

<sup>89</sup> APCO International May 31, 2022 *Ex Parte*, at 2-3.

<sup>90</sup> APCO International Comments at 3.

<sup>91</sup> 47 CFR § 15.407(k)(15)(vi).

<sup>92</sup> Broadcom Inc. Proposal to be Approved as an Automated Frequency Coordination System Operator at 14; Comsearch Proposal to be Designated as a 6 GHz Automated Frequency Coordination System Operator at 9; Proposal by RED Technologies for Operating an AFC System at 7, 11; Proposal of Sony Group Corporation to Serve as an Automated Frequency Coordination System Operator at 5; Kyrio Proposal to Serve as an Automated Frequency Coordination System Operator at 14; Key Bridge Wireless Proposal to Administer an Automated Frequency Coordination System at 10; Proposal of Wi-Fi Alliance at 10; Qualcomm Incorporated Application to be Authorized as 6 GHz Band Automated Frequency Coordination System Operator at 5, 10, 12; Plume Design Inc. ("Plume") Proposal for Approval as an Automated Frequency Coordination System Operator at 11-12; Proposal by Federated Wireless, Inc. to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band at 15; Google Proposal to be Approved as an Automated Frequency Coordination System Operator at 10; Proposal of Nokia to be Approved as an Automated Frequency Coordination System Operator at 4; Wireless Broadband Alliance Ltd. Application to Become an Automated Frequency Coordination (AFC) System Operator at 9; Qualcomm Automated Frequency Coordination System Operator Application: Responses to Supplemental Questions, ET Docket No. 21-352, at 4 (filed Feb. 28, 2022); Supplement to the Proposal by RED Technologies SAS to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band, ET Docket No. 21-352, at 3 (filed Nov. 26, 2021); Supplement to Proposal from Sony Group Corporation to Serve as an Automated

(continued....)

standard-power device or preventing standard-power device operations in a particular area on a particular frequency is a straightforward task for an AFC system, more detailed information than what the applicants have provided is not necessary at this time. This required functionality can be tested prior to final approval to ensure the AFC systems properly handle any relevant shutdown requests. Consequently, we find that there is no reason to delay the conditional approval of the AFC systems based on the concerns expressed regarding interference mitigation and enforcement.

31. In the *6 GHz Report and Order*, the Commission encouraged stakeholders to form a multi-stakeholder group to address issues concerning 6 GHz unlicensed device operations.<sup>93</sup> The Commission encouraged the multi-stakeholder group to “address any issues it deems appropriate regarding interference detection and mitigation” which would “include procedures and processes that could be followed if an incumbent licensee has, or potentially has, an interference complaint.”<sup>94</sup> While the Commission encouraged the multi-stakeholder group to address these issues, it did not make this a mandatory requirement or condition for AFC system approval. The multi-stakeholder working group focused on harmful interference detection, reporting, and resolution produced a report on recommended procedures for interference detection, reporting and resolution to protect microwave receivers.<sup>95</sup> This report presents two alternate viewpoints on how interference should be reported and what procedures should be used to resolve interference complaints.<sup>96</sup> These two viewpoints represent the conflicting positions of microwave incumbents and unlicensed standard-power device proponents. Because of the lack of consensus of the multi-stakeholder group and lack of recommendations by other industry groups such as the WFA and WinnForum regarding how to resolve reports of potential harmful interference, we will not provide specific requirements regarding interference mitigation at this time. Considering that the Commission did not require these groups to address these issues, the lack of consensus from these groups does not provide a basis to delay AFC system conditional approval as Verizon requests.

32. However, as the commenters suggest, the AFC system operators can clearly do more to streamline the process of investigating interference complaints and implementing enforcement instructions from the Commission. For example, providing a process for the Commission to seamlessly provide enforcement instructions to all the AFC systems through a web-based interface could be helpful to both the Commission and AFC operators. Providing a centralized means for microwave licensees to report suspected harmful interference and a process for AFC systems to investigate instances of potential interference could be useful to resolving harmful interference, if any occurs, in a timely manner. Creating a shared database of exclusion areas or blacklisted devices could ease the process of coordinating enforcement instructions across the different AFC systems. Many of the AFC system applicants have indicated an intention to collaborate with industry groups to formulate procedures for acting on reports of

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Frequency Coordination System Operator, ET Docket No. 21-352, at 4 (filed Feb. 24, 2022); Wi-Fi Alliance Supplemental filing at 6, (February, 22 2022); Response to Commission Questions Regarding Nokia’s Proposal to be Approved as an Automated Frequency Coordination (AFC) System Operator, ET Docket No. 21-352, at 4 (filed April 14, 2022); Google Feb. 28, 2022 *Ex Parte* ET Docket No. 21-352, at 2; Supplement of Plume Design Inc. to Proposal for Approval as an Automated Frequency Coordination System Operator, ET Docket No. 21-352, at 9 (filed Feb. 28, 2022); Broadcom Feb. 24, 2022 *Ex Parte* ET Docket No. 21-352, at 3; Kyrio Feb. 25, 2022 *Ex Parte* ET Docket No. 21-352, at 3.

<sup>93</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3917-18, para. 174.

<sup>94</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3918, para. 176.

<sup>95</sup> *Best Practices and Recommended Procedures for Interference Detection, Reporting, and Resolution to Protect Fixed Microwave service Receivers in the 6 GHz Band*, 6 GHz Multi-stakeholder Group, July 11, 2022, filed in ET Docket No. 18-295 (July 11, 2022).

<sup>96</sup> *Id.* at 28-34.

potential harmful interference.<sup>97</sup> We encourage the AFC system applicants and industry groups to work on ways to address claims of potential interference, but as it is not required in the rules, we will not delay conditional approval of the proposed AFC systems based on the lack of any such reporting mechanisms being in place today. Finally, while we encourage AFC system operators to work together to develop streamlined processes to address complaints of potential interference, we note that the Commission has not adopted rules requiring that licensees be reimbursed for any costs incurred if they experience harmful interference. Thus, APCO's desire that AFC operators account for such cost is beyond the scope of AFC system conditional approval. In addition, as the Commission's rules do not require AFC systems to have the means to immediately disable access points, as FWCC and APCO suggest, this cannot be addressed as part of the AFC system conditional approval process.

## 6. Propagation Models

33. The rules adopted in the *6 GHz Report and Order* specify the propagation models the AFC systems must use for determining frequency availability and power levels, which depend on the distance between the standard-power device and the licensed microwave station. For separation distances of 30 meters or less, the AFC systems are directed to use a free space pathloss model.<sup>98</sup> When the separation distance is greater than 30 meters, but less than 1 kilometer, the AFC systems are required to use the WINNER II model.<sup>99</sup> The WINNER II model is one of the most widely used and well-known channel models in the world<sup>100</sup> and was developed from measurements conducted by the WINNER organization, as well as results from academic literature.<sup>101</sup> When using the WINNER II model, the rules require the AFC system to use site-specific information, including building<sup>102</sup> and terrain data, for determining the line-of-sight/non-line-of-sight path component where this information is available.<sup>103</sup> For evaluating paths where this data is not available, the rules specify probabilistic combining of the line-of-sight and non-line-of-sight paths into a single path-loss.<sup>104</sup> For distances greater than 1 kilometer, the AFC systems are required to use the Irregular Terrain Model (ITM) combined with a clutter model for the local environment.<sup>105</sup> The ITM has been widely available and accepted since the early 1980s, has been used by

<sup>97</sup> See e.g., Broadcom Feb. 24, 2022 *Ex Parte* ET Docket No. 21-352, at 3; Kyrio Feb. 25, 2022 *Ex Parte* ET Docket No. 21-352, at 3; Qualcomm Automated Frequency Coordination System Operator Application: Responses to Supplemental Questions, ET Docket No. 21-352, at 4 (filed Feb. 28, 2022); Supplement to Proposal from Sony Group Corporation to Serve as an Automated Frequency Coordination System Operator, ET Docket No. 21-352, at 4-5 (filed Feb. 24, 2022); Wi-Fi Alliance Feb. 22, 2022 *Ex Parte* ET Docket No. 21-352, at 6; Supplement to the Proposal by Federated Wireless to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band, ET Docket No. 21-352, at 9 (filed Feb. 9, 2022); Supplement to Comsearch Proposal to be Approved as an Automated Frequency Coordination Operator, ET Docket No. 31-352, at 9-10 (filed Mar. 1, 2022).

<sup>98</sup> 47 CFR § 15.407(l)(1)(i); *6 GHz Report and Order*, 35 FCC Rcd at 3875, para. 64.

<sup>99</sup> 47 CFR § 15.407(l)(1)(ii); *6 GHz Report and Order*, 35 FCC Rcd at 3875-76, para. 65.

<sup>100</sup> Patrick Marsch et al., "5G System Design: Architectural and Functional Considerations and Long-Term Research", 2018, at 57.

<sup>101</sup> Martin Döttling et al., "Radio Technologies and Concepts for IMT-Advanced," 2010, at 75.

<sup>102</sup> See, e.g., OSM building data. <https://osmbuildings.org/data/>.

<sup>103</sup> 47 CFR § 15.407(l)(1)(ii).

<sup>104</sup> 47 CFR § 15.407(l)(1)(ii). When site-specific information regarding line-of-sight/non-line-of-sight is not available, the AFC system must use a probabilistic model combining the line-of-sight (LOS) path and non-line-of-sight (NLOS) path into a single path-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. *Id.* 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  $(1-P_{LOS})$ . *Id.*

<sup>105</sup> 47 CFR § 15.407(l)(1)(iii); *6 GHz Report and Order*, 35 FCC Rcd at 3876-77, para. 66.

the Commission for interference prediction in other proceedings, and is the propagation model currently used to determine spectrum availability by the SAS that are managing spectrum access for the 3550-3700 MHz band in the CBRs.<sup>106</sup> When using the ITM, the rules specify that AFC systems are to use 1 arc-second digital elevation terrain data and,<sup>107</sup> for locations where such data is not available, use the most granular digital elevation terrain data available.<sup>108</sup> 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.2108<sup>109</sup> for urban and suburban environments and the ITU-R P.452-16 clutter model for rural environments.<sup>110</sup>

34. AT&T and Verizon state that industry consensus has not been achieved regarding certain parameters used in the propagation models and that only one applicant, RED Technologies, has indicated in its AFC application what parameters it will use.<sup>111</sup> AT&T raised this concern in an earlier ex parte filing in which it pointed out that agreement had not been reached on the confidence and reliability levels used in the ITM propagation model and for the confidence levels used in the urban/suburban clutter models and the WINNER II model.<sup>112</sup> AT&T advocates using 95% for the confidence level and 80% for reliability.<sup>113</sup> AT&T suggests that these values are appropriate because they are consistent with the propagation models used for coordination between microwave links and that unlicensed devices must provide licensed microwave links with at least the same level of protection.<sup>114</sup> AT&T urges OET to either engage actively in the multi-stakeholder group deliberations or define any parameters the group is unable to achieve consensus on given all parties' interest in timely AFC system approvals.<sup>115</sup> Verizon advocates

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<sup>106</sup> *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>.

<sup>107</sup> 47 CFR § 15.407(l)(1)(iii). “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>.

<sup>108</sup> 47 CFR § 15.407(l)(1)(iii). 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/>.

<sup>109</sup> 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>.

<sup>110</sup> 47 CFR § 15.407(l)(1)(iii). *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](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. 47 CFR § 15.407(l)(1)(iii). However, if detailed local information is not available, the “Village Centre” clutter category should be used. *Id.*

<sup>111</sup> AT&T Services Comments at 7-9; Verizon Comments at 3-4; *see also* Utilities Technology Council and the Edison Electric Institute Comments at 5-6; FWCC Comments at 7-8; AT&T Services April 26, 2022 *Ex Parte*, ET Docket No. 18-295, at 9-11; APCO International May 31, 2022 *Ex Parte*, ET Docket 18-295, at 2.

<sup>112</sup> AT&T Services Oct. 14, 2021 *Ex Parte*, ET Docket No. 18-295, slide presentation at 3, 6-7.

<sup>113</sup> *Id.* at 6-7.

<sup>114</sup> *Id.* at 4.

<sup>115</sup> AT&T Services April 26, 2022 *Ex Parte*, ET Docket No. 18-295, at 11.

use of a 99% confidence level, which can be later adjusted with experience, and also requests that the Commission obtain information about the parameters that each AFC system will use to implement the various models adopted in the rules.<sup>116</sup>

35. In response to AT&T's ex parte filing, Apple, Broadcom, et al. claim that the *6 GHz Report and Order* did not delegate authority to OET to prescribe parameters for implementing the propagation models but instead established a process where AFC system operators would submit proposals subject to review and comment followed by conditional approval and thorough testing.<sup>117</sup> According to Apple, Broadcom et al., the Commission left issues specific to technical and operational issues of the AFC systems to industry.<sup>118</sup> According to Apple, Broadcom, et al., AFC system proposals are not required to include detailed discussions of their implementation of specific technical algorithms, and incumbents would have an opportunity to evaluate the AFC systems through the testing process.<sup>119</sup> Apple, Broadcom, et al. also point out that AT&T's suggested parameters are far more restrictive than what the Commission used in its analysis in the *6 GHz Report and Order*, which used 50% as the confidence and reliability levels in the propagation models and that using AT&T's worst-case parameters would prevent unlicensed devices from using channels where such restrictions are not necessary to protect licensees.<sup>120</sup>

36. Of the AFC applicants, only Red Technologies addressed these propagation parameters in its application, indicating it would use a 95% confidence level and an 80% reliability level in the propagation models.<sup>121</sup> In a supplemental filing, Sony also endorsed using a 95% confidence level, while Qualcomm and Nokia indicate they intend to use a 50% confidence level.<sup>122</sup> All AFC applicants indicated in supplemental filings that these parameters are configurable in their AFC implementations and that they would use parameters consistent with Commission rules or guidance or industry consensus.

37. We disagree with Apple, Broadcom, et al. to the extent that they imply that OET has no authority to require use of particular parameters for the AFC systems. The Commission delegated to OET the authority to administer the AFC systems and AFC system operator functions set forth in the Commission's rules.<sup>123</sup> This authority specifically includes the ability to "develop procedures that these AFC system operators will use to ensure compliance with the requirements for AFC system operations."<sup>124</sup> OET appreciates the efforts of industry groups in developing specifications and protocols for AFC system operation. However, OET has the responsibility to administer the AFC systems and ensure that their operations are consistent with the Commission's rules to prevent harmful interference from occurring to licensees.

38. In the case of these propagation model parameters, it appears that, to date, the industry has not yet reached a consensus. Because discussion among stakeholders is ongoing, and propagation model

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<sup>116</sup> Verizon May 16, 2022 *Ex Parte*, ET Docket No. 21-352, at 2; Verizon Comments at 8.

<sup>117</sup> Apple, Broadcom et al. Nov. 11, 2021 *Ex Parte*, at 2.

<sup>118</sup> *Id.* at 2.

<sup>119</sup> *Id.* at 4.

<sup>120</sup> *Id.* at 5-7.

<sup>121</sup> Proposal by RED Technologies for Operating an AFC System, ET Docket 21-352, at 10 (filed Nov. 26, 2021).

<sup>122</sup> Supplement to Proposal from Sony Group Corporation to Serve as an Automated Frequency Coordination System Operator, ET Docket 21-352, at 2 (filed Feb. 24, 2022); Qualcomm Automated Frequency Coordination System Operator Application: Responses to Supplemental Questions, ET Docket 21-352, at 6 (filed Feb. 28, 2022); Response to Commission Questions Regarding Nokia's Proposal to be Approved as an Automated Frequency Coordination (AFC) System Operator, ET Docket 21-352, at 1 (filed April 14, 2022).

<sup>123</sup> 47 CFR § 0.241(k); see AT&T Services April 26, 2022 *Ex Parte*, ET Docket No. 18-295, at 11 ("[I]t is clear that the Commission intended that OET could define parameters for AFC system operation.").

<sup>124</sup> 47 CFR § 0.241(k).

parameters are merely inputs to those models and are easily configurable as a parameter within the AFC, OET is not inclined to specify specific parameters at this time so that the industry can continue working toward consensus. However, acting under our delegated authority we are specifying a bound on these parameters that we believe is necessary to provide protection to the microwave incumbents and is consistent with the Commission's actions in the *6 GHz Report and Order*. We note that in the Commission's link budget analysis of five actual fixed point-to-point links used as one factor in the Commission's decision in the *6 GHz Report and Order*, all statistical quantities were treated as a median or average value.<sup>125</sup> That is, for link budget analyses using the ITM model and the WINNER II model, a confidence and reliability of 50%--i.e. the median value-- was used. As the Commission found that unlicensed devices could co-exist in the 6 GHz band with incumbent users based on such modeling, we believe that using 50% for the reliability and confidence levels in the ITM model and 50% for the confidence level in the WINNER II model and clutter models are consistent with the *6 GHz Report and Order* and are sufficient to ensure that fixed service microwave links are adequately protected from receiving harmful interference.<sup>126</sup> As these parameters represent the minimum protection level that must be provided to incumbent microwave stations, we emphasize that AFC systems may use more stringent levels (i.e., predict additional standard-power device path loss by using higher reliability and confidence levels in the propagation models), but they may not provide a lower level of protection. We appreciate that industry stakeholders may desire to implement propagation models using more stringent parameters so as to provide additional protection (above the minimum required) to licensed incumbents—especially during initial AFC deployment. We believe there is value in having the AFC systems make uniform assumptions when both implementing the propagation models and modeling the incumbent microwave systems.<sup>127</sup> We encourage industry stakeholders to continue to work toward reaching a consensus on this issue.<sup>128</sup>

## 7. Indoor Operation of Standard-power Devices

39. Verizon requests that the Commission obtain information about the parameters AFC systems will use to implement models for building entry loss.<sup>129</sup> AT&T claims that industry has not reached agreement on how building entry loss should be applied for standard-power devices that are indoors.<sup>130</sup> As the rules for low-power indoor devices are predicated on an assumed building entry loss,<sup>131</sup> AFC systems could theoretically also use an assumed value or model for building entry loss to reduce the calculated signal level from an indoor unlicensed device due to signal attenuation from passing through the building walls. During meetings held with each AFC applicant, OET staff requested that the AFC system applicants explain whether they were contemplating a method to incorporate building entry loss

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<sup>125</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3898-3902, paras. 127-131.

<sup>126</sup> We note that the Commission has precedent for using 50% confidence and reliability levels in specifying how to evaluate propagation loss. These same levels are used by the Citizens Broadband Radio Service (CBRS) spectrum access systems (SAS) in their ITM implementation to control access in the 3.55-3.7 GHz band. These SAS's are successfully preventing harmful interference from occurring in the 3.55-3.7 GHz band, which provides further indication that these parameters are appropriate.

<sup>127</sup> Verizon also claims that there is a need to standardize other parameters such as how AFC systems will determine line-of-sight conditions, application of site specific information where available, implementation of clutter models, antenna patterns when the actual microwave antenna pattern isn't available, and microwave system noise figure. Verizon May 16, 2022 *Ex Parte*, ET Docket 21-352, at 3-4. Industry should continue to work toward consensus on these issues.

<sup>128</sup> If industry does not reach a consensus to use more stringent confidence and reliability levels, individual AFC operators have the option of adopting such levels on their own initiative.

<sup>129</sup> Verizon Comments at 8.

<sup>130</sup> AT&T Services April 26, 2022 *Ex Parte*, ET Docket No. 18-295, at 11.

<sup>131</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3889, 3899-900, paras. 100, 128, footnote 297, Table 4.

into their AFC system propagation prediction models. Most of the applicants responded that they would comply with industry consensus and Commission directives. The only exception was RED Technologies, who indicated that because the Commission's rules do not provide a distinction between indoor and outdoor standard-power devices, its AFC will treat indoor standard-power devices identically to those located outdoors.<sup>132</sup> Broadcom, while indicating that its AFC system will follow FCC rules and industry standards, indicated that it expects the vast majority of standard-power access points to operate indoors and that its AFC system will be capable of accounting for building entry loss when assigning channels to standard-power devices that operate indoors.<sup>133</sup>

40. The *6 GHz Report and Order* clearly provided that standard-power devices may operate either indoors or outdoors under the control of an AFC system.<sup>134</sup> Based on our analysis supporting low-power indoor devices which accounted for building entry loss, it would stand to reason that an AFC could, based on building entry loss, determine a higher permitted power level for an indoor versus an outdoor standard-power device so long as it is aware of whether such a device is operating indoors or outdoors. The sole requirement in the rules is for AFC systems to use the specified propagation models to protect microwave receivers based on the -6 dB I/N metric used in the *6 GHz Report and Order*. Recognizing that building entry loss could be an input to any predictive propagation model to determine permitted power levels for 6 GHz standard-power devices, accounting for indoor operation would provide such devices located indoors additional power to serve a larger coverage area. However, neither the *6 GHz Report and Order* nor the rules governing AFC system operations directly address how the AFC systems could determine that a device is, in fact, located indoors. We note that there may be methods for making this determination and providing it to the AFC.<sup>135</sup> Given the developmental state of these location determining technologies and the lack of a professional installer requirement for 6 GHz standard-power devices,<sup>136</sup> we take no position at this time whether to permit the AFC to account for building entry loss for indoor standard-power devices. We will continue to monitor how these technologies mature and their effectiveness at precisely determining location, and, if warranted, provide additional guidance in the future. However, in consideration of providing more flexibility near-term as we move forward with the AFC approval process and given our experience with low-power indoor devices, we believe that it would be possible to protect the microwave incumbents while permitting the AFC systems to adjust their calculations to take into account building entry loss when standard-power devices are indoors. If entities believe their technology or unique situation merits Commission consideration for providing the flexibility of considering building entry loss for indoor standard-power devices, the Commission may consider waiver requests to allow such operation. Any waiver request must provide full support for how standard power devices will be constrained to indoor locations, how interference protection to incumbent spectrum users will be provided, and any arrangements with AFC providers to ensure that indoor versus outdoor location data is being properly transmitted, interpreted, and acted on appropriately.

## V. AFC SYSTEM TESTING

41. As directed by the *6 GHz Report and Order*, we require that the conditionally approved AFC systems undergo rigorous testing, both in a controlled environment and through demonstration projects, before we approve them for commercial operations.<sup>137</sup> The controlled environment testing shall consist of

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<sup>132</sup> Supplement to the Proposal by RED Technologies SAS to Serve as an Automated Frequency Coordination System Operator in the 6 GHz Band, ET Docket 21-352, at 3 (filed Nov. 26, 2021).

<sup>133</sup> Broadcom Feb. 24, 2022 *Ex Parte* ET Docket No. 21-352, at 2.

<sup>134</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3862, para. 22.

<sup>135</sup> See, e.g., Hewlett Packard Enterprise Jul. 29, 2022 *Ex Parte* ET Docket No. 18-295.

<sup>136</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3869, para. 43.

<sup>137</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3871, para. 49.

testing conducted by a third-party test lab.<sup>138</sup> In addition to this lab testing, we shall also require the AFC systems to undergo one or more demonstration projects.<sup>139</sup> While we will provide details on this testing in a forthcoming public notice, we are providing preliminary information on the required testing to enable the AFC system applicants to begin preparing for the testing process.

42. *Lab Testing.* The required lab testing for each conditionally approved AFC will consist of a set of tests that will ultimately be specified by OET. We have encouraged stakeholders to contribute their thoughts on how testing could be conducted in an efficient and expeditious manner. To that end, WFA created a lab test plan.<sup>140</sup> In addition, WFA is creating a set of inputs (test vectors) to thoroughly test the AFC systems' ability to protect incumbent microwave systems that is being revised based on collaboration with WinnForum.<sup>141</sup> These test vectors will include geographic coordinates (including location uncertainty), antenna height above ground, , as well as the available frequencies and permitted power levels that the AFC systems should return for the geographic location and height.<sup>142</sup> The test vectors will need to include a wide range of scenarios, such as multiple fixed service station locations and a variety of separation distances between the standard-power devices and fixed service receive sites. In addition to fixed service protection, test vectors must also include scenarios to test that AFC systems protect radio astronomy sites in accordance with the rules as well as recognizing United States borders.<sup>143</sup> We expect that the WFA test plan and test vectors will have widespread support from all AFC applicants as well as other stakeholders, including fixed service licensees. We intend to consider the results of this collaborative process when deciding the final protocols and test vectors for AFC system lab testing, including adding additional test vectors beyond those provided to us. Hence, we are not specifying the test plan and test vectors to be used for the lab testing at this time. Instead, we will provide guidance on a test plan and test vectors in a forthcoming public notice to be issued after we have an opportunity to review the test plan and final test vectors provided by WFA and/or other industry stakeholders.

43. So that interested parties can begin preparing to conduct the required AFC system lab testing, we are providing some guidance on those entities that will be permitted to conduct such testing. As an initial matter, we need to ensure that such testing is conducted by entities with the proper experience and expertise for this specialized testing. In this connection, the Commission's experience in approving CBRS SASs and devices is instructive regarding our approach to similar testing for AFC systems. Although CBRS SAS testing was conducted by NTIA's Institute for Telecommunication Sciences (ITS), the device testing, which includes using specific test software and a test harness, is conducted by FCC-recognized accredited labs.<sup>144</sup> Thus, many FCC-recognized accredited labs already possess expertise for

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<sup>138</sup> See *id.*

<sup>139</sup> See *id.*

<sup>140</sup> *Wi-Fi Alliance AFC System (SUT) Compliance Test Plan Version 1.2.1*, September 26,, 2022, <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-further-automated-frequency-coordination-specification-and>.

<sup>141</sup> Wi-Fi Alliance and Wireless Innovation Forum July 27, 2022 *Ex Parte*, ET Docket No. 18-295, at 6-7; Wi-Fi Alliance and Wireless Innovation Forum Oct. 20, 2022 *Ex Parte*, ET Docket No. 18-295, at 6.

<sup>142</sup> See 47 CFR § 15.407(k)(8)(ii); *Wi-Fi Alliance AFC System (SUT) Compliance Test Plan Version 1.1*, April 14, 2021, at Section 3.1.3.

<sup>143</sup> 47 CFR § 15.407(k)(14), (m).

<sup>144</sup> *Wireless Telecommunications Bureau and Office of Engineering and Technology Approve Four Spectrum Access System Administrators for Full Scale Commercial Deployments in the 3.5 GHz Band and Emphasize Licensee Compliance Obligations in the 3650-3700 MHz Band under Part 96*, Public Notice, GN Docket No. 15-319, 35 FCC Rcd 117, 118, para. 3 (2020); *Certification and Test Procedures for Citizen Broadband Radio Service Devices Authorized Under Part 96*, Office of Engineering and Technology KDB Publication 940660 D01 (Oct. 29, 2020), [https://apps.fcc.gov/kdb/GetAttachment.html?id=oXoQ1f1y7fj8yxgm424g0w%3D%3D&desc=940660%20D01%20Part%2096%20CBRS%20v03&tracking\\_number=229297..](https://apps.fcc.gov/kdb/GetAttachment.html?id=oXoQ1f1y7fj8yxgm424g0w%3D%3D&desc=940660%20D01%20Part%2096%20CBRS%20v03&tracking_number=229297..) FCC recognized accredited testing laboratories are organizations which conduct the testing required for devices to obtain certification under the Commission's

(continued....)

similar testing as is required for AFC systems.<sup>145</sup> Because we have confidence that the FCC-recognized accredited testing laboratories that have also been approved through WinnForum’s Citizens Broadband Radio Service Device (CBSD) testing and certification program possess the facilities and expertise to conduct AFC testing, we will permit such labs to perform AFC system lab testing once such procedures are approved by the Commission.<sup>146</sup> We make this determination because the AFC system lab testing will, similar to CBRS device testing, involve using test harness software to send and receive information from the server on which the AFC system is running. Consequently, we believe that this subset of FCC-recognized accredited testing laboratories has the capability to conduct the AFC system lab testing. For these labs, no additional certification or permission from OET will be necessary.

44. In making the determination to permit labs that have been certified by WinnForum for CBRS testing to also conduct AFC system testing, we are mindful of not foreclosing other qualified entities from conducting such testing. WinnForum is creating a process, similar to what it did for CBRS, to develop criteria and approve labs to conduct AFC system testing.<sup>147</sup> Under the draft process outlined by WinnForum, a prospective test lab will submit an application to WinnForum that includes proof of ISO/IEC 17025 accreditation to the WinnForum 6 GHz AFC system test plans, an overview of the test lab including its experience with the test modules, the resumes of the lab’s subject matter experts and engineers who will be involved with the testing, a demonstration of execution of the test harness software, a written description of the test procedures, a test report template, and a valid set of sample test vectors representative of additional tests that the test lab may run.<sup>148</sup> A task group of industry stakeholders operating independently of WinnForum and not including representatives of the candidate test labs will review the application to ensure that all requirements are satisfied.<sup>149</sup> After WinnForum finalizes this process, we will examine it and issue guidance on whether test labs approved under the process will be eligible to conduct AFC system lab testing as part of the overall process toward AFC’s obtaining approval to commence commercial operations.

45. *Demonstration Projects*: As part of the multi-stage review process to designate AFC operators, the *6 GHz Report and Order* requires conditionally approved AFC system applicants to “provide a test system that will be subject to a public trial period to provide interested parties an opportunity to check that it provides accurate results.”<sup>150</sup> To meet this directive, OET intends to require each of the AFC system applicants to conduct a public trial as a demonstration project after completing

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equipment authorization program. 47 CFR §§ 2.907, 2.948; *Accredited Testing Laboratory Program Roles and Responsibilities*, Office of Engineering and Technology, KDB Publication 974614 D01 (Apr. 2, 2019), [https://apps.fcc.gov/kdb/GetAttachment.html?id=koP7QuHnAbqrT0URaUjRBw%3D%3D&desc=974614%20D01%20Accredited%20Test%20Lab%20Roles%20and%20Resp%20v05r01&tracking\\_number=44684](https://apps.fcc.gov/kdb/GetAttachment.html?id=koP7QuHnAbqrT0URaUjRBw%3D%3D&desc=974614%20D01%20Accredited%20Test%20Lab%20Roles%20and%20Resp%20v05r01&tracking_number=44684).

<sup>145</sup> For example, KDB 940660 D01 detailing test procedures for CBRS Equipment specifies in footnote 6 that test laboratories submitting data using the WinnForum publicly available test software and test harness must be recognized by WinnForum as an entity to perform such tests. The KDB is available at <https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?switch=P&id=229297>.

<sup>146</sup> A list of FCC recognized accredited testing laboratories can be found at <https://apps.fcc.gov/oetcf/eas/reports/TestFirmSearch.cfm>. As of May 20, 2022, there are 569 FCC recognized accredited testing laboratories. A list of WinnForum-approved CBSD test labs can be found at <https://cbars.wirelessinnovation.org/cbsd-certification-program>.

<sup>147</sup> WinnForum submitted a preliminary draft into the AFC proposals docket. See *Wireless Innovation Forum Authorized AFC System Test Lab Requirements*, WinnForum, ET Docket 21-352, filed April 22, 2022. An updated version of WinnForum’s recommended approval process is available on the WinnForum website. *Forum Work Products*, Wireless Innovation Forum, <https://6ghz.wirelessinnovation.org/work-group-products> (last visited Oct. 28, 2022).

<sup>148</sup> *Id.* at 3.

<sup>149</sup> *Id.*

<sup>150</sup> *6 GHz Report and Order*, 35 FCC Rcd at 3870-71, para. 49.

lab testing. During this public trial each AFC system applicant will be required to make a website available for a specified period of time (e.g. 30 days) that provides an opportunity for members of the public to test the functionality of their AFC system.<sup>151</sup> The website will permit the ‘tester’ to specify information is provided to the AFC system such as the devices latitude, longitude, height above ground, and location uncertainty. The AFC system will then calculate the available 6 GHz band channels and maximum permissible power for each. The website will either display this information to the tester or the test system will send the information in an email to the tester. The website will also be required to have the capability for the tester to raise specific concerns about the available frequencies calculated and their associated maximum power levels. The AFC system applicant will then investigate the concerns and provide a response to the tester by email. Once the public trial is complete the AFC system applicant will submit a report to OET describing how they have addressed any concerns raised or explaining why those concerns do not require any action.

46. We will permit the AFC system applicants to either work together to jointly operate a public trial website as a single point of entry for testing multiple AFC systems or to operate individual websites. Providing a single website for multiple AFC systems would benefit the public by providing a means to test multiple AFC systems with identical coordinates at the same time making it easy to compare the outputs returned by the different AFC systems. However, we appreciate that requiring the AFC system applicants to jointly create a website could be complex and not all AFC systems may be complete and ready for testing in the same timeframe. Therefore, while we believe a single point of entry for testing all AFCs has many benefits for the public, we will not require such a system and permit each AFC system applicant the option of using a common website, if available, or setting up its own public trial website.

47. The public trial is intended to supplement the lab testing by providing additional test vectors to the AFC systems. Incumbent licensees can submit coordinates near their microwave receivers to verify that the AFC systems correctly implemented the propagation models and are providing appropriate protection.

48. In addition to a public trial demonstration project, OET is also considering requiring the AFC system applicants to conduct an integration test of the AFC systems. If required, this test would involve deploying standard-power devices in the field and verifying that they operate under the control of the AFC systems on the appropriate channels and at the specified power levels. For such testing to occur standard-power devices would need to be available, either after the devices are certified as required by the Commission’s rules or under experimental authority. Because the timeframe for device availability is not currently known, the timing of any required integration testing cannot currently be determined. However, we expect that such demonstration projects could be conducted at the same time as the public trial.

49. One possible model for integration testing is the Initial Commercial Deployment (ICD) required for the Spectrum Access Systems (SAS) that control spectrum access in the CBRS band (3550-3700 MHz).<sup>152</sup> The ICD testing was designed to complement SAS lab testing by providing a real-world environment to assess compliance with certain of the Commission’s rules as well as certain features of the SAS such as the device registration process, communication between the SAS and CBRS devices, interoperability between different SASs, utilization of information from Commission databases, and implementation of the relevant interference protection criteria.<sup>153</sup> Because the ICD plans were created by the individual SAS applicants, applicants had flexibility to determine where and when the test were

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<sup>151</sup> The WinnForum recently suggested requirements for public trials of the AFC systems. Our tentative plans for the public trial appear to be in close agreement with WinnForum’s suggestions. *Recommendations for AFC System Approval Process: Public Trial and Demonstration Project*, WinnForum, ET Docket 21-352, filed Sept. 2, 2022, at 9-12.

<sup>152</sup> *Wireless Telecommunications Bureau and Office of Engineering and Technology Establish Procedure and Deadline for Filing Spectrum Access System Initial Commercial Deployment Proposals*, Public Notice, GN Docket No. 53-319, 33 FCC Rcd 7390 (2018).

<sup>153</sup> *Id.* at 7392-3, para. 7.

conducted. As AFC systems are less complex than the SAS, any such testing, if required, will be simpler than the ICD testing—i.e. the testing will address a smaller set of functions.<sup>154</sup> We mention the SAS ICD testing to provide an example of one potential model that any required integration testing could follow and do not intend to imply that if we choose to require an integration test for the AFC systems that the testing will follow this exact process.

50. *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](mailto:Nicholas.Oros@fcc.gov).

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<sup>154</sup> For example, unlike the AFC systems the different SAS are required to communicate with each other. 47 CFR §§ 96.55(a)(2), 96.59(a), 96.63(i). In addition, the SAS have the capability to shut down devices at any time unlike the AFC systems. 47 CFR § 96.15(a)(4).