

**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 Spectrum Between 3.7 and 24 GHz)	GN Docket No. 17-183
)	

REPLY COMMENTS OF CTIA

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CTIA respectfully submits these reply comments in response to the *Notice of Proposed Rulemaking* (“Notice”) released by the Federal Communications Commission (“Commission”) seeking to promote new opportunities in the 5.925-7.125 GHz (“6 GHz”) band.¹

I. INTRODUCTION AND SUMMARY.

A review of the initial comments demonstrates support for varying uses of the 6 GHz band – for existing services with vital incumbent operations and for innovative future services, both unlicensed *and* licensed. The record shows that with a balanced, reasoned approach, the Commission can achieve multiple goals in this proceeding: protecting incumbent operations; devising a rigorous regime that will enable new unlicensed opportunities; and repurposing spectrum for exclusive use, flexible rights licensed stakeholders. These reply comments focus on key issues in the record.

First, several commenters emphasized the critical role mid-band spectrum will play in realizing the promise of 5G. The Commission must act quickly to ensure that the amount of licensed mid-band spectrum made available is sufficient to enable the U.S. to lead the world in

¹ *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Proposed Rulemaking, 33 FCC Rcd 10496 (2018) (“Notice”).

the deployment of next-generation services. Pursuant to this goal, the Commission should promptly issue a Further Notice of Proposed Rulemaking to consider designating the upper portion of the 6 GHz band for licensed, flexible use. The FCC should also work with the National Telecommunications and Information Administration (“NTIA”) to add a non-federal allocation to a portion of the 7.125-8.5 GHz band to expand opportunities to relocate incumbent licensees from the 6 GHz band and enhance the efficient use of spectrum in the 7.125-8.5 GHz band. Making the upper portion of the 6 GHz band available for licensed, flexible use can be done while accommodating or protecting incumbent licensed services and creating new opportunities for unlicensed operations.

Second, CTIA and other commenters agree that unlicensed spectrum is an important element of the wireless broadband experience, but the Commission can use this proceeding to provide a better balance between licensed and unlicensed spectrum. Today, the Unlicensed National Information Infrastructure (“U-NII”) bands already offer 580 megahertz of mid-band spectrum for unlicensed use. The 3.5 GHz band will provide an additional 80 megahertz of spectrum dedicated to General Authorized Access use and opportunistic sharing of the full 150 megahertz of the Citizens Broadband Radio Service band, including spectrum assigned as Priority Access Licenses (“PALs”). Yet today, there is no licensed, flexible use mid-band spectrum available above 3 GHz. As such, CTIA believes there is no basis to designate the full 1.2 gigahertz of 6 GHz spectrum to unlicensed use. In light of evidence that substantial swaths of unlicensed spectrum lie nearly vacant, the Commission should adopt a balanced approach to the 6 GHz band, including a spectrum sharing regime for unlicensed operations in the lower portion of the 6 GHz band and a framework for licensed, flexible use services in the upper 6 GHz band.

Third, the Commission should move ahead with a 6 GHz spectrum sharing regime provided it implements a rigorous interference protection framework that safeguards incumbent licensed service operations. Unlicensed stakeholders must accept that the burdens of protecting incumbent operations rest on them. To that end, the Commission should adopt the proposed automated frequency control (“AFC”) system, subject to the modifications discussed herein. The Commission should certify AFC providers in a systematic manner to ensure accountability and robust protection of incumbent operations; require the AFC to use data contained within the Commission’s Universal Licensing System (“ULS”) and also to verify the information using a third-party database; adopt robust security requirements to ensure operations comply with the AFC; and most critically, ensure the protection of incumbent licensed operations by requiring that the AFC apply to all access points – whether located outdoors or indoors, and no matter the power level. Doing so will ensure that incumbent operations are given adequate protection against unacceptable interference.

CTIA commends the Commission for moving ahead in making additional mid-band spectrum available. The Commission should take the steps outlined herein to ensure such spectrum is made available in a way that best promotes the public interest.

II. THE COMMISSION SHOULD DESIGNATE THE UPPER PORTION OF THE 6 GHz BAND FOR LICENSED, FLEXIBLE USE.

A. The Commission Should Seize This Critical Opportunity To Make Mid-Band Spectrum Available For Licensed, Flexible Use.

As the Commission has observed, the combination of favorable propagation characteristics and the opportunity for wider channel bandwidths makes mid-band spectrum well

suites for next-generation wireless services.² Wireless stakeholders continue to stress the importance of mid-band spectrum to the development of 5G networks – and the transformative nature of such networks.³ For example, AT&T observes that mid-band is a “critical component of terrestrial 5G networks and essential to maintain U.S. international competitiveness.”⁴ Verizon urges the Commission to “quickly introduce a significant amount of mid-band spectrum for flexible, exclusive-use licenses.”⁵ And Ericsson, like CTIA, specifically calls for the Commission to designate the upper portion of the 6 GHz band for licensed, flexible use.⁶

The reality is that right now, America’s wireless providers do not have access to any wide-channel licensed, flexible use mid-band spectrum above 3 GHz.⁷ The 3.5 GHz Citizens Broadband Radio Service (“CBRS”) rules rely on 10-megahertz blocks, allow for a maximum of 40-megahertz licensed channelization, and are subject to low power levels short of the levels necessary for macro broadband deployments.⁸ CTIA continues to advocate for access to

² See Federal Communications Commission, 5G Fast Plan, <https://www.fcc.gov/5G> (last visited Mar. 14, 2019); see also *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373 (2017) (“*Mid-Band NOI*”).

³ See Comments of AT&T Services, Inc., GN Docket No. 18-122, at 1 (filed Oct. 29, 2018) (“AT&T C-Band Comments”); Comments of Verizon, ET Docket No. 18-295, at 12 (filed Feb. 15, 2019) (“Verizon Comments”); Comments of Ericsson, ET Docket No. 18-295, at 2 (filed Feb. 15, 2019) (“Ericsson Comments”). See also Comments of the City of Los Angeles, ET Docket No. 18-295, at 2-3 (filed Feb. 15, 2019) (“City of Los Angeles Comments”) (emphasizing that “expanding spectrum access is an essential element in making ubiquitous affordable broadband a reality”).

⁴ AT&T C-Band Comments at 1.

⁵ Verizon Comments at 12.

⁶ Ericsson Comments at 2, 13-16.

⁷ Comments of CTIA, ET Docket No. 18-295, at 6 (filed Feb. 15, 2019) (“CTIA Comments”).

⁸ *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959, 3982 ¶ 67 (2015); see also CTIA Comments at 6. As the *2018 3.5 GHz Order* noted, “[t]he Commission adopted significantly lower limits in this band than it has typically imposed in other bands in order to reduce coexistence challenges. . . . The adopted power limits . . . may be less suitable for wide-area coverage as compared to other bands.” *Promoting Investment in the 3550-3700 MHz Band*, Report and Order, 33 FCC Rcd 10598, 10634 ¶ 65 (2018) (“*2018 3.5 GHz Order*”). By way of comparison, the PCS and AWS power levels are “approximately 316 times the 3.5 GHz limit of 47 dBm/10

hundreds of megahertz of 3.7-4.2 GHz spectrum, but the incumbent satellite operators' current proposal in that proceeding is to repurpose only 180 megahertz for flexible-use licensed services.⁹ The Commission has made significant progress in repurposing low- and high-band spectrum available for exclusive use, flexible rights licensing in recent auctions, but access to licensed mid-band spectrum for 5G remains extremely limited.¹⁰

Meanwhile, other countries on average are on track to make four times more licensed mid-band spectrum available than the U.S. by the end of 2020 – with several making available 100 megahertz-wide channelization.¹¹ A recent Analysys Mason study on global allocation of mid-band spectrum found that by 2020, Canada, China, France, Germany, Japan, Russia, Singapore, South Korea, and the UK will have available, on average, nearly 300 megahertz of mid-band spectrum for 5G.¹² For example, China assigned 460 megahertz of mid-band spectrum to three of its national carriers last year,¹³ South Korea auctioned nearly 300 megahertz of mid-band spectrum,¹⁴ and Japan assigned 200 megahertz to providers on a national basis and has committed to release up to 500 megahertz of additional mid-band spectrum this spring.¹⁵

MHz for Category B devices and 15,800 times the 3.5 GHz limit of 30 dBm/10 MHz for Category A devices.” *Id.* at 10634 n.259.

⁹ See Comments of the C-Band Alliance, GN Docket No. 18-122, at 5 (filed Oct. 29, 2018) (proposing to reallocate 200 megahertz, including a 20-megahertz guard band).

¹⁰ See CTIA Comments at 6; see also Scott Bergmann & Kelly Cole, *More Mid-Band Spectrum is Key to U.S. 5G Leadership*, CTIA (Feb. 5, 2019) (“CTIA Mid-Band Spectrum Blog”), <https://www.ctia.org/news/more-mid-band-spectrum-is-key-to-u-s-5g-leadership>; CTIA, *The Global Race to 5G*, at 8, 11 (Apr. 2018), <https://api.ctia.org/wp-content/uploads/2018/04/Race-to-5G-Report.pdf>.

¹¹ CTIA Comments at 4-5 (citing CTIA Mid-Band Spectrum Blog).

¹² *Id.* at 4 (citing David Abecassis, Janette Stewart, Michael Kende & Chris Nickerson, *Final report for CTIA Midband spectrum global update*, ANALYSYS MASON, at 1 (Nov. 2018) (“Analysys Mason Report”), <https://api.ctia.org/wp-content/uploads/2018/12/Analysys-Mason-Mid-Band-Spectrum-Global-Update.pdf>).

¹³ Comments of CTIA, GN Docket No. 18-122, at 5-6 (filed Oct. 29, 2018).

¹⁴ Analysys Mason Report at 2.

¹⁵ *Id.*

And a recent Analysis Group study underscores the economic impact that licensed, flexible use access to mid-band spectrum is expected to have.¹⁶ The study concludes that making 400 megahertz of mid-band spectrum available will result in \$150 billion in wireless investments, 1.3 million new jobs on a direct and spillover effect basis, and a contribution of \$274 billion to America’s GDP over a seven-year period.¹⁷ For these reasons, the FCC should not overlook the opportunity in the 6 GHz band to further licensed use, as well as unlicensed operations.¹⁸

B. The Commission Can Enable Both Licensed And Unlicensed Operations While Accommodating or Protecting Incumbent Licensees – A Win-Win-Win For The Public Interest.

The unlicensed stakeholders filing as part of the 6 GHz RLAN Group dismiss the notion of exclusive, flexible use licensing in the 6 GHz band, pointing to hurdles including identifying “a suitable destination band” and a “viable plan for compensating” incumbents.¹⁹ But the national interest in 5G demands more thorough consideration. And, as CTIA explained, the Commission and the wireless industry have a long and successful history of making repurposing work – new licensees ensure that incumbents in the repurposed band are made whole either through relocation to comparable facilities or are otherwise protected.²⁰

¹⁶ See David W. Sosa & Greg Rafert, *The Economic Impacts of Reallocating Mid-Band Spectrum to 5G in the United States*, ANALYSIS GROUP (Feb. 2019) (“Analysis Group Report”), <https://api.ctia.org/wp-content/uploads/-/2019/02/The-Economic-Impacts-of-Reallocating-Mid-Band-Spectrum-to-5G-1.pdf>.

¹⁷ CTIA Comments at 3-4 (citing Analysis Group Report at 1).

¹⁸ See Ericsson Comments at 5; CTIA Comments at 6-7.

¹⁹ See Comments of Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, Qualcomm Incorporation, and Ruckus Networks, ET Docket No. 18-295, at 12 (filed Feb. 15, 2019) (“6 GHz RLAN Group Comments”).

²⁰ CTIA Comments at 10-12.

Here, the Commission can repurpose 6 GHz spectrum, assign it by auction, and require winning bidders to relocate fixed point-to-point microwave services (“FS”) and electronic newsgathering incumbents pursuant to *Emerging Technologies* policies, while ensuring that fixed satellite service (“FSS”) operations are protected.²¹ The *Emerging Technologies* framework is a time-tested method for achieving spectrum repurposing through the successful relocation of incumbents to comparable facilities.²² As CTIA previously stated, the framework balances the interest of new licensees “with the need to minimize disruption to incumbent operations used to provide service to customers during the transition.”²³ It has been successfully used to clear incumbent operations from several different bands over the last three decades.²⁴

CTIA and Ericsson both observe that the 7.125-8.5 GHz band is one range of frequencies that could accommodate fixed service operations that are relocated out of the 6 GHz band.²⁵ The record shows that the 7.125-8.5 GHz band, currently allocated for federal use, is underutilized and it appears the band could accommodate the relocation of non-federal incumbent licensees

²¹ *Id.* at 10-11, 13.

²² See *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, First Report and Order and Third Notice of Proposed Rulemaking, 7 FCC Rcd 6886 (1992) (subsequent history omitted). See also Ericsson Comments at 14 (encouraging the Commission to “apply its long standing Emerging Technologies policies, requiring winning bidders that acquire the new licenses at auction to relocate incumbents to comparable facilities, be it in different frequencies or transmission media”); CTIA Comments at 10-11 (citing *Emerging Technologies* to relocate incumbent licensees to comparable facilities).

²³ CTIA Comments at 11 (quoting *Amendment of Part 2 of the Commission’s Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Services*, Ninth Report and Order and Order, 21 FCC Rcd 4474, 4480 ¶ 11 (2006)).

²⁴ CTIA Comments at 11-12 (citing *Amendment of the Commission’s Rules to Establish New Personal Communications Services*, Second Report and Order, 8 FCC Rcd 7700 (1993) (subsequent history omitted)); *Amendment of Part 2 of the Commission’s Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, Second Report and Order, 17 FCC Rcd 23193 (2002); *Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-220 MHz Bands*, Report and Order and Order of Proposed Modification, 27 FCC Rcd 16102, 16214 ¶ 304 (2012)).

²⁵ Ericsson Comments at 15-16; CTIA Comments at 13-16.

from the 6 GHz band. CTIA’s initial comments highlighted two examples – San Diego and Denver – demonstrating the significantly lesser use of the federal spectrum above 7.125 GHz as compared to non-federal spectrum in the 6 GHz band.²⁶ NTIA data also show that there are nearly three times as many non-federal assignments in the 350 megahertz of spectrum between 6.525-6.875 GHz as these are federal frequency assignments in the 1,375 megahertz between 7.125-8.5 GHz.²⁷ The Commission should revisit the Fixed Wireless Communications Coalition (“FWCC”) request to add a non-federal fixed service allocation to the 7.125-8.5 GHz band²⁸ and incorporate the petition as part of Further Notice.

In addition, the proximity of the 7.125-8.5 GHz band would aid the relocation of non-federal fixed point-to-point stations. Because propagation characteristics are similar between the 6 GHz and 7 GHz frequency bands, the engineering design of the links would not change. Further, links in the new band should be able to operate from the same tower locations using the same infrastructure that is currently used by 6 GHz point-to-point links. Moreover, because the 7.125-8.5 GHz band is allocated for fixed service on a world-wide basis in the International Radio Regulations, equipment available globally could meet the requirements of 6 GHz licensees that relocate to the band in the United States.

²⁶ CTIA Comments at 15-16 (stating “usage in the 7.125-8.4 GHz band is much less than non-federal usage in the 5.925-7.125 GHz band and, in fact, is virtually non-existent in some areas” including places like Denver and San Diego).

²⁷ CTIA Comments at 15; *see also* Chriss Hammerschmidt, *Broadband Spectrum Survey in the San Diego, California Area*, NTIA Report No. TR-14-498, at 103-05, 120 (Mar. 2014), <https://www.its.bldrdoc.gov/publications/download/TR-14-498r.pdf>; Chriss Hammerschmidt, Heather E. Ottke & J. Randy Hoffman, *Broadband Spectrum Survey in the Denver and Boulder, Colorado, Metropolitan Areas*, NTIA Report No. TR-13-496, at 115-117, 129 (Mar. 2014), <https://www.its.bldrdoc.gov/publications/download/TR-13-496r.pdf>; Comments of Comsearch, ET Docket No. 18-295 (filed Feb. 15, 2019) (“Comsearch Comments”).

²⁸ *See* CTIA Comments at 14 (citing Petition of the Fixed Wireless Communications Coalition for Rulemaking, RM-11605 (filed Mar. 16, 2010)).

Meanwhile, incumbent Broadcast Auxiliary Service (“BAS”) and Cable Television Relay Service (“CARS”) licensees may be able to use other spectrum, including spectrum in the 2 GHz band, 12.7-13.2 GHz band, and the lower portion of the 6 GHz bands.²⁹ As commenters have previously stated, today there are more alternatives for BAS and CARS operations than previously existed.³⁰ Further, existing FSS space-to-earth including Mobile Satellite Service (“MSS”) feeder links are extremely limited – as the Commission recognized in *Mid-Band NOI* – and can be accommodated through coordination zones.³¹ Ericsson agrees that the Commission should “explore whether coordination zones would provide protection.”³²

As such, the Commission should promptly issue a Further Notice of Proposed Rulemaking to repurpose the upper portion of the 6 GHz band for exclusive use, flexible rights licensing. The Commission should also work with NTIA to add a non-federal allocation to a portion of the 7.125-8.5 GHz band to expand opportunities to relocate incumbent licensees from the 6 GHz band and enhance the efficient use of spectrum in the 7.125-8.5 GHz band. And the Commission can act on this Further Notice without delaying action on a spectrum sharing regime in the lower portion of the 6 GHz band.

²⁹ Ericsson Comments at 16; CTIA Comments at 12.

³⁰ Comments of T-Mobile USA, Inc., GN Docket No. 17-183, at 19 (filed Oct. 2, 2017) (“T-Mobile NOI Comments”); CTIA Comments at 12.

³¹ Ericsson Comments at 16; CTIA Comments at 12-13; *see also Mid-Band NOI*, 32 FCC Rcd at 6384 ¶ 33.

³² Ericsson Comments at 16.

III. THE COMMISSION SHOULD SEEK A BALANCE BETWEEN LICENSED AND UNLICENSED OPERATIONS IN THE 6 GHz BAND.

A. Unlicensed Spectrum is an Important Element of the Wireless Broadband Experience.

CTIA and its member companies support Commission action to assign spectrum for both licensed and unlicensed use.³³ For example, Verizon states that “unlicensed spectrum is also a vital and growing part of our network and our customers’ wireless experience,”³⁴ AT&T notes that that it “has long and often advocated for increases in the amount of commercial spectrum available for both licensed and unlicensed applications,”³⁵ and T-Mobile states that it “remains a significant user of unlicensed spectrum and supports making spectrum available for both licensed and unlicensed operations.”³⁶

Given the promise of unlicensed technologies, CTIA agrees with the 6 GHz RLAN Group that “Commission action in mid-band spectrum would therefore improve and expand the existing unlicensed ecosystem, for the benefit of all users.”³⁷ To that end, the Commission should designate the lower portion of the 6 GHz band for unlicensed use, provided that it adopts a rigorous interference protection regime to protect incumbent licensees in that portion of the band, as outlined in Section IV below, even as it launches a Further Notice to consider licensing in the upper portion of the band.

³³ See, e.g., CTIA Comments at 3.

³⁴ Verizon Comments at 1.

³⁵ Comment of AT&T Services, Inc. ET Docket No. 18-295, at 3 (filed Feb. 15, 2019) (“AT&T Comments”).

³⁶ T-Mobile NOI Comments at 16.

³⁷ 6 GHz RLAN Group Comments at 2.

The Commission can best achieve the public interest benefits of both unlicensed and licensed by constructing a framework that provides an opportunity for *both* to flourish in the 6 GHz band.

B. CTIA Supports Unlicensed in the Mid-Band, But There is No Basis to Dedicate the Full 1.2 Gigahertz of 6 GHz Spectrum to Unlicensed.

1. Seven Gigahertz of Unlicensed Millimeter Wave Spectrum Lies Nearly Vacant, While UMFUS Licensees Are Actively Deploying 5G.

In the *Spectrum Frontiers* proceeding, the Commission designated a full seven gigahertz of millimeter wave (“mmW”), or high-band, spectrum – the 64-71 GHz band – for unlicensed operations, on top of the seven gigahertz that it had already made available for unlicensed at 57-64 GHz.³⁸ And beyond the 14 gigahertz of mmW unlicensed spectrum, the Commission recently adopted an order in the *Spectrum Horizons* proceeding designating an additional 21.2 gigahertz of spectrum for unlicensed in the above 95 GHz bands.³⁹ In contrast, the Commission has dedicated only 5.5 gigahertz of high-band spectrum for licensed use. And yet, high-band terrestrial licensees have moved quickly to innovate, invest, and deploy in the mmW bands, far surpassing efforts to make productive use of the new *Spectrum Frontiers* unlicensed mmW spectrum.

In designating the full 64-71 GHz band for unlicensed use, the Commission concluded that its actions would “encourage the development of new and innovative unlicensed applications” and that “unlicensed applications are ready in the very near future to make use of this spectrum”⁴⁰ – but that has not yet panned out. NCTA and others laid claim to the full seven

³⁸ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8062-65 ¶¶ 125-30 (2016) (“*Spectrum Frontiers First Order*”).

³⁹ *Spectrum Horizons*, Report and Order, ET Docket No. 18-21, FCC 19-19 (adopted Mar. 15, 2019).

⁴⁰ *Id.* at 8062 ¶ 125, 8065 ¶ 130.

gigahertz and asserted that “the unlicensed industry is well-placed to incorporate the 64-71 GHz band into chips and devices *in the near term*.”⁴¹ But today, nearly three years later, the Commission’s equipment authorization database contains only three new devices that are certified for operation in the 64-71 GHz band.⁴²

In sharp contrast, the assignment of licensed spectrum in the mmW bands has triggered more investment, more innovation, and many new innovative devices. The *Spectrum Frontiers First Order* opened approximately three gigahertz of mmW spectrum for the licensed Upper Microwave Flexible Use Service (“UMFUS”). To date, the Commission has licensed less than a third of this spectrum. But it has already certified 18 devices to operate in one or more of the UMFUS bands – six times the number developed for the unlicensed 64-71 GHz band.⁴³ As further evidence of the relative investment and innovation in the mmW bands, stakeholders filed four times the number of experimental license applications for use of the spectrum dedicated to UMFUS than for use of the 64-71 GHz band dedicated to unlicensed between adoption of the *Mid-Band NOI* and the *Spectrum Frontiers First Order*.⁴⁴

The benefits flowing from this innovation and investment in licensed UMFUS services are self-evident. Verizon launched 5G fixed broadband services using mmW spectrum in

⁴¹ See, e.g., Opposition of NCTA – The Internet & Television Association to Petitions for Reconsideration, GN Docket No. 14-177, at 6 (filed Jan. 31, 2017) (emphasis added).

⁴² These devices were certified by Accton Technology Corp, Mikrotikls SIA, and Ceragon Networks Ltd. See FCC Equipment Authorization System, <https://apps.fcc.gov/oetcf/eas/index.cfm> (last visited Mar. 7, 2019). In addition, two devices previously certified for operation at 57-64 GHz have been approved for use at 64-71 GHz.

⁴³ These devices were certified by Nokia, Samsung, Motorola Mobility, Ericsson, NetGear, and others. See FCC Equipment Authorization System, <https://apps.fcc.gov/oetcf/eas/index.cfm> (last visited Mar. 7, 2019). In addition, two devices previously certified for operation were newly certified in the UMFUS bands.

⁴⁴ See FCC Experimental Licensing System, <https://apps.fcc.gov/oetcf/els/index.cfm> (last visited Mar. 7, 2019). There were 205 experimental applications in the three UMFUS bands (27.5-28.35, 37-38.6, and 38.6-40 GHz). During the same time period, there were 53 experimental applications in the 64-71 GHz band.

October 2018,⁴⁵ and will offer subscribers mmW-compatible LG and Samsung mobile phones in the first half of 2019.⁴⁶ AT&T deployed its mobile 5G service using mmW spectrum at the end of 2018.⁴⁷ Sprint will begin offering its customers an LG-manufactured 5G device capable of using mmW spectrum this spring.⁴⁸ T-Mobile will also launch a 5G mmW-capable Samsung mobile device in the summer of 2019.⁴⁹ Nokia recently announced it will build out a 5G network for U.S. Cellular using, among other products, its mmW-enabled AirScale radio platform.⁵⁰ Qualcomm announced a mmW antenna module and a second-generation 5G New Radio modem that will support mmW bands.⁵¹ Intel announced that in 2019 it will launch a 5G wireless modem chip that will support speeds up to six gigabits per second using mmW

⁴⁵ John O'Malley, *What is millimeter wave technology?*, Verizon (June 21, 2018) <https://www.verizon.com/about-our-company/5g/what-millimeter-wave-technology>; Corinne Reichert, *Verizon launching 5G in October*, ZDNet (Sept. 11, 2018), <https://www.zdnet.com/article/verizon-launching-5g-in-october/>.

⁴⁶ Press Release, Verizon, Verizon adds third 5G smartphone in 2019 (Feb. 24, 2019), <https://www.verizon.com/about/news/verizon-adds-third-5g-smartphone-2019>.

⁴⁷ News Release, AT&T, AT&T First to Make Mobile 5G Service Live in the U.S. on Dec. 21 (Dec. 18, 2018), https://about.att.com/story/2018/att_brings_5g_service_to_us.html. AT&T began offering a Samsung-made mobile 5G mmW device in February 2019. News Release, AT&T, Order the All-New Samsung Galaxy S10, S10+ or S10e Tomorrow for Use on the Nation's Best Network (Feb. 20, 2019), https://about.att.com/story/2019/new_samsung_devices.html.

⁴⁸ News Release, Sprint, Sprint's First 5G Smartphone, LG V50 ThinQ 5G, Launches this Spring (Feb. 24, 2019), <https://newsroom.sprint.com/sprints-first-5g-smartphone-lg-v50-thinq-5g-launches-this-spring.htm>.

⁴⁹ Press Release, T-Mobile, T-Mobile Unleashes the Fastest Samsung Phones to Fly on the Fastest LTE Network (Feb. 20, 2019), <https://investor.t-mobile.com/news-and-events/t-mobile-us-press-releases/press-release-details/2019/T-Mobile-Unleashes-the-Fastest-Samsung-Phones-to-Fly-on-the-Fastest-LTE-Network/default.aspx>.

⁵⁰ Press Release, Nokia, Nokia and U.S. Cellular sign multi-year 5G network modernization deal (Mar. 5, 2019), <https://www.nokia.com/about-us/news/releases/2019/03/05/nokia-and-us-cellular-sign-multi-year-5g-network-modernization-deal/>; Press Release, Nokia, #MWC19: Nokia small cells provide new mmWave and mid-band options to ensure optimal indoor and outdoor 5G coverage (Feb. 20, 2019), <https://www.nokia.com/about-us/news/releases/2019/02/20/mwc19-nokia-small-cells-provide-new-mmwave-and-mid-band-options-to-ensure-optimal-indoor-and-outdoor-5g-coverage/>.

⁵¹ Press Release, Qualcomm, Qualcomm Announces Second Generation 5G RF Front-End Solutions for Sleeker, More Efficient 5G Multimode Mobile Devices (Feb. 19, 2019), <https://www.qualcomm.com/news/releases/2019/02/19/qualcomm-announces-second-generation-5g-rf-front-end-solutions-sleeker-more>.

spectrum.⁵² And to build 5G coverage outside of cities, Ericsson recently announced improved performance to its transport solutions, including microwave solutions supporting up to 10 Gbps capacities.⁵³

The need for careful balancing between licensed and unlicensed spectrum in the mid-band range – as well as the Commission’s experience with the 64-71 GHz band – should inform its actions in the 6 GHz band, and lead it to issue a Further Notice to designate the upper portion of the band for licensed use. Both unlicensed and licensed stakeholders should have the opportunity to develop innovative solutions and drive investment in and productive use of the entire 6 GHz band.

2. Unlicensed Stakeholders Ask For Multiple 160-Megahertz Channels In Addition to Substantial Mid-Band Spectrum, Even As No Wideband Channels Exist for Licensed Use in the Mid-Band.

The current allocations of mid-band licensed and unlicensed spectrum are out of balance, and a Further Notice will create an opportunity to rectify that. Today, the 5 GHz U-NII bands offer 580 megahertz of mid-band spectrum for unlicensed use, an amount that supports unlicensed stakeholders’ desired 160-megahertz channels (and unlicensed interests are seeking an additional 75 megahertz in 5.9 GHz). The 3.5 GHz CBRS band provides 80 megahertz dedicated to General Authorized Access (essentially unlicensed) use, as well as opportunistic sharing of the full 150 megahertz of the band, including spectrum assigned as PALs.⁵⁴

⁵² News Release, Intel, Intel Accelerates Timing for Intel XMM 8160 5G Multimode Modem to Support Broad Global 5G Rollouts (Nov. 12, 2018), <https://newsroom.intel.com/news/intel-accelerates-timing-intel-xmm-8160-5g-multimode-modem-support-broad-global-5g-rollouts/#gs.Ortpif>.

⁵³ Press Release, Ericsson, Ericsson enhances 5G Platform for smooth network evolution (Feb. 19, 2019), <https://www.ericsson.com/en/press-releases/2019/2/ericsson-enhances-5g-platform-for-smooth-network-evolution> (announcing the addition of a new MINI-Link for these purposes); *see also* Ericsson, Microwave, <https://www.ericsson.com/en/portfolio/networks/ericsson-radio-system/mobile-transport/microwave> (last visited Mar. 14, 2019) (noting Ericsson’s MINI-Link works from 4 to 80 GHz).

⁵⁴ *2018 3.5 GHz Order*, 33 FCC Rcd at 10599-00 ¶ 3.

Even as unlicensed stakeholders call for up to seven 160-megahertz channels across 1,200 megahertz in the 6 GHz band⁵⁵ – adding to the existing U-NII bands and the CBRS spectrum they will have access to – the only concrete plan for licensed, flexible use mid-band spectrum is a total of 70 megahertz of PAL spectrum and aggregation is limited to four 10-megahertz-wide channels.⁵⁶ And, although making hundreds of megahertz of spectrum available in the 3.7-4.2 GHz band has been correctly identified as critical to U.S. 5G leadership, the satellite operators currently propose to make available just 180 megahertz for terrestrial, flexible use licensing.

Further, there is substantial unlicensed spectrum in the 5 GHz band that is highly underutilized – specifically, the U-NII-2 bands (5.25-5.35 GHz and 5.47-5.725 GHz), which require use of Dynamic Frequency Selection (“DFS”). The Commission has observed the lack of deployment in these bands.⁵⁷ And stakeholders have also noted that DFS bands have “not produced the level of investment and consumer benefit seen in the 2.4 GHz, non-DFS U-NII-3, and U-NII-1 bands.”⁵⁸ There is, as a result, an unsatisfying case for unlicensed needing access to 1.2 gigahertz of additional mid-band spectrum – particularly given that a rigorous interference

⁵⁵ See, e.g., Comments of Charter Communications, Inc., ET Docket No. 18-295, at 3 (filed Feb. 15, 2019) (“Charter Comments”) (designating entire band for unlicensed “will allow indoor, low power devices to operate across seven contiguous 160 megahertz channels”); Comments of Open Technology Institute at New America, American Library Association, Consumer Federation of America, COSN–Consortium for School Networking, Public Knowledge, Access Humboldt, ET Docket No. 18-295, at 14 (filed Feb. 15, 2019) (“Public Interest Orgs. Comments”) (filed as Public Interest Organizations); 6 GHz RLAN Group Comments at 3.

⁵⁶ 2018 3.5 GHz Order, 33 FCC Rcd at 10653 ¶ 105.

⁵⁷ The Commission noted in its *Mid-Band NOI* that “the most active use appears to have congregated in discrete portions of the bands not subject to dynamic frequency selection,” and sought comment on whether DFS is “a disincentive to developing and deploying U-NII devices in these bands.” *Mid-Band NOI*, 32 FCC Rcd at 6383 ¶ 30.

⁵⁸ Comments of All Points Broadband, Amplex Internet, Apple, Blaze Broadband, Broadcom, Cambium Networks, Cisco Systems, Cypress Semiconductor, Dell, Extreme Networks, Facebook, Fire2wire, Google, Hewlett-Packard Enterprise, HP, Intel, Joink, Mediatek, Metalink Technologies, Microsoft, New Wave Net, Pixius Communications, Qualcomm, Rise Broadband, Ruckus, A Unit of Brocade, Snappy Internet, Sony Electronics, Western Broadband, Wireless Internet Service Providers Association, Wisper ISP, GN Docket No. 17-183, at 17 (filed Oct. 2, 2017).

protection framework will likewise be required. The reluctance of unlicensed manufacturers and users to commit sufficient resources to developing and using the DFS mitigation technique in the U-NII-2 bands does not bode well for the intensive use of the 6 GHz band subject to AFC requirements.

There is no doubt that wireless operators have a mid-band deficit when it comes to building 5G networks. The FCC should not overlook an opportunity to accommodate both unlicensed and licensed interests in the 6 GHz band.

IV. A PATH EXISTS TO INTRODUCE UNLICENSED IN THE 6 GHz BAND WHILE PROTECTING INCUMBENT LICENSED SERVICES, BUT AGGRESSIVE VIEWS ON UNLICENSED ACCESS WILL DELAY ACTION.

A. Sound Rules of the Road for AFCs Are Necessary to Protect Incumbents and Enable Unlicensed Operations.

The record reflects that the Commission can adopt a spectrum sharing regime for unlicensed operations in the lower portion of the 6 GHz band by implementing a rigorous interference protection framework that safeguards incumbent operations from interference. To do so, Commission rules should clearly place the burden of protecting licensed services on all unlicensed operations in the band. As commenters noted, licensees should not be required to bear costs to enable unlicensed operations in the 6 GHz band, and these costs should be considered as a prerequisite for unlicensed operations in the 6 GHz band.⁵⁹

Therefore, although the AFC framework offers the potential to permit unlicensed operations in the lower portion of the 6 GHz band, the Commission should modify certain of the proposals in the Notice to ensure that incumbent service licensed operations are fully protected.

The record identifies a few key points:

⁵⁹ See CTIA Comments at 17; see also Comsearch Comments at 14 (“[M]icrowave operators licensed under Part 101 are the *primary* service licensees and it is the regulatory responsibility of the unlicensed device to avoid interference.”).

AFC System Certification. Commenters urge the Commission to require that AFC applicants engage in a certification process to demonstrate that AFC systems can function as intended and that interference to licensees will not occur in the first place.⁶⁰ The Wireless Internet Service Providers Association (“WISPA”) proposes, for example, that “the Commission’s Office of Engineering and Technology should test and certify AFCs,”⁶¹ and others note that the Commission can draw on a “transparent testing and validation process similar to what is required for TV White Space and CBRS administrators.”⁶²

As part of the certification process, the Commission should ensure that performance-based security safeguards are in place so that device-based software cannot be easily modified to allow operation on frequencies other than those that the AFC indicates are available.⁶³ As El Paso Electric Company explains, no one “should be able to modify the AFC database to accommodate use of unavailable frequencies as determined by AFC.”⁶⁴ It is essential that all 6 GHz unlicensed devices contain security features “sufficient to protect against unauthorized modification of software and firmware.”⁶⁵

⁶⁰ See, e.g., Comsearch Comments at 24 (“All AFC operators must be FCC tested and certified.”); Verizon Comments at 7 (“The FCC should test and certify AFC designs to ensure positive control capabilities, such that unlicensed devices may operate only under the command of the AFC.”); City of Los Angeles Comments at 13 (suggesting “real-world testing of AFCs, access points, and client devices across a variety of environments, to ensure the systems work as designed and no interference results”).

⁶¹ Comments of the Wireless Internet Service Providers Association, ET Docket No. 18-295, at 20 (filed Feb. 15, 2019) (“WISPA Comments”).

⁶² See Comments of Southern Company Services, Inc., ET Docket No. 18-295, at 13 (filed Feb. 15, 2019) (“Southern Company Comments”); see also, e.g., Comments of Sony Electronics Inc., ET Docket No. 18-295, at 8 (filed Feb. 15, 2019) (“Sony Comments”); AT&T Comments at 19; Comments of APCO International, ET Docket No. 18-295, at 8 (filed Feb. 15, 2019) (“APCO Comments”); Comsearch Comments at 24; City of Los Angeles Comments at 13.

⁶³ See, e.g., CTIA Comments at 20-21; APCO Comments at 8-9; Comments of El Paso Electric Company, ET Docket No. 18-295, at 4 (filed Feb. 15, 2019) (“El Paso Electric Comments”); Comments of the Wi-Fi Alliance, ET Docket No. 18-295, at 30-31 (filed Feb. 15, 2019) (“Wi-Fi Alliance Comments”).

⁶⁴ El Paso Electric Comments at 4.

⁶⁵ Sony Comments at 7.

Robust Database to Protect Incumbent Licensed Services. The record confirms that requiring AFC operators to rely on the ULS alone for purposes of determining the characteristics of incumbent systems is insufficient. For example, Comsearch notes that the Part 101 prior frequency coordination process accommodates operation of microwave links well before the data appears in ULS, a microwave path can be put into service under a conditional license at any time upon application submission, and that during the recent partial government shutdown, license and equipment data was not updated in ULS.⁶⁶ While some commenters note that incumbents will have incentives to update missing or incorrect information in ULS and support a waiver of any associated application fees, problems related to the time lag between when microwave operations may begin and when ULS is updated would remain.⁶⁷ Therefore, the Commission should require AFC operators to also verify the information using a third-party database.

Database Updates. In order to avoid interference in the first instance, unlicensed operations must have updated, accurate data about incumbent licensed operations and the surrounding spectrum environment. ULS files, for example, are updated daily, as new and modified licenses may expand in the band. An effective spectrum sharing regime thus requires frequent check-ins with a database of licensed service operations, and it does not serve the public interest to propose that unlicensed transmitters be updated on an infrequent basis.⁶⁸ But a few unlicensed advocates suggest just that. For example, the 6 GHz RLAN Group proposes that it

⁶⁶ See Comsearch Comments at 17. See also Comments of Xcel Energy Services Inc., ET Docket No. 18-295, at 6 (filed Feb. 15, 2019); Comments of the Association of American Railroads, ET Docket No. 18-295, at 7 (filed Feb. 15, 2019) (“AAR Comments”); Comments of the Fixed Wireless Communications Coalition, ET Docket No. 18-295, at 28 (filed Feb. 15, 2019) (“FWCC Comments”); City of Los Angeles Comments at 11-12; Comments of the National Association of Broadcasters, ET Docket No. 18-295, at 4 (filed Feb. 15, 2019).

⁶⁷ See, e.g., Comments of Hewlett Packard Enterprise Company, ET Docket No. 18-295, at 28 (filed Feb. 15, 2019) (“HPE Comments”).

⁶⁸ See, e.g., Comsearch Comments at 15; Comments of the City of New York, ET Docket No. 18-295, at 4 (filed Feb. 15, 2019).

would be sufficient for the AFC system to have “monthly queries” of ULS data,⁶⁹ and the Wi-Fi Alliance asserts that access points need only verify available channel assignments with the AFC every 30 days (even as AFCs are updated as frequently as ULS).⁷⁰ Unlicensed interests would be better served by fully embracing the responsibilities inherent in protecting incumbent services.

Access Point Registration. Access point registration is critical to the functioning of an AFC because, among other things, it helps “support security methods, track down problems, and avoid spoofing and noncompliance.”⁷¹ Indeed, as a recent report explained, in the TV White Spaces and CBRS sharing regimes, the Commission has required that “users register the location and technical characteristics of every access point, that mobile devices not registered must be under the control of those APs, and that the permission to transmit must be renewed by the database at defined intervals, allowing any user or device to be shut down quickly.”⁷² But several unlicensed stakeholders argue otherwise, opposing any device registration. For example, Microsoft argues “there is no need to register individual standard-power access points” given that the AFC can confirm that the access point model is certified with that AFC and such activity can be combined with interference protection criteria and security provisions.⁷³ Wi-Fi Alliance

⁶⁹ 6 GHz RLAN Group Comments at App. C-5; *id.* at 42 (suggesting AFC systems obtain up-to-date information “at least once every 30 days”).

⁷⁰ Wi-Fi Alliance Comments at 23.

⁷¹ Verizon Comments at 6.

⁷² See, *Automated Frequency Coordination – An Established Tool for Modern Spectrum Management*, DYNAMIC SPECTRUM ALLIANCE, at 31 (Mar. 2019), http://dynamicspectrumalliance.org/wp-content/uploads/2019/03/-DSA_DB-Report_Final_03122019.pdf.

⁷³ See Comments of Microsoft Corporation, ET Docket No. 18-295, at 21 (filed Feb. 15, 2019) (“Microsoft Comments”); see also 6 GHz RLAN Group Comments at 65-66; Comments of Broadcom Inc., ET Docket No. 18-295, at 41 (filed Feb. 15, 2019) (“Broadcom Comments”).

puts it more simply: “[t]he interference avoidance role of the AFC is outbound[.]”⁷⁴ But, as AT&T notes, before unlicensed is introduced into the 6 GHz band there must be “a technical solution to detect, locate, and resolve interference as rapidly as possible.”⁷⁵ Sound spectrum management dictates that the Commission reject calls to permit unlicensed devices into the 6 GHz band without the failsafe of registration information that will aid interference mitigation and enforcement in the real world.⁷⁶

Unlicensed advocates must protect incumbent operators by making sure the AFC system is “capable of assisting in identifying the source of and resolving harmful interference.”⁷⁷ As WISPA notes, even though “[d]evice registration adds a degree of complexity to the AFC [it] serves several useful purposes,” including to resolve interference complaints.⁷⁸ Sony agrees and notes that “much of the technology necessary for implementing such a system has already been developed.”⁷⁹ And device registration may not be as burdensome as some commenters allege, as

⁷⁴ Wi-Fi Alliance Comments at 30.

⁷⁵ AT&T Comments at 18.

⁷⁶ See CTIA Comments at 19; *see also, e.g.*, AT&T Comments at 18 (arguing registration should be “required”); Verizon Comments at 5 (advocating the AFC be a positive, centralized controller “so as to protect incumbent service licensees from harmful interference”); Comsearch Comments at 22 (“[T]he FCC must sufficiently protect licensed incumbents and ensure a level of reliability equivalent to well-engineered microwave link designed for implementation under the current service rules[.]”); Comments of Intelsat License LLC and SES Americom, Inc., ET Docket No. 18-295, at 13 (filed Feb. 15, 2019) (“[T]o ensure that the AFC system can effectively mitigate aggregate interference . . . registration should be mandatory[.]”); Sony Comments at 5 (noting a registration requirement is “necessary in order to facilitate the identification and remediation of harmful interference to incumbent licensees”); City of Los Angeles Comments at 13 (noting it “firmly believes” registration is necessary); Comments of Midcontinent Communications, ET Docket No. 18-295, at 16 (filed Feb. 15, 2019) (“[A]ccess point registration is essential to a functioning AFC system[.]”); APCO Comments at 6 (urging the Commission to “make device registration in the database mandatory”).

⁷⁷ Comments of Tucson Electric Power Company and UNS Electric, Inc., ET Docket No. 18-295, at 14 (filed Feb. 15, 2019) (“Tucson Electric Comments”).

⁷⁸ WISPA Comments at 19.

⁷⁹ Sony Comments at 5.

AFC operators “may need to register their customers’ devices anyway simply to be able to charge for their services on a recurring basis.”⁸⁰

CTIA and others support the registration of data including: Commission ID of the device; manufacturer’s serial number of the device; geographic coordinates; antenna height; name of the individual or business that owns the device; and contact information for a person responsible for the device’s operation.⁸¹ Such data will allow the AFC system to better protect licensees and provide a failsafe for tracking interference.

Response to Interference Occurrence. Many commenters urge the Commission to ensure that AFCs maintain the capability, in the event of reported interference to an incumbent service licensee, to direct unlicensed operations on the impacted channel to cease immediately.⁸² As Comsearch put it: “AFC operators should have ‘kill switch’ authority[.]”⁸³ An unlicensed device does not have a vested interest to operate on any frequency,⁸⁴ so when an interference event occurs, the AFC system should “immediately disable the offending RLAN(s), without prior

⁸⁰ WISPA Comments at 19.

⁸¹ See, e.g., CTIA Comments at 19; AT&T Comments at 18-19; Sony Comments at 5; Tucson Electric at 17-18.

⁸² See, e.g., Southern Company Comments at 20 (“The AFC operator is the only entity that will have information on devices that have been deployed in the area and that has the means to readily alter or terminate operation of a given device.”); Comments of Los Angeles County, California, City and County of Denver, Colorado, City of Kansas City, Missouri, Ozaukee County, Wisconsin, San Bernardino County, California, the Regional Wireless Cooperative, and the Government Wireless Technology & Communications Association, ET Docket No. 18-295, at 8 (filed Feb. 15, 2019) (“[I]t must be abundantly clear that the interfering unit must immediately discontinue operation.”); Verizon Comments at 5 (advocating that the AFC should “have the capability to change the device’s chosen channel and/or power level – or even turn it off”); APCO Comments at 20; Tucson Electric Comments at 19; FWCC Comments at 31.

⁸³ Comsearch Comments at 23; *id.* (“AFC [operator should have the ability] to ‘push’ a command to mute transmission to an unlicensed device during an interference event[.]”).

⁸⁴ See 47 C.F.R. § 15.5 (stating that users of unlicensed devices “shall not be deemed to have any vested or recognizable right to continued use of any given frequency”).

notice, pending repair or replacement,”⁸⁵ or at a minimum shift the unlicensed use to another channel if a non-interfering channel is identified.

Access Point Mobility. CTIA notes here that the interference risks associated with mobile or portable access points should be accounted for before any such operations are permitted in the 6 GHz band. For example, Southern Company expresses concern that devices in motion will cross paths with a microwave receiver “before the location of the device can be identified and corrective action taken.”⁸⁶ There are possible solutions. As Comsearch explains, these issues could be addressed by adopting a requirement that an unlicensed device recheck with the AFC whenever it moves beyond a certain “uncertainty sphere.”⁸⁷ Or devices could be de-registered if they lose contact with the AFC system.⁸⁸ In any event, the Commission should ensure that access points do not move about and raise the risk of harmful interference before these issues are resolved (perhaps in a standards body).⁸⁹

Power Limits. With the protections that result from a rigorous AFC system, it may be possible to adopt higher power levels for outdoor operations than those proposed in the Notice. As Verizon notes, “[a]ctive AFC management of unlicensed access points will enable greater security and protection and, in turn, allow for higher powered unlicensed use.”⁹⁰ If the AFC

⁸⁵ FWCC Comments at 35.

⁸⁶ Southern Company Comments at 19.

⁸⁷ Comsearch Comments Attachment A at 2.

⁸⁸ *See, e.g.*, Southern Company Comments at 13.

⁸⁹ Comments of Qualcomm Incorporated, ET Docket No. 18-295, at 16 (filed Feb. 15, 2019) (“Qualcomm Comments”); Comments of Apple Inc., ET Docket No. 18-295, at 7 (filed Feb. 15, 2019) (“Apple Comments”) (elaborating on solutions to permit unlicensed operations in cars and noting that such solutions “depend[] on a 6 GHz access point’s ability to know its location as it moves so that it can determine whether it is within an area for which an AFC system would permit operations”).

⁹⁰ *See* Verizon Comments at 3; *see also* CTIA Comments at 20; Comments of Nokia, ET Docket No. 18-295, Technical Study at 9 (filed Feb. 15, 2019).

controls unlicensed operations and maintains interference protection specific to each individual incumbent licensee’s operating parameters, together with the fact that unlicensed operations may deploy directional antennas, the Commission should consider adopting higher power levels for outdoor operations than those proposed in the Notice.

B. The Commission Should Reject Proposals for Unmanaged Unlicensed Devices That Would Operate Independent of an AFC System.

CTIA and many others are on the record emphasizing the importance of AFC and positive control to ensure the integrity of the proposed spectrum sharing regime in 6 GHz.⁹¹ Nevertheless, some unlicensed stakeholders call for unmanaged unlicensed use that suggests a more cavalier view of interference protection.⁹² By stretching the bounds of spectrum management in a sharing regime, these advocates risk slowing down the unlicensed opportunity in the 6 GHz band and creating unnecessary interference threats to licensed services. Instead, informed by experiences in the 5 GHz band and TV white spaces, the Commission should take a careful, coordinated approach to addressing risks to incumbent licensed operations.⁹³

⁹¹ See, e.g., CTIA Comments at 17; Ericsson Comments at 3 (conditioning support of unlicensed in the band on an AFC that serves as a positive controller with regard to unlicensed operations); Comments of the Critical Infrastructure Coalition, ET Docket No. 18-295, at 8 (filed Feb. 15, 2019) (opposing indoor unlicensed operations without control of the AFC system); Tucson Comments at 19 (“[A]ll unlicensed client devices operating at 6 GHz should be under the control of an access point at all times, with a valid and current frequency assignment, from the AFC system.”); AAR Comments at 5 (arguing that all devices should be under the control of a centralized and fully accurate AFC system).

⁹² Some commenters call for the Commission to permit low-power, indoor devices throughout the 6 GHz band without being under the control of an AFC system. See, e.g., 6 GHz RLAN Group Comments at 3, 16-17; Broadcom Comments at 27; Charter Comments at 3; Qualcomm Comments at 10; Wi-Fi Alliance Comments at 10-11. A few commenters also urge the Commission to authorize very-low-power, 14 dBm, unlicensed operations indoor, or outdoor, throughout the band without the control of an AFC system. See, e.g., Apple Comments at 7; 6 GHz RLAN Group Comments at 4; HPE Comments at 7; Broadcom Comments at 27; Comments of Facebook, Inc., ET Docket No. 18-295, at 5 (filed Feb. 15, 2019) (“Facebook Comments”). Advocates for these proposals generally argue that the proposals are unlikely to cause interference to licensed incumbents.

⁹³ See, e.g., Comments of Motorola Solutions, Inc., ET Docket No. 18-295, at 2 (filed Feb. 15, 2019) (noting the significant challenges in relying on unlicensed devices to effectively implement software-based control of equipment operating in the 5 GHz bands); AT&T Comments at 19-20 (explaining the Commission’s experiences in TV White Spaces and 5 GHz are instructive); Verizon Comments at 7 (explaining how the Commission’s

As CTIA and others explain, unmanaged, unlicensed devices pose an unacceptable interference threat to critical incumbent operations – for example, the proposal that an AFC is not required for indoor-only use creates substantial risks and the Commission should refrain from adopting it. Comsearch simulations demonstrate that with low-power indoor device deployment, there is “a high likelihood for co-channel interference” to licensed microwave receivers across the entire U-NII-5.⁹⁴ And, even if unlicensed devices are transmitting at very low power or from very far distances, “the risk persists” according to AAR.⁹⁵

And claims that low-power transmissions will be attenuated by building entry losses, clutter loss, and polarization mismatch losses are overstated.⁹⁶ The FWCC notes that it is incorrect to assume that building walls will not allow interfering signals to leak out, stating: “[a]ctual calculations give a very different result: even through building walls, an inopportunistically located RLAN at any useful power will cause FS interference from kilometers away.”⁹⁷ Similarly, the Association of Federal Communications Consulting Engineers does not believe that attenuation from building walls and windows is a realistic barrier to prevent interference from occurring.⁹⁸

Further, it will be impossible to ensure that “indoor-only” devices remain indoors. It is all too easy to move indoor-only devices outdoors. Any battery powered device could be moved

experiences in 5 GHz and with TV White Spaces demonstrate that “harmful interference is unavoidable” if an access point device acts autonomously).

⁹⁴ Comsearch Comments at 14.

⁹⁵ AAR Comments at 8.

⁹⁶ Wi-Fi Alliance Comments at 11.

⁹⁷ FWCC Comments at 4.

⁹⁸ Comments of the Association of Federal Communications Consulting Engineers (“AFCCE”), ET Docket No. 18-295, at 1-2 (filed Feb. 15, 2019).

outdoors. And a requirement that indoor devices have a direct connection to a 120 volt AC power outlet “can easily be defeated with a low cost and simple expedient of an AC extension cord.”⁹⁹ And in any event, AC outlets can be located outside (for example, on the balcony of a high-rise apartment).

Access point devices themselves “cannot understand the entire radio environment” in which they are operating without the information from an AFC, and therefore, unlicensed access points should not operate in the 6 GHz band on a stand-alone basis or be able to choose a channel autonomously.¹⁰⁰ As Verizon explains, “[a]n autonomous decentralized access-point-based approach would make it much harder, if not impossible, to account for these considerations in a failsafe manner.”¹⁰¹ Therefore, to ensure protection of incumbent licensed operations, the Commission should require that the AFC apply as a positive control to all access points – whether located outdoors or indoors, and no matter the power level.

Specifically, the Commission should refrain from adopting its proposal to permit low-power, indoor devices in certain sub-bands absent the positive control mechanism of an AFC system;¹⁰² dismiss calls to extend the Commission proposal for low-power, indoor operations without AFC control across all of the 6 GHz band;¹⁰³ and reject proposals to authorize very-low-power (*e.g.*, 14 dBm) unlicensed operations – indoor or outdoor – throughout the 6 GHz band

⁹⁹ Comments of Engineers for the Integrity of Broadcast Auxiliary Services Spectrum (“EIBASS”), ET Docket No. 18-295, at 5 (filed Feb. 15, 2019); *see* Notice, 33 FCC Rcd at 10521 ¶ 71 (suggesting the Commission could require indoor devices to have a direct connection to a power outlet).

¹⁰⁰ Verizon Comments at 5.

¹⁰¹ *Id.*

¹⁰² Notice, 33 FCC Rcd at 10518 ¶ 59.

¹⁰³ *See, e.g.*, 6 GHz RLAN Group Comments at 17; Public Interest Orgs. Comments at 17; Wi-Fi Alliance Comments at 10; Comments of NCTA – The Internet and Television Association, ET Docket No. 18-295, at 16 (filed Feb. 15, 2019); Microsoft Comments at 5, WISPA Comments at 27; Charter Comments at 3; Facebook Comments at 5-6.

without the control of an AFC system.¹⁰⁴ Access point connection to the AFC – regardless of location or power level – is critical both to preventing interference and resolving interference complaints that may occur. Incumbent licensees deserve better than mere promises not to interfere based on speculation that the risk of interference is low.

Finally, the Commission must reject claims that AFC-connected devices would result in so much increased cost and complexity as to “sacrifice [] the greatest benefit of this rulemaking[.]”¹⁰⁵ This argument undermines the integrity of the proposed interference protection regime.¹⁰⁶ Although some unlicensed advocates are eager to bring off-the-shelf, low-cost devices to the 6 GHz band, lower-cost alternatives cannot come at the expense of interference-free licensed services.¹⁰⁷ Any costs necessary to protect licensed incumbents from interference fall squarely on the shoulders of new unlicensed operators.

¹⁰⁴ See, e.g., Apple Comments at 3; HPE Comments at 7; 6 GHz RLAN Group Comments at 35.

¹⁰⁵ Public Interest Orgs. Comments at 17; see also Comments of HP. Inc., ET Docket No. 18-295, at 4 (filed Feb. 15, 2019).

¹⁰⁶ See Verizon Comments at 6 (“[B]ecause the capabilities of all devices will span the entire 6 GHz band dedicated to unlicensed use, incorporating AFC connectivity and registration requirements are not additional burdens for indoor access points.”).

¹⁰⁷ See, e.g., Comments of the Boeing Company, ET Docket No. 18-295, at 8 (filed Feb. 15, 2019) (suggesting permitting LPI devices throughout the 6 GHz band without being under the control of the AFC “would substantially reduce the costs of U-NII-5 and U-NII-7 devices that are designed solely for indoor use”).

V. CONCLUSION.

CTIA reiterates its support for a Further Notice of Proposed Rulemaking to consider flexible use, licensed spectrum in the upper portion of the 6 GHz band and adoption of a rigorous spectrum sharing regime that will protect incumbent licensed services while enabling new unlicensed use.

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