

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Unlicensed Use of the 6 GHz Band)	ET Docket No. 18-295
)	
Expanding Flexible Use in Mid-Band)	GN Docket No. 17-183
Spectrum Between 3.7 and 24 GHz)	

**REPLY COMMENTS OF
NCTA – THE INTERNET & TELEVISION ASSOCIATION**

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INTRODUCTION AND SUMMARY

NCTA – The Internet & Television Association (NCTA) continues to support making the 6 GHz band available for unlicensed use,¹ as long as incumbent C-Band Fixed Satellite Services (FSS) uplinks (C-Band uplinks), Broadcast Auxiliary Services (BAS), and Low Power Auxiliary Stations (LPAS) can be fully protected and assured ongoing availability and capacity to meet future demand.

Commenters agree that protecting incumbents is critically important in intensively utilized spectrum, and that rules to facilitate new unlicensed uses must be carefully crafted.² Commenters also agree that the proximity of the 6 GHz band to the existing 5 GHz Unlicensed National Information Infrastructure (U-NII) bands creates the potential for meaningful

¹ *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, ET Docket No. 18-295, GN Docket No. 17-183, FCC 18-147 (rel. Oct. 24, 2018) (*Notice*).

² *See, e.g.*, NCTA Comments at 2-3; Qualcomm Comments at 6-8; Wireless Innovation Forum Comments at 2; Comments of Apple, Broadcom, Cisco Systems, Facebook, Google, HP Enterprise, Intel, Marvell Semiconductor, Microsoft, Qualcomm, and Ruckus Networks at 1-2 (RLAN Group Comments); FWCC Comments at 1-3. Unless otherwise noted, all citations to comments refer to comments filed on or around February 15, 2019, in ET Docket No. 18-295 and GN Docket No. 17-183.

efficiencies in equipment manufacturing and deployment.³ Therefore, where doing so is possible while protecting incumbents, the Commission should seek to harmonize new rules for unlicensed use with existing technology-neutral U-NII rules that have supported robust real-world deployments and consumer needs.

Consistent with NCTA's initial comments, and with support in the record from numerous other commenters, the Commission should adopt its proposals to:

- Permit standard-power access point (AP) operation in the 5.925-6.425 GHz (U-NII-5) and 6.525-6.875 GHz (U-NII-7) sub-bands indoors or outdoors, on frequencies determined by an Automated Frequency Coordination (AFC) system, and using power levels permitted for unlicensed use in the U-NII-1 and U-NII-3 bands;⁴ and
- Permit indoor, low-power AP operation in the 6.425-6.525 GHz (U-NII-6) and 6.875-7.125 GHz (U-NII-8) sub-bands using the lower power levels applicable to operations in the U-NII-2 band, so long as those operations do not cause harmful interference to incumbent users.⁵

The Commission should also:

- Adopt higher power limits than proposed for client devices across the 6 GHz band;⁶ and
- Permit indoor, low-power AP operations without AFC in the U-NII-5 and U-NII-7 bands.⁷

Finally, while enabling standard-power operations with AFC in some portion of the U-NII-8 sub-band, as some commenters suggest, could allow for even more intensive unlicensed use of the 6 GHz band,⁸ the record remains relatively undeveloped on that issue. The

³ See, e.g., NCTA Comments at 9; Microsoft Comments at 4; Cisco Comments at 9-10; Wi-Fi Alliance Comments at 8-9; RLAN Group Comments at 2.

⁴ Notice ¶ 20.

⁵ *Id.*

⁶ *Id.* ¶ 78.

⁷ *Id.* ¶ 73.

⁸ See *id.* ¶¶ 74-75.

Commission should take this further step only if a more robust record clearly demonstrates that incumbent BAS operations would not be disrupted.

I. COMMENTERS RECOGNIZE THE IMPORTANCE OF INCUMBENT 6 GHz OPERATIONS, PARTICULARLY FSS AND BAS, AS WELL AS THE PROMISE OF NEW UNLICENSED OPPORTUNITIES IN THIS BAND.

NCTA and many other commenters support the Commission's proposal to adopt carefully crafted rules to enable robust unlicensed use while not disrupting incumbent operations. There is no dispute in this proceeding about the importance of protecting incumbents. Contrary to the suggestions of some commenters,⁹ neither the Commission nor commenters supporting unlicensed use of the band argue that the Commission should adopt rules to permit unlicensed use without regard to the consequences for existing services. The Commission and commenters agree about the need to protect the video industry's use of C-Band uplink for video distribution,¹⁰ use of BAS for electronic news gathering and other purposes,¹¹ use of LPAS for wireless microphones,¹² and use of Fixed Services (FS) for public safety, critical infrastructure, backhaul, and other purposes.¹³ The central issue is how best to coordinate new and existing services to avoid harmful interference.

The record also confirms that it is important to increase the amount of unlicensed spectrum available to support demand for services already in heavy use by consumers, as well as

⁹ See, e.g., Joint Comments of Los Angeles County, California; City and County of Denver, Colorado; City of Kansas City, Missouri; Ozaukee County, Wisconsin; San Bernardino County, California; Regional Wireless Cooperative; and Government Wireless Technology & Communications Association at 6-7 (Joint Local Government Comments).

¹⁰ See, e.g., NCTA Comments at 4-5; Intelsat/SES Comments at 1-2.

¹¹ See, e.g., NCTA Comments at 5; NAB Comments at 1.

¹² See, e.g., NCTA Comments at 5-6.

¹³ See, e.g., Motorola Comments at 1-2; APCO International Comments at 1-2.

innovative new and emerging services.¹⁴ Commenters agree with the *Notice*'s judgment that the 6 GHz sub-bands are uniquely well-suited to this purpose due to their proximity to the existing U-NII bands and the efficiency and speed with which unlicensed equipment compatible with this expanded set of frequencies could be brought to market.¹⁵

A small subset of commenters from the mobile wireless industry ask the Commission to adopt a *Further Notice* proposing to allocate a portion of the 6 GHz band for exclusive licensed use.¹⁶ But the Commission already sought and received extensive comments on that issue two years ago;¹⁷ and it determined, after careful consideration, that unlicensed use is the best way to maximize the use of the band.¹⁸ The Commission should decline to revisit that issue, and instead proceed with its efforts to permit unlicensed use of the 6 GHz band while fully protecting incumbent services.¹⁹

¹⁴ See, e.g., NCTA Comments at 6-9; Charter Comments at 1-2; Wi-Fi Alliance Comments at 5-7; RLAN Group Comments at 7-10.

¹⁵ *Notice* ¶¶ 11, 19; see, e.g., Public Interest Organizations Comments at 21; Microsoft Comments at 4; Cisco Comments at 9-10; RLAN Group Comments at 2; see also Charter Comments at 2 (opining that, although the 5.9 GHz band is the “best near-term unlicensed spectrum opportunity,” the 6 GHz band “is not far behind”).

¹⁶ Ericsson Comments at 5-13; CTIA Comments at 4-10.

¹⁷ See *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd. 6373 ¶ 36 (2017).

¹⁸ See *Notice* ¶¶ 16-19.

¹⁹ See CTIA Comments at 10-13 (noting that numerous incumbent 6 GHz services could not coexist with exclusive licensed uses and therefore would have to be relocated and reimbursed for their relocation expenses).

II. CAREFULLY CRAFTED TECHNICAL RULES WILL FACILITATE COEXISTENCE BETWEEN INCUMBENT AND UNLICENSED USES.

A. Commenters Generally Support the Proposed Technical Framework for U-NII-5 and U-NII-7 Operations While Suggesting Modest Changes.

A wide array of commenters support the Commission's proposed technical framework to permit unlicensed use of the U-NII-5 and U-NII-7 sub-bands, including the use of standard-power APs either indoors or outdoors under AFC control.²⁰ No one denies the important nature of incumbent uses of these sub-bands. But the record confirms that these uses should not preclude the Commission from conscientiously enabling new ones within the general parameters it has proposed, with minor modifications consistent with the recommendations below.

Power Limits. Commenters agree that the Commission should adopt the proven U-NII-1 and U-NII-3 power limits for APs in the U-NII-5 and U-NII-7 sub-bands.²¹ To help facilitate deployment in rural and underserved areas, the record also supports the adoption of higher power limits in such areas, particularly for P2P and P2MP systems.²²

To address potential aggregate interference to C-Band uplinks, both immediately and in the longer term, the Commission also should adopt a restriction similar to the one in place for the U-NII-1 band, limiting power levels for unlicensed antennas in standard-power, outdoor

²⁰ See, e.g., HP Enterprise Comments at 7; Qualcomm Comments at 8-9; Verizon Comments at 3-4; WISPA Comments at 2; Public Interest Organizations Comments at 2-3; Intelsat/SES Comments at 12.

²¹ Notice ¶¶ 22, 78-79; see NCTA Comments at 10; Wi-Fi Alliance Comments at 32; RLAN Group Comments at 68-69.

²² See NCTA Comments at 10; Midcontinent Communications Comments at 12; Wi-Fi Alliance Comments at 32-33; RLAN Group Comments at 69-70; Facebook Comments at 8-9; Dynamic Spectrum Alliance Comments at 15-16.

operations where elevation angles exceed 30 degrees.²³ The Commission should not, however, adopt an absolute limitation on aggregate power at this time, contrary to what some commenters argue.²⁴

Out-of-Band Emissions. The Commission should adopt the U-NII-3 mask for out-of-band emissions (OOBE) in the U-NII-5 and U-NII-7 sub-bands, as this mask has helped make the U-NII-3 band the most widely utilized 5 GHz unlicensed band.²⁵ By contrast, the OOBE limit proposed in the *Notice* would reduce the utility of the band by forcing a transmit power reduction for the wide channel bandwidths employed in the 802.11ax standard and anticipated in the next generation of the 802.11 standard. If the Commission declines to adopt a higher limit than proposed, it should adopt the proposal in the *Notice*,²⁶ rather than overly restrict new unlicensed uses by adopting an even more conservative mask, as some have suggested.²⁷ NCTA also agrees with commenters supporting the Commission's proposal to adopt OOBE limits only at the lower edge of the U-NII-5 band and the upper edge of the U-NII-8 band, as long as incumbents are protected from harmful interference.²⁸ Band-edge limits would enable unlicensed users to utilize channels that span boundaries between sub-bands, thus increasing efficiency, performance, and capacity.

²³ See *Notice* ¶ 55; 47 C.F.R. § 15.407(a)(1); NCTA Comments at 10; see also Sirius XM Comments at 19-20 (recommending restricting U-NII-5 devices from pointing toward the geostationary arc to limit aggregate interference to satellite operations).

²⁴ Intelsat/SES Comments at 5-8.

²⁵ See 47 C.F.R. § 15.407(b)(4)(i); NCTA Comments at 11.

²⁶ *Notice* ¶ 82 & n.169 (proposing the adoption of OOBE limits consistent with rules governing the U-NII-1 and U-NII-2 bands).

²⁷ 5G Automotive Association Comments at 5-6.

²⁸ Wi-Fi Alliance Comments at 38-39. This approach would be consistent with the Commission's decision in an analogous context to not require OOBE limits between the U-NII-1 and U-NII-2A sub-bands. See 47 C.F.R. § 15.407(b)(1)-(2).

Automated Frequency Coordination. Many commenters agree that an AFC system would adequately protect incumbent FS operations in the U-NII-5 and U-NII-7 sub-bands while still enabling robust unlicensed use, but commenters diverge as to how the AFC concept should be implemented.²⁹ The wide variety of specific proposals is evidence that adopting prescriptive rules could limit the development of innovative solutions.³⁰ Modest, flexible, and performance-based rules will maximize the 6 GHz band's potential. Accordingly, NCTA agrees with commenters urging the Commission to adopt light-touch AFC regulations that focus on the AFC's baseline responsibility to protect incumbents by identifying permissible frequencies on which APs may operate at a given location.³¹

Consistent with such a framework, and in order to ensure that important incumbent C-Band uplink operations are protected, the AFC system should include information that allows for the creation of interference profiles for registered FSS earth stations.³² As NCTA explained in its comments, the threat of direct interference to C-Band uplinks from newly authorized terrestrial operations in the 6 GHz band is significantly less than the threat to C-Band downlinks

²⁹ Compare Comsearch Comments at 15-28 (proposing detailed rules governing AFC operation, including "kill-switch" authority, a requirement that all devices communicate with all AFCs, mandatory recording of frequencies in use by each access point, and required use of parameters agreed to by a multistakeholder group), with Apple Comments at 12-17 (opposing a requirement that all AFCs be able to communicate with all devices and arguing that AFCs should not be required to interoperate with one another, that they should not record frequency-in-use data for devices, and that the rules should not specify whether the AFC is centralized or decentralized), and Ericsson Comments at 20-22 (arguing that the AFC should exercise "positive control" over AP frequency utilization).

³⁰ See Wi-Fi Alliance Comments at 20-21.

³¹ See, e.g., *id.*; Broadcom Comments at 40-41; RLAN Group Comments at 40; Microsoft Comments at 17-18; Facebook Comments at 2-3, 9; Apple Comments at 12-13; HP Enterprise Comments at 22-23.

³² See NCTA Comments at 12. NCTA agrees with Intelsat and SES that AFC operators should be required to collect the relevant information for this purpose from the Commission's International Bureau Filing System (IBFS). Intelsat/SES Comments at 13-14.

from proposed new uses of the 3.7-4.2 GHz band.³³ But that does not mean that the threat to 6 GHz C-Band uplinks is nonexistent or that protective measures are not necessary to mitigate the risk of unlicensed transmissions interfering with the delivery of news, sports, and entertainment programming to hundreds of millions of Americans.³⁴

Access Point Height. Commenters point out that an absolute limit on antenna height would unduly restrict deployments, particularly for fixed operations serving rural areas.³⁵ The record further shows that absolute height restrictions are not necessary given AFC protection of FS operations.³⁶ Rather than attempt to fashion a one-size-fits-all maximum height rule for all deployments, the Commission should instead allow the AFC to consider actual height as it specifies permissible channels for operation.

Relatedly, a wide variety of commenters support the use of three-dimensional exclusion zones based on actual antenna heights, rather than two-dimensional exclusion zones that rely on

³³ Compare Notice ¶ 24, with NCTA Comments at 12; see, e.g., Comments of Comcast Corporation and NBCUniversal Media, LLC, GN Docket Nos. 18-122 & 17-183, at 14-23 (Oct. 29, 2018).

³⁴ See NCTA Comments at 12 (describing how unlicensed operations in close proximity to earth stations could directly interfere with C-Band uplinks, causing anomalies and/or outages). Although the need to protect C-Band uplinks from direct interference from unlicensed operations attracted little attention from commenters, NCTA continues to believe that the risk of such interference remains an important issue that must be adequately addressed.

³⁵ See, e.g., NCTA Comments at 12-13; WISPA Comments at 22-23; see also Midcontinent Communications Comments at 3-8 (demonstrating how the proposed 30-meter limit would constrain such deployments, and showing that increasing the limit to 65 meters could increase fixed coverage by more than 40 percent, with even greater gains should the limit be increased further).

³⁶ NCTA Comments at 12-13; WISPA Comments at 22-23; Microsoft Comments at 19; HP Enterprise Comments at 24-25; Wi-Fi Alliance Comments at 25-26.

typical or assumed heights.³⁷ A three-dimensional approach would better protect incumbents based on the parameters of their actual deployments, while also maximizing unlicensed use of the U-NII-5 and U-NII-7 sub-bands.

Professional Installation. As the *Notice* recognizes, professional installation is one means by which antenna heights could be ascertained.³⁸ But the record indicates that requiring professional installation could be so burdensome that it “would eliminate any meaningful consumer market for these devices.”³⁹ Instead, professional installation should be viewed as one of a variety of methods for the AFC to obtain accurate height information.⁴⁰ Where professional installation is not used, height can be determined with some degree of accuracy by GPS, and the AFC can factor any uncertainty in GPS-based height information into its calculations.⁴¹

If the Commission does adopt a professional installation requirement, it should exempt indoor installations. As the RLAN Group notes, professional installation requirements for indoor equipment “would be radically inconsistent with consumers’ expectations for these types of devices.”⁴² Building attenuation substantially reduces the risk of harmful interference from

³⁷ See, e.g., APCO International Comments at 13-14; Motorola Comments at 4; FWCC Comments at 29-30; RLAN Group Comments at 55-58; Dynamic Spectrum Alliance Comments at 13-14.

³⁸ *Notice* ¶ 52; see also Public Interest Organizations Comments at 21-22 (arguing that the use of AFC that determines heights through professional installation would obviate the need to limit high-power operations or ban P2MP deployments).

³⁹ RLAN Group Comments at 54; see also NCTA Comments at 13-14.

⁴⁰ See FWCC Comments 29-30 (stating that “elevation can be assessed *either* through GPS *or* by professional installation”) (emphasis added).

⁴¹ See RLAN Group Comments at 53-54; Microsoft Comments at 19; HP Enterprise Comments at 24-25; see also *Notice* at ¶52 (noting that GPS provides more precise horizontal accuracy than vertical accuracy).

⁴² RLAN Group Comments at 32-33; see also Microsoft Comments at 19; Wi-Fi Alliance Comments at 19. For the same reason, professional installation should not be required for

indoor uses,⁴³ and hindering deployment scenarios that are commonplace today would be contrary to the public interest.

Transmission of Identifying Information. The record supports NCTA's position that the Commission should not require APs or client devices to transmit digital identifying information.⁴⁴ Commenters point out that interference risks must be addressed by adopting the right rules *ex ante*, and that reliance on *post hoc* interference resolution procedures is not feasible, as recognized in this and other proceedings.⁴⁵ Even parties advocating for the maximum level of protection for incumbent FS uses admit that the transmission of identifiers to the AFC would be of no practical benefit unless the identifying information ties each device to its specific user,⁴⁶ and the record suggests that such measures would jeopardize consumer privacy,⁴⁷ impose substantial burdens on providers,⁴⁸ and limit the utility of the band.⁴⁹

outdoor installations below a height of six meters, to enable non-professional installation in residential settings, such as patios or decks. NCTA Comments at 13 n.48.

⁴³ See Notice ¶ 70; Leading Builders of America Comments at 2-14, App. A; RLAN Group Comments at 23-24, App. E; Wi-Fi Alliance Comments at 12-13.

⁴⁴ Notice ¶¶ 87-88; see NCTA Comments at 14; WISPA Comments at 25; Broadcom Comments at 41-43; Apple Comments at 13-17; RLAN Group Comments at 64-66; Wi-Fi Alliance Comments at 30.

⁴⁵ Broadcom Comments at 41-43 (noting that “both incumbent FS operators and prospective RLAN operators have considered transmit identifiers but have dismissed the concept as unworkable”); WISPA Comments at 25 (noting that the Commission did not require the transmission of identifying information for the 5 GHz U-NII bands); see also Notice ¶ 87.

⁴⁶ Joint Local Government Comments at 7.

⁴⁷ See City of Los Angeles, California Comments at 13-14; RLAN Group Comments at 64-66; NCTA Comments at 14; Apple Comments at 14-15.

⁴⁸ See NCTA Comments at 14 (explaining that device-specific identification requirements would greatly complicate inventory management without corresponding benefits).

⁴⁹ See Apple Comments at 14 (noting that requiring the use of persistent unique hardware identifiers would negate the possibility of decentralized AFCs, thus significantly reducing industry flexibility to optimize business models and use cases).

Technology-Neutral Rules. The Commission should adopt technology-neutral rules across the 6 GHz band and reject calls to implement rules designed to favor a particular technology.⁵⁰ Qualcomm purports to agree, but its vision of a “technology-neutral” framework includes restrictive coexistence rules that would “prefer[]” and “give precedence to” certain technologies.⁵¹ The Commission should reject that approach. Bona fide technology-neutral rules have enabled other unlicensed bands to support a plethora of different unlicensed uses, and the Commission should continue to “rel[y] on [standards] bodies – not prescriptive regulations – to drive innovative uses of spectrum and new technologies.”⁵²

B. Low-Power Indoor Use Across the Band Without AFC Would Deliver Tremendous Benefits, Although Incumbent Protection Concerns Remain.

There is strong support in the record for enabling low-power, indoor (LPI) use throughout all four 6 GHz sub-bands without AFC.⁵³ The benefits of LPI use across the band are clear, yet they must be weighed against the potential for harmful interference to incumbent services, including indoor and outdoor BAS operations in the U-NII-6 and U-NII-8 sub-bands. The Commission and other commenters suggest that interference could be mitigated, consistent with current BAS coordination practices.

⁵⁰ See CTIA Comments at 21-22; Ericsson Comments at 22-23; Verizon Comments at 11-12; Wi-Fi Alliance Comments at 26-28.

⁵¹ See Qualcomm Comments at 21-23 (suggesting preferential treatment for “synchronized operations,” including 5G NR-U, in the U-NII-7 band); Letter from John W. Kuzin, Vice President and Regulatory Counsel, Qualcomm, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 18-295 et al., at 1 (Mar. 8, 2019) (same).

⁵² CTIA Comments at 22 (noting that “the Commission rejected adding spectrum etiquette regulations to the 2.4 GHz and 5.8 GHz bands” in 2014, and arguing that “the success of unlicensed services is directly related to the technology-neutral approach the Commission follows in its Part 15 rules”).

⁵³ See Charter Comments at 3; RLAN Group Comments at 33-35; Broadcom Comments at 25-27; Cisco Comments at 9-13; HP Enterprise Comments at 8-12; NCTA Comments at 15-16.

With respect to outdoor BAS operations, which comprise the majority of BAS operations, the *Notice* recognized that limiting unlicensed operations to indoor use will significantly attenuate signals and protect BAS signals.⁵⁴ Furthermore, Leading Builders of America states that the International Telecommunications Union (ITU) models on which the Commission’s proposal was based significantly understate the attenuation provided by modern building materials that are required in many jurisdictions.⁵⁵

The record also shows that enabling LPI use in the U-NII-5 and U-NII-7 sub-bands without AFC is unlikely to cause harmful interference to incumbent FS operations. HP Enterprise explains that, in order to cause interference to an FS link, an LPI access point “would have to win the ‘interference lottery’ by somehow falling into four different and unlikely corner-case situations simultaneously.”⁵⁶ The RLAN Group also notes that the RKF Study demonstrated that even standard-power, outdoor unlicensed operations (without AFC) would result in interference to less than 0.2 percent of FS links.⁵⁷ Broadcom further argues that, when taking into account key mitigating characteristics of LPI use that the RKF Study did not consider – namely, network geometry, building attenuation, antenna direction and polarization, and channel selection – interference is even less likely.⁵⁸

⁵⁴ *Notice* ¶¶ 69-70.

⁵⁵ See Leading Builders of America Comments at 2-14, App. A; RLAN Group Comments at 23-24, App. E; Wi-Fi Alliance Comments at 12-13.

⁵⁶ HP Enterprise Comments at 12-16; see also Letter from Alex Royblat, Senior Director of Regulatory Affairs, Wi-Fi Alliance, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 18-295, GN Docket No. 17-183, Attachment at 2 (Mar. 4, 2019) (arguing that this “[e]xtreme corner case is not a sound foundation for spectrum management policy”).

⁵⁷ RLAN Group Comments at 19.

⁵⁸ Broadcom Comments at 6-21; see also *id.* at 21 (describing a study of RLAN-to-FS interference in the 6 GHz band in the United Kingdom, which “showed that there is only a 1 in 100 million probability that an unconstrained RLAN would meet or exceed -10 I/N at an

Commenters observe that allowing LPI use without AFC in only the U-NII-6 and U-NII-8 sub-bands would result in a “checkerboard approach” that would “substantially undermine the overall value of the band,”⁵⁹ noting that equipment with AFC functionality will take longer to develop, whereas LPI equipment without AFC can be developed and deployed very quickly.⁶⁰ Indeed, the proposed “checkerboard approach” would enable the near-term use of only *one* new 160-megahertz-wide channel (the channel bandwidth required to fully support the next-generation 802.11ax – or “Wi-Fi 6” – standard) for LPI use, whereas allowing such use without AFC throughout the band would make available up to *seven* new 160-megahertz channels.⁶¹ As Cisco notes, adding only one new 160-megahertz channel would be inadequate to meet demand even for today’s devices, do nothing to prepare the country for the anticipated growth in unlicensed use over the next few years, and “severely reduce incentives for manufacturers to design access points and client devices.”⁶²

Some commenters opposing LPI use argue that there is no way to preclude the outdoor use of LPI equipment.⁶³ However, as NCTA has noted, the challenges of enforcing indoor-only requirements have been overcome in the past.⁶⁴ Parties suggest a multitude of potential solutions

FS receiver 2 percent of the time in the UK – 10 times less than the long-term interference protection criteria requirement assumed for that study”).

⁵⁹ RLAN Group Comments at 33.

⁶⁰ Broadcom Comments at 26-27; Cisco Comments at 10-11; HP Enterprise Comments at 11.

⁶¹ Broadcom Comments at 27; Cisco Comments at 11; RLAN Group Comments at 33-34; Charter Comments at 3-4.

⁶² Cisco Comments at 11.

⁶³ *See, e.g.*, NAB Comments at 12; APCO International Comments at 15-16; Motorola Comments at 6; Southern Company Comments at 17-18.

⁶⁴ NCTA Comments at 15.

to ensure indoor-only use, including prohibiting connectorized antennas;⁶⁵ requiring physical or electronic indoor-only labels;⁶⁶ prohibiting weatherproofing features;⁶⁷ requiring a direct connection to main power;⁶⁸ requiring open-air vents on top-casings;⁶⁹ and requiring a beacon or geofencing system.⁷⁰ While NCTA does not endorse any particular solution proposed, the variety of options presented supports NCTA's position that the Commission should provide industry with maximum flexibility to develop indoor-only solutions and leverage the equipment authorization process to ensure compliance.⁷¹

C. The Record Supports Higher Power Limits for Client Devices.

Multiple commenters agree that the device power limits proposed in the *Notice* are overly conservative and can be increased to allow power spectral densities up to 21 dBm/MHz for devices without AFC and 27 dBm/MHz for devices with AFC.⁷² These changes would facilitate full use of some of the most meaningful innovations associated with the new Wi-Fi 6 standard, including orthogonal frequency-division multiple access (OFDMA).⁷³ The record also supports

⁶⁵ HP Enterprise Comments at 21; Sirius XM Comments at 16-17; RLAN Group Comments at 31-32.

⁶⁶ Apple Comments at 17-19; RLAN Group Comments at 32; Sony Comments at 9-10; Wi-Fi Alliance Comments at 19.

⁶⁷ Sirius XM Comments at 16.

⁶⁸ HP Enterprise Comments at 21; RLAN Group Comments at 32; Wi-Fi Alliance Comments at 18-19.

⁶⁹ Boeing Company Comments at 7.

⁷⁰ NAB Comments at 18.

⁷¹ NCTA Comments at 15.

⁷² *Notice* ¶¶ 78-79; *see* NCTA Comments at 16-17; Charter Comments at 3-4; Broadcom Comments at 34-36; RLAN Group Comments at 17, 68-69.

⁷³ NCTA Comments at 16-17 & n.57; Broadcom Comments at 34; RLAN Group Comments at 68-69.

increasing the maximum conducted power for all devices to at least 250 mW,⁷⁴ and more generally ensuring that LPI devices are permitted to operate at the same power level as their associated APs, in order to avoid uplink-downlink disparities that would reduce coverage areas for any applications requiring two-way communication.⁷⁵ These power limits remain low enough for building attenuation to effectively limit the potential for indoor uses to cause harmful interference to incumbents, and AFC management of APs will ensure that outdoor operations at these levels do not cause harmful interference.

D. Making Additional U-NII-8 Spectrum Available for AFC-Coordinated Use Merits Further Consideration If Additional Record Support Shows that Incumbents Will Be Protected.

Some commenters support permitting standard-power unlicensed use with AFC in the U-NII-8 sub-band in the lower 100 megahertz nationwide and/or in geographic areas where certain incumbent uses are not authorized to operate in the band, including, but not limited to the lower 100 megahertz.⁷⁶ If incumbents can be fully protected, enabling such use would be beneficial for unlicensed operations, particularly because it would make available an additional 160-megahertz channel.⁷⁷ However, the record does not contain enough information at this time for the Commission to adopt this proposal. The Commission should consider adopting this proposal only if a more robust record indicates that incumbent operations will not be disrupted.

⁷⁴ NCTA Comments at 17; Charter Comments at 3-4; Microsoft Comments at 11-13.

⁷⁵ NCTA Comments at 17; Broadcom Comments at 36-37; Facebook Comments at 2, 5; GE Healthcare Comments at 7; Microsoft Comments at 11-13; RLAN Group Comments at 17-18, 49; Wi-Fi Alliance Comments at 33.

⁷⁶ Broadcom Comments at 37-38; WISPA Comments at 26; Public Interest Organizations Comments at 29-30; CompTIA Comments at 2; GE Healthcare Comments at 7; Microsoft Comments at 14-15; RLAN Group Comments at 39-40, 46-47; Wi-Fi Alliance Comments at 33; *see also Notice* ¶¶ 74-75.

⁷⁷ RLAN Group Comments at 39-40.

CONCLUSION

Support is widespread for the Commission's proposal to permit unlicensed use across the 6 GHz band to support wireless innovation, narrow the digital divide, and alleviate congestion in existing unlicensed bands. There is also universal recognition that incumbent users of 6 GHz spectrum including C-Band uplinks, BAS, wireless microphones, and FS must be protected from harmful interference. NCTA therefore urges the Commission to move expeditiously, but carefully, to adopt new rules to enable and encourage unlicensed use of the 6 GHz band, while also protecting those important incumbent uses.

Respectfully submitted,

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