

From the UTC Public Policy Division

Re: FCC Issues Final Report and Order Authorizing Unlicensed Use of 6 GHz Band
Date: April 30, 2020

Summary. The FCC has issued its final Report and Order authorizing outdoor and indoor unlicensed operations in the 6 GHz band. Most of the final Report and Order is the same as the draft version that we reported previously, but there are some nuanced changes primarily with regard to the multi-stakeholder working group, as well as parts of the Further Notice of Proposed Rulemaking (FNPRM) with regard to mobile standard power operations and higher power standard power operations. As previously reported, the FCC is authorizing standard power access point for both outdoor and indoor operations and these operations will be controlled by automated frequency control (AFC). Indoor operations would be authorized to use the entire band and potential interference would be mitigated only by output power restrictions. As previously reported, the FCC is also considering authorizing very low power (VLP) unlicensed operations in the FNPRM, and perhaps more troubling it is also considering increasing the power for indoor operations without AFC as well as standard power access devices operating outdoors. The FCC is also inviting comment on how to account for use of directional antennas for standard power operations, as well as whether to authorize mobile operations as well as fixed standard power access systems.

Discussion. In the final Report and Order, the FCC authorizes outdoor and indoor operations at the following power levels, and as further described in detail below:

Table 3: 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)	36 dBm	23 dBm/MHz
Client Connected to Standard-Power Access Point	U-NII-7 (6.525-6.875 GHz)	30 dBm	17 dBm/MHz
Low-Power Access Point (indoor only)	U-NII-5 (5.925-6.425 GHz) U-NII-6 (6.425-6.525 GHz)	30 dBm	5 dBm/MHz
Client Connected to Low-Power Access Point	U-NII-7 (6.525-6.875 GHz) U-NII-8 (6.875-7.125 GHz)	24 dBm	-1 dBm/MHz

Standard Power Access Devices for Outdoor and Indoor Operations and AFC
General Rules of Operation

The final version of the Report and Order authorizes standard power outdoor and indoor unlicensed devices, which will be controlled by AFC. On the AFC issue, the FCC agreed with UTC and utilities that argued for a centralized approach, and found that that this is consistent with its approach with the TV Whitespace technology. It also agreed that it will provide better oversight by the FCC, as well as reduce design complexity of the AFC. The AFC will rely on data in the FCC's Universal Licensing System (ULS). The FCC will require that applicants for temporary fixed links submit the details of their operations (transmitter and receiver location, antenna height, antenna azimuth, antenna make and model, etc.) in the Universal Licensing System prior to transmission if they desire to be protected from potentially receiving harmful interference from standard-power access points in the U-NII-5 and U-NII-7 bands. The AFC will determine frequency and channel availability at the maximum permissible power of 36 dBm for standard-power access points, as well as at lower power levels in steps of no greater than 3 dB below the maximum 36 dBm permissible EIRP, down to a minimum level of 21 dBm for client devices.

Exceptions on Power Restrictions and for Transportable Devices

In the final version of the Report and Order, the FCC provided two exceptions to the general power restrictions for client devices. First, the FCC will allow a client device to operate at 36 dBm (i.e. the same power as access devices) provided that provided it complies with all of the requirements for access points, including using an AFC to obtain a list of available channels, having a geolocation capability and complying with the limit on upward antenna radiation from outdoor devices (no greater than 21 dBm at more than 30 degrees above the horizon). Second (and this was part of the draft Report and Order), the FCC will allow Wi-Fi extenders and mesh networking equipment intended (and other devices) to work in conjunction with an indoor access point and share the same propagation path and thus the same power requirement (i.e. full 5 dBm/MHz PSAD), provided that provided that they comply with all the requirements the FCC sets out for low power indoor access points (i.e., the device cannot be weather resistant, must have an integrated antenna and cannot have capability of connecting other antennas, cannot be capable of operating on battery power, and must include a label regarding proper usage) and the end unit obtains its own equipment certification.

The final version also provides for transportable access points, although the FCC generally prohibits the use of 6 GHz access points while in motion. These operations are defined as devices that “are not intended to be used in motion, but rather at stationary locations.” Transportable access points will have to otherwise comply with the rules the FCC adopted. That is, they will either operate under the control of an AFC system or they will have to operate only indoors. Indoor transportable access points will have to comply with all of the restrictions the FCC adopted to prevent outdoor use.

Geolocation Capability and ULS Data Access/Updating

Standard power access points will be required to include an internal geolocation capability to determine their geographic coordinates, rather than relying on a professional installer to determine them. These geolocation capabilities may not work where GPS is unavailable, so the FCC is allowing manufacturers to use external sources for the devices to obtain geolocation using wireless or cables to connect with the source of the geolocation coordinates. The FCC will also allow the standard power access point to determine its height above ground either

automatically by the device or manually by a professional installer. The interval for standard power access points to coordinate with the ULS will be on a daily basis, consistent with the timeframe that the ULS data is updated. If ULS goes down or the access point is otherwise unable to contact it, the FCC will permit the device to continue operating until 11:59 p.m. of the following day.

Multi-Stakeholder Working Group

The final version of the Report and Order expands upon the multi-stakeholder group provisions in the draft version. As previously reported, the FCC is creating an industry led multi-stakeholder group to study technical and operational issues in the 6 GHz Band, which will (as provided in the draft version) address such issues as interference detection and mitigation, AFC system and standard power access point security measures, AFC system testing and certification procedures and ensuring that AFC systems contain complete and up-to-date incumbent data.

However, the final version of the Report and Order expands the scope of the issues to include low power indoor operations. In addition, the final version also strongly suggests (but does not require) that the multi-stakeholder working group should be a newly formed entity (not an offshoot of an existing group) and focus solely on issues relevant to the 6 GHz band. Similarly, the FCC encourages (but does not require) representation by stakeholders comprising all sectors of the 6 GHz ecosystem, “including: wireless service providers with interest in providing service through standard-power and indoor low power devices, RLAN and network equipment manufacturers, potential AFC operators, fixed service vendors and operators, existing 6 GHz band incumbent licensees, ultrawideband equipment manufacturers, academic experts, testing organizations, and other 6 GHz band stakeholders.”

The final version of the Report and Order also suggests (but does not require) that the multi-stakeholder working group “address any issues it deems appropriate regarding interference detection and mitigation in the event that an incumbent licensee believes it may be experiencing harmful interference from standard-power or indoor low-power operations.” This includes procedures and processes for resolving interference complaints, which for example could let network operators of standard-power or indoor low-power operations decide to make points of contact publicly available or create a website to facilitate addressing concerns or for reporting complaints.

The FCC added that the multi-stakeholder working group should set a goal of creating a process through which the industry can effectively address and resolve interference claims without necessitating involvement of the Commission’s Enforcement Bureau. Finally, the final version of the Report and Order takes up the requests by several utilities and UTC for testing of LPI devices, and suggests (but does not require) that the multi-stakeholder working group should use the interim time period prior to commercial deployment of devices to “work cooperatively to develop and test devices to aid in the goal of developing processes for introducing and operating devices across the 6 GHz band.” In doing so, the FCC declined to adopt detailed timelines for testing, which Southern Company had suggested in its comments.

The final version of the Report and Order also suggests that the multi-stakeholder working group address tasks related to AFC system development for standard power access points, including

“any standards that are necessary for AFC operators, such as how to implement the required propagation models or whether common communications protocols are needed between standard power unlicensed devices and the AFC(s),” as well as “AFC system testing and certification procedures and processes for ensuring that AFC systems contain complete and up-to-date incumbent data.” In addition, the FCC suggests that the multi-stakeholder group should develop best practices and standards concerning standard-power operations (and use of the AFC system) and for indoor low-power operations, including “such concerns as device and communication link security.” In this context, the FCC stated that it views these activities as a starting point for any issues the multi-stakeholder working group deems appropriate to address.

With regard to FCC oversight, the final version of the Report and Order tasks the Commission’s Office of Engineering and Technology (OET) to act as a liaison to “observe the functioning” and the “technical concerns that it is considering to ensure that the group’s activities are useful and pertinent.” In this role, “OET will provide guidance to any such group on the topics on which it would be most helpful for the Commission to receive input and a sense of the time frames in which such input would be helpful.”

Authorization of AFC Operators

The FCC will designate entities to serve as AFC operators, and it will allow multiple AFC operators to serve in this capacity. AFC operators will be authorized for a five year term. The FCC will not require that these AFC systems synchronize data with each other. The FCC reasoned that there is no need for the AFC systems to share information about registered standard-power access points with each other because the FCC is not requiring AFC operators to consider aggregated interference.

AFC Parameters

The AFC system itself will rely on underlying assumptions about propagation analysis. On that point, the FCC determined that the AFC systems will use different models: specifically it will use a free-space model for short distances (separation distances of 30 meters or less); WINNER II for medium distances (urban, suburban, and rural environments), and irregular Terrain Model for longer distances (distances between 1 km and 2000 km). The interference protection criteria will be – 6 dB interference to noise power (I/N ratio), but the FCC expressly stated that it is not making a determination that any signal received with an I/N greater than -6 dB would constitute “harmful interference.” As noted above, the FCC will not consider aggregated interference from multiple access points to point-to-point microwave links. However, the FCC will include some adjacent channel protection in addition to co-channel protection when the AFC system is calculating its exclusion zone.

In terms of security, the FCC will require that AFC systems and standard-power access points employ protocols and procedures to ensure that all communications and interactions between the AFC and standard-power access points are accurate and secure and that unauthorized parties cannot access or alter the database or the list of available frequencies and power levels sent to an access point. Standard power outdoor devices will be required to register with the AFC system when requesting a list of available operating frequencies and power levels, which the FCC reasoned will provide another layer of protection by ensuring only authorized devices access the spectrum.

Low-Power Indoor Operations

General Rules

Indoor operations will be permitted to operate over the entire 6 GHz band without the need for AFC-controlled access. In order to reduce the potential for interference the FCC is requiring LPI operations to be (1) limited to indoor operation; (2) required to use a contention-based protocol; and (3) subject to low-power operation. Of these, the power levels are the main form of protection, and the FCC set the limit at a maximum radiated power spectral density of 5 dBm per 1 megahertz and an absolute maximum radiated channel power of 30 dBm for the maximum permitted 320-megahertz channel (or 27 dBm for a 160-megahertz channel). In addition, to ensure that client devices remain in close proximity to the indoor access points, the FCC limited their PSD and maximum transmit power to 6 dB below the power permitted for the access points.

The FCC concluded that these power limits (and other restrictions) will operate to protect fixed microwave systems from interference by unlicensed indoor operations. In making this determination, the FCC largely agreed with technical studies by unlicensed stakeholders and disagreed with studies by opponents, including the CII User study that was filed by UTC, EEI, NRECA and APPA, as well as the American Gas Association, the American Water Works Association, and the Nuclear Energy Institute. The FCC also disagreed with legal arguments that it lacks authority to allow unlicensed operations to share the 6 GHz band if there is a significant potential for interference. Moreover, it stated that “the technical and operational limits we are adopting in this proceeding ensure that unlicensed devices will not have a significant potential for causing harmful interference to the users authorized to operate in the 6 GHz band.”

Further Notice of Proposed Rulemaking

Very Low Power Operations

The FCC proposes to authorize very low power (VLP) operations; and second, it seeks comment on increasing the power spectral density EIRP for low-power indoor operations from 5 dBm/MHz up to 8 dBm/MHz. Specifically, it asks what the power level should be for VLP operations, and suggests a maximum 7 dBm EIRP (for a 160-megahertz channel). In addition, it proposes requiring VLP to integrate its antenna and it asks for comment on whether VLP should be required to use a contention-based protocol such as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

Increasing the Power for Low Power Indoor Operations

The FCC also proposes allowing LPI to use a higher power spectral density of 8 dBm/MHz with a maximum permissible EIRP of 33 dBm when a device uses a bandwidth of 320 megahertz in the U-NII-5 through U-NII-8 bands. For devices operating with bandwidths other than 320 megahertz, the maximum allowable total power would scale accordingly (e.g., 30 dBm with a bandwidth of 160 megahertz, 27 dBm with a bandwidth of 80 megahertz, 24 dBm with a bandwidth of 40 megahertz, and 21 dBm with a bandwidth of 20 megahertz). The FCC asks a number of related policy questions regarding increasing the power, and finally asks for comment on the benefits and costs of its proposal.

Allowing Mobile Standard Power Access Devices

The FCC is asking for comment on whether to allow standard-power access points, under AFC control, to be used in mobile applications under rules similar to those for personal/portable white space devices. Specifically, it asks whether it should allow mobile standard-power access point operation in the 6 GHz band, and if so, what technical requirements should apply, including whether it should adopt rules similar to those that apply to personal/portable white space device operations, and if so, which ones. In that context, the FCC stated that it believes that such devices would need an integrated geolocation capability and have an integrated connectorized antenna. It also asks for comment on the appropriate power levels for mobile standard-power access points, and whether the same power limits should apply for both mobile and fixed operations. On a related note, the FCC is asking for comment on the separation distances as well as the location data and the time interval for updated location data. Finally, it asks for comment on whether mobile operation should be permitted in both the U-NII-5 and U-NII-7 bands, as well as issue related to AFC control of these mobile operations and the detailed technical aspects of such operations, including the methods of protecting incumbent users from harmful interference.

Higher Power Limits and Antenna Directivity for Standard-Power Access Points

In the final version of the FNPRM, the FCC is inviting comment on whether to allow standard-power access points used in fixed point-to-point applications to operate at power levels greater than 36 dBm EIRP. The FCC stated that it believes that any flexibility provided for higher power should be used for targeted for applications that would benefit from point-to-point operations, such a backhaul and not for point-to-multipoint use or as a scheme for providing more wide area service through multiple antennas aimed to cover larger areas. In that context, it is asking whether it should replicate the U-NII-1 and U-NII-3 band requirement on such links that would exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

It also seeks comment on the appropriate technical parameters and limits that would be associated with 6 GHz point-to-point operation. Specifically, it asks about the power limits and whether there should be a limit on the maximum conducted transmitter power and whether there should be specific antenna requirements for standard-power access points operating at power levels above 36 dBm EIRP, such as a minimum gain or maximum beamwidth requirement.

Regarding unlicensed point-to-point applications in the 6 GHz band, the FCC also seeks comment on whether the AFC system should be permitted to take the directivity of a standard-power access point's antenna into account when determining the available frequencies and power levels at a location, rather than assuming an omnidirectional antenna. The FCC explained that the directional pattern of an access point's antenna could affect the identification of available frequencies at a location, because when the transmit antenna points away from a microwave receiver, the effect would be that the access point has a lower EIRP in the direction of the receiver. Under these conditions, the required separation distance between the access point and microwave receiver would be shorter, which could increase the number of locations where a device could operate. The FCC asks whether taking access point transmit antenna directivity into account would result in any significant increase in the amount of spectrum available to unlicensed devices. Finally, the FCC asks how it would assure the accuracy of antenna pattern and orientation information, and whether it should require installation of

directional antennas by a professional installer. Similarly, it asks about AFC and whether the location information would be accurate, including antenna gain information.

Conclusions and Next Steps

The Commission adopted the final Report and Order during its April Open Commission Meeting on April 23, 2020 and released it publicly on April 24, 2020. UTC will continue to engage with the FCC to provide further information for the record regarding the significant interference potential to utility mission critical microwave systems in the 6 GHz band.

One of the improvements in the final Report and Order is that the multi-stakeholder working group may take up testing of LPI devices, prior to commercial deployment; and that the group may include representatives from incumbents. UTC will be participating in the multi-stakeholder working group and encourages members to provide input into those meetings. UTC has formed its own 6 GHz working group to facilitate technical input into the multi-stakeholder working group, and members are encouraged to participate.

That said, UTC remains concerned that LPI operations without AFC will cause interference to utility microwave systems, even when power is reduced to 5 dBm/MHz PSD, and it is even more concerned that the FCC appears inclined to increase the power to 8 dBm/MHz PSD for LPI, as well as for standard power access systems, as proposed in the FNPRM. It is also concerned that VLP and mobile standard power operations proposed in the FNPRM will cause interference that will be difficult to trace, even if it is controlled by AFC.

UTC will be providing comments in response to the FNPRM and invites member input. Comments will be due 30 days after the FNPRM is published in the Federal Register and reply comments will be due 60 days after the FNPRM is published in the Federal Register.