

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

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

COMMENTS OF NCTA – THE INTERNET & TELEVISION ASSOCIATION

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I. INTRODUCTION AND SUMMARY

The Commission has made great strides over the last several years in freeing up more low-, mid- and high-band spectrum for licensed and unlicensed wireless broadband, from the recent incentive auction, to the 3.5 GHz band, all the way up to the millimeter wave frequencies. NCTA – The Internet & Television Association (NCTA)¹ applauds those significant efforts and welcomes the mid-band Notice of Inquiry as the latest in an ongoing process to ensure that available licensed and unlicensed mobile spectrum resources keep pace with growing demand.

Because there is no more greenfield spectrum, in any proceeding where the Commission inquires about new opportunities for wireless broadband, it must also carefully consider the impact of new services on incumbent users. Spectrum sharing technologies are rapidly improving and arrangements that would have been unthinkable a decade ago—the three-tier access system envisioned at 3.5 GHz, for example—are now close to implementation. But each band brings new sharing challenges and the 3.7-4.2 GHz and 5.925-6.425 GHz bands merit a close look as part of this proceeding. The cable television industry—operators and programmers alike—continue to rely on this core C-band satellite spectrum as a primary means of distributing television content. Before authorizing use of these bands for flexible wireless or expanded fixed broadband use, the Commission must have before it a complete record, including detailed sharing analyses and test results, if appropriate, indicating that new operations will fully protect

¹ NCTA is the principal trade association for the U.S. cable industry, representing cable operators serving 85 percent of the nation's cable television households and more than 200 cable program networks. The cable industry is the nation's largest provider of broadband service after investing more than \$250 billion over the last two decades to build two-way interactive networks with fiber optic technology. Cable companies also provide state-of-the-art competitive voice service to more than 30 million customers.

existing satellite and Cable Television Relay Service (CARS)/Broadcast Auxiliary Service (BAS) users from harmful interference.

Provided that incumbent operations can be fully protected, NCTA supports designating the 5.925-7.125 GHz (6 GHz) band for unlicensed use. Growing consumer demand, plus increasing use of wide-bandwidth gigabit Wi-Fi channels, deployment of LTE technologies in unlicensed spectrum, and the advent of 5G networking will all contribute to taxing existing unlicensed bands beyond the load they reasonably can bear. In combination with unlicensed access to the 5.9 GHz band, the 6 GHz band presents a unique opportunity to address the pressing need for additional unlicensed mid-band spectrum resources.

Industry's experience in the 5 GHz band suggests that new unlicensed bands will be most attractive for Wi-Fi deployments if the technical rules align closely with those adopted for U-NII-1 and U-NII-3. Although most of NCTA's members deploy equipment capable of operating in the portions of the 5 GHz band encumbered with dynamic frequency selection (DFS) rules, devices use U-NII-1 and U-NII-3 channels far more often. Higher power limits and the absence of complex DFS requirements render U-NII-1 and U-NII-3 more flexible and better suited to a broader range of applications. Although using U-NII-2 may become more attractive as U-NII-1 and U-NII-3 become increasingly congested, these encumbered bands are no substitute for bands that allow higher power operation without the added complexity of DFS.

II. C-BAND SATELLITE SPECTRUM REMAINS CRITICAL TO THE DELIVERY OF TELEVISION PROGRAMMING AND INCUMBENT C-BAND OPERATIONS MUST BE PROTECTED FROM HARMFUL INTERFERENCE

NCTA counts among its members both owners and operators of cable systems and providers or distributors of programming for retransmission by cable systems. Both cable operators and programmers depend on C-band satellite spectrum to deliver high-quality television service to tens of millions of cable customers. Almost every national cable

programming network and many regional networks are uplinked to C-band FSS satellites using the 5.925 to 6.425 GHz band and distributed to earth station antennas at cable system headends located throughout the country using the 3.7-4.2 GHz downlink band. Programming networks also rely on C-band satellite spectrum to deliver time-sensitive programming such as news and sports from remote locations back to network operations centers where that content can be incorporated into the program stream and delivered to headends and then on to customers.

NCTA recently polled its membership regarding their use of C-band spectrum. The results indicated that members continue to use thousands of C-band earth station antennas to transmit and receive programming. Even as cable system operators continue to expand their fiber networks, C-band earth stations remain a primary means of receiving content for distribution to customers. Several operator and programmer members indicated an intent to construct new earth station facilities in the next few years. Our results also indicate that, as the Commission's rules permit,² members have not registered many of their earth station receive antennas. If our members' practices reflect the registration practices of other C-band users, relying on data only for registered earth stations would significantly underrepresent how heavily the band is currently used by C-band satellite incumbents.³

Of course, delivery of television programming constitutes just one of a broad range of existing C-band operations. Commenters on the Broadband Access Coalition's recent petition for rulemaking relating to the 3.7-4.2 GHz band note that various providers use C-band spectrum

² See 47 C.F.R. § 25.131(b).

³ See Opposition of Intelsat License LLC, RM-11791, at 3 (filed Aug. 7, 2017) (Intelsat Opposition).

to deliver broadband, emergency communications, and communications in remote areas. For example, General Communication, Inc. states that it relies on C-band spectrum to provide long-distance, mobile, telehealth, long-distance learning, and government services, including in hard-to-reach regions of Alaska.⁴ Intelsat notes that C-band satellite operations “provide sole source connectivity in remote areas, restore communications following natural disasters, and support government communications.”⁵ In the NOI, the Commission also describes a variety of services operating in C-band spectrum, including “enabling communications on board planes and ships, . . . providing data connectivity for merchant credit card transactions, and supporting corporate data networks.”⁶

As discussed in further detail below, NCTA supports the Commission’s efforts to identify opportunities for additional flexible wireless broadband use of mid-band spectrum. As the Commission considers proposals for new services in core C-band spectrum, however, it must also consider the important existing uses outlined above. In particular, NCTA urges the Commission to ensure that C-band transmissions carrying millions of hours of content to thousands of cable headends are fully protected from harmful interference. The Commission should only proceed to authorize new uses of C-band spectrum if it has before it a complete record, supported by technical studies and testing, if appropriate, demonstrating that new users can fully protect existing operations. NCTA also urges the Commission carefully to consider the

⁴ Comments of General Communication, Inc., RM-11791, at 5-11 (filed Aug. 7, 2017).

⁵ Intelsat Opposition at 3.

⁶ *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373, 6376 ¶ 8 (2017) (NOI).

impact on C-band users of proposals that would narrow the frequencies, azimuths, and elevation angles currently available for their use.⁷ As NCTA has described in other contexts, such restrictions “could have a significant impact on the ability of earth station licensees—who require 100 percent reliability—to consistently deliver high-quality programming to cable customers . . . [and on] programming networks’ use of C-Band spectrum to deliver time-sensitive programming from remote locations to their network operations centers.”⁸

III. AUTHORIZING UNLICENSED USE OF THE 5.925-7.125 GHZ BAND WOULD CREATE UNIQUE WIRELESS BROADBAND OPPORTUNITIES

Provided that satellite and CARS/BAS operations can be fully protected from harmful interference, NCTA supports FCC action to authorize unlicensed use of the 6 GHz band to keep pace with ever-growing demand for wireless broadband. NCTA’s members operate some of the largest Wi-Fi networks in the country, in homes, small businesses, enterprises, and public spaces. As of June 2017, NCTA’s members had deployed 19.7 million public Wi-Fi access points, which supported an average of nearly 2.5 billion active sessions carrying 191 petabytes of data per month between January and June 2017. These Wi-Fi networks play an important role in keeping people connected, including in the wake of natural disasters. Recognizing that Wi-Fi networks can help people to contact emergency services and loved ones when other means of

⁷ See *id.* ¶¶ 17-18 (describing proposals by the Fixed Wireless Communications Coalition to modify the FSS and FS coordination procedures in 3.7-4.2 GHz and seeking comment on “whether to alter our existing service rules to permit more intensive fixed use in the 3.7-4.2 GHz band” including “specific changes to coordination requirements”).

⁸ Letter from Danielle J. Piñeres, Associate General Counsel, NCTA, to Marlene H. Dortch, Secretary, FCC, RM-11778, at 1-2 (filed Feb. 3, 2017).

communication are unavailable, NCTA's member companies opened up thousands of their hotspots in Texas and Florida to non-customers at no cost after hurricanes Harvey and Irma.⁹

The unlicensed spectrum bands that these extensive Wi-Fi networks rely upon—primarily the 2.4 GHz band and the U-NII-1 and U-NII-3 portions of the 5 GHz band—are becoming increasingly congested.¹⁰ Based on traffic and busy-hour forecasts, one recent study estimates that the United States will require between 788 MHz and 1.6 GHz of new, contiguous unlicensed spectrum between 2 and 10 GHz by 2025 just to support growing demand for Wi-Fi.¹¹ This should come as no surprise, given Cisco's forecast that the total data carried over U.S. Wi-Fi networks will increase from 10.9 exabytes per month in 2016 to 34 exabytes per month by

⁹ Comcast opened approximately 137,000 Xfinity hotspots in Florida and 53,000 Xfinity hotspots in the Houston area. *Comcast Opens Free Xfinity WiFi Service Across Florida to Aid Residents, Emergency Personnel*, BUSINESSWIRE (Sept. 6, 2017), <http://www.businesswire.com/news/home/20170906006502/en/Comcast-Opens-Free-Xfinity-WiFi-Service-Florida>; Comcast, *Comcast NBCUniversal Supports Hurricane Harvey Relief Efforts* (Aug. 29, 2017), <http://corporate.comcast.com/comcast-voices/comcast-nbcuniversal-supports-hurricane-harvey-relief-efforts>. Charter made available more than 32,000 hotspots in Florida. Christopher Spata, *Spectrum and Xfinity Wifi Hotspots Are Free for Everyone In Preparation for Hurricane Irma*, TAMPA BAY TIMES (Sept. 8, 2017), <http://www.tampabay.com/blogs/timesnews/spectrum-wifi-hotspots-are-free-for-everyone-in-preparation-for-hurricane/2336760>. Altice opened up its Suddenlink stores in the Houston area to provide free Wi-Fi for anyone in need. *Altice USA Extends Help in Texas*, MULTICHANNEL NEWS (Aug. 29, 2017), <http://www.multichannel.com/news/technology/altice-usa-extends-help-texas/414869>.

¹⁰ See Cisco, *Enterprise Best Practices for iOS Devices on Cisco Wireless LAN*, at 4, 44 (Nov. 2016), https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/technotes/8-3/Enterprise_Best_Practices_for_Apple_Devices_on_Cisco_Wireless_LAN.pdf; Terry Ngo, *Why Wi-Fi Stinks—And How to Fix It*, IEEE Spectrum (Jun. 28, 2016), <https://spectrum.ieee.org/telecom/wireless/why-wifi-stinksand-how-to-fix-it> (IEEE Spectrum Article).

¹¹ Quotient Associates, *Wi-Fi Spectrum Needs Study: Final Report*, at 26, 28-29 (Feb. 2017), https://www.wi-fi.org/downloads-registered-guest/Wi-Fi%2BSpectrum%2BNeeds%2BStudy_0.pdf/33364 (Wi-Fi Spectrum Needs Study).

2021.¹² Moreover, the latest Wi-Fi standard, IEEE 802.11ac, and the coming version, 802.11ax, make extensive use of wide-bandwidth channels (up to 160 MHz). These wide channels mean faster speeds and better battery life on Wi-Fi-enabled devices, but also mean fewer total Wi-Fi channels on which to operate.¹³ Service providers and consumers will continue to upgrade legacy devices to equipment capable of using higher bandwidths and subscribers will continue to use data-heavy applications like streaming video, augmented reality/virtual reality, and others, all contributing to 5 GHz congestion.

Of course, increasing use of unlicensed bands by other technologies will also contribute to the unlicensed spectrum crunch. As carriers ramp up their deployments of LTE-U and LAA¹⁴—LTE technologies that operate in unlicensed spectrum—this will further increase congestion (even putting aside the question whether such technologies fairly coexist with Wi-Fi). Some forecasts estimate that carriers will use LAA and LTE-U to shift up to 60 percent of mobile data transmissions from licensed to unlicensed spectrum over the next few years.¹⁵

¹² Cisco, *VNI Forecast Highlights Tool* (2017), https://www.cisco.com/c/m/en_us/solutions/service-provider/vni-forecast-highlights.html (select “United States” from the “North America” drop-down menu, then select the radial button for “Wired Wi-Fi Mobile Traffic” and view the “Fixed/Wi-Fi” section).

¹³ IEEE Spectrum Article.

¹⁴ Monica Allevan, *T-Mobile Takes LTE-U Crown, Launches In Select Locations*, FIERCE WIRELESS (Jun. 26, 2017), <http://www.fiercewireless.com/wireless/t-mobile-takes-lte-u-crown-launches-select-locations>; Monica Allevan, *AT&T Secure In Decision to Go With LAA and Skip LTE-U*, FIERCE WIRELESS (July 13, 2017), <http://www.fiercewireless.com/wireless/at-t-secure-decision-to-go-laa-and-skip-lte-u>.

¹⁵ IEEE Spectrum Article.

The wireless industry also agrees that unlicensed bands will form a critical input to new 5G networks.¹⁶ After surveying 65 companies from across the world, the Wireless Broadband Alliance recently concluded that “5G [will] be[] a combination of licensed and unlicensed technologies,” with Wi-Fi technology playing a leading role.¹⁷ Cisco has noted that, “[t]he integration of unlicensed network technologies such as Wi-Fi for use with conventional licensed cellular networks is now largely accepted as an essential ingredient of mobile network evolution.”¹⁸ Nokia has echoed these comments, stating that “[5G] will be a combination of existing [Radio Access Technologies (RATs)] in both licensed and unlicensed bands, plus one or more novel RATs optimized for specific deployments, scenarios and use cases.”¹⁹ This confluence of events—growing demand for Wi-Fi; new, wide-bandwidth Wi-Fi channels; deployment of LTE technologies in unlicensed bands; and ongoing development of 5G—suggests that the Commission issued its mid-band NOI at just the right time. While it is yet to be determined if these various technologies can share unlicensed mid-band spectrum, the Commission should reiterate its support for coexistence, where feasible, and urge all stakeholders to work toward this goal in good faith.

¹⁶ See, e.g., *5G to Embrace Unlicensed Bands and Wi-Fi*, Mobile World Live (Feb. 24, 2016), <http://www.mobileworldlive.com/mwc16-articles/5g-to-embrace-unlicensed-bands-and-wi-fi>.

¹⁷ Wireless Broadband Alliance, *5G Networks: The Role of Wi-Fi and Unlicensed Technologies*, at 3 (Sept. 2017), <https://www.wballiance.com/resources/wba-white-papers>.

¹⁸ Cisco, *Cisco 5G Vision Series: Licensed, Unlicensed, and Access-Independent Networks*, at 1 (May 23, 2016), <https://www.cisco.com/c/dam/en/us/solutions/collateral/service-provider/ultra-services-platform/5g-vision-series.pdf>.

¹⁹ Nokia, *FutureWorks Looking Ahead to 5G: Building a Virtual Zero Latency Gigabit Experience*, at 3 (2014), http://www.5gamericas.org/files/3614/3898/6583/Nokia_White_Paper_-_Looking_ahead_to_5G.pdf.

Not only did the Commission choose the right time to explore new unlicensed bands, it correctly identified 6 GHz as a promising candidate,²⁰ provided that studies demonstrate that unlicensed users can protect incumbent operations. The 1200 MHz of contiguous 6 GHz spectrum is uniquely well-suited for unlicensed. This spectrum could support up to seven 160 MHz gigabit Wi-Fi channels, significantly increasing the total number of available wide-bandwidth channels. As the Commission correctly points out, 6 GHz is also “close to spectrum that [it has] designated for Unlicensed National Information Infrastructure (U-NII) use, [such that] it may be possible and technically beneficial for U-NII devices to operate in both this band and the existing U-NII spectrum.”²¹ Proximity to the existing unlicensed 5 GHz band likely means it will be faster and less costly to implement 6 GHz in new unlicensed devices as compared to far-flung frequencies. NCTA understands that existing radio components could simply be modified to permit operation in the new band rather than new components developed.

Authorizing unlicensed use of 6 GHz would not, as some have suggested,²² obviate the need for additional unlicensed spectrum in the adjacent 5.9 GHz band. First, after four years to develop a record, the Commission is well-positioned to act on 5.9 GHz in the near-term to help alleviate the pressing need for more unlicensed spectrum. Second, the 6 GHz band becomes *more* valuable for unlicensed if the Commission also authorizes unlicensed use of 5.9 GHz. Opening up 5.9 GHz would help bridge the divide between the widely used U-NII-3 band and potential new unlicensed spectrum at 6 GHz, and enable additional wide-bandwidth channels.

²⁰ See *NOI* ¶¶ 29, 36.

²¹ *Id.* ¶ 26.

²² Letter from Hilary M. Cain, Director, Technology and Innovation Policy, Toyota, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 2 (filed Sept. 20, 2017).

Although detailed sharing proposals, interference analysis, and testing, if appropriate, remain necessary precursors to authorizing unlicensed devices to share 6 GHz with incumbent users, including C-band satellite operations and CARS/BAS licensees, NCTA believes that there is reason for optimism. Unlicensed devices have a successful track record of sharing spectrum with other users on a non-interference basis. Here, the Commission should consider whether sharing solutions can both fully protect satellite and BAS/CARS incumbents from harmful interference and facilitate robust Wi-Fi access to the spectrum. Because different incumbents operate in different portions of the 6 GHz band,²³ different coexistence solutions may prove to be appropriate for different frequency ranges between 5.925 and 7.125 GHz. NCTA urges the Commission to move forward quickly in the portions of 6 GHz where coexistence may prove easier to tackle and take its time where sharing questions prove more difficult to resolve.

IV. CABLE OPERATORS DEPLOY DFS-READY EQUIPMENT, BUT DFS-ENCUMBERED BANDS ARE NO SUBSTITUTE FOR SPECTRUM AVAILABLE UNDER MORE FAVORABLE TECHNICAL RULES

Cable operators have invested substantial resources to deploy some of the largest Wi-Fi networks in the country. The industry's operational experience suggests that bands encumbered by DFS, although used today, are no substitute for unlicensed bands made available pursuant to more favorable technical rules.

DFS is a technology that enables Wi-Fi devices to share spectrum with federal government radar, but imposes significant restrictions on Wi-Fi device utilization. Generally

²³ Unlicensed devices would share the 5925-6425 MHz band primarily with FSS C-band uplink and fixed point-to-point links, while in the 6425-6525 MHz and 6875-7125 MHz bands, unlicensed would share with other services, including mobile broadcast auxiliary service and cable television relay service stations. *See* 47 C.F.R. § 2.106.

speaking, a DFS-enabled Wi-Fi device operating in the U-NII-2A (5250-5350 MHz) or U-NII-2C (5470-5725 MHz) bands must listen for these radars, vacate the channel on which it is operating if it detects a radar transmission, and then rescan to find a new channel on which to operate.²⁴ This listen-detect-and-vacate method limits the utility of DFS bands for certain applications, including those that are most susceptible to loss of service, such as video calling, online gaming, virtual private network connections, or wireless augmented reality/virtual reality. The FCC's technical rules for U-NII-2 also restrict the transmit power of Wi-Fi devices to 250 mW, compared to 1 W permitted for Wi-Fi access points operating in the U-NII-1 and U-NII-3 bands, further limiting the U-NII-2 band's utility for outdoor applications.²⁵

Because of the operational limitations associated with DFS spectrum, one can easily see why a network operator would prefer, other things being equal, to use bands unencumbered by DFS that also permit higher power operations. Acknowledging this reality, many vendor implementations prefer the use of U-NII-1 and U-NII-3 channels over U-NII-2 in the equipment that NCTA's members deploy. As a result, although most of NCTA's members currently deploy equipment certified to operate in DFS bands, this equipment may not select U-NII-2 channels because the access points favor finding a U-NII-1 or U-NII-3 channel on which to operate. This concentrates Wi-Fi usage in U-NII-1 and U-NII-3, and leads to lighter use of U-NII-2 across the cable industry. A recent study by Quotient Associates for Wi-Fi Alliance suggests that the same is true across the broader Wi-Fi ecosystem.²⁶

²⁴ 47 C.F.R. § 15.407(h)(2).

²⁵ Compare 47 C.F.R. § 15.407(a)(2) with § 15.407(a)(1) and § 15.407(a)(3). Access points operating outdoors in U-NII-1 must employ an antenna restriction, while client devices operating in U-NII-1 are restricted to 250 mW.

²⁶ Wi-Fi Spectrum Needs Study at 23-24.

Although changing consumer demands, spectrum environment, and technology may make U-NII-2 more attractive, particularly for indoor operation, DFS-encumbered U-NII-2 spectrum will never be a substitute for unlicensed bands governed under more favorable technical rules. Reduced technical complexity and higher power limits enable a broader range of existing and innovative applications and reduce equipment and operating costs. As noted above, the U.S. requires access to additional, contiguous unlicensed mid-band spectrum under favorable technical rules by 2025 just to meet projected demand for Wi-Fi. As the Commission explores opportunities for new unlicensed bands in this and other proceedings, it should strive for rules that closely mirror those that have made U-NII-1 and U-NII-3 a resounding success.

V. CONCLUSION

The cable industry continues to rely heavily on satellite C-band spectrum to ensure that innovative new content reaches customers. As the Commission considers flexible use options for mid-band spectrum, NCTA requests that it also carefully consider the potential impact to television distribution and other important C-band services. The Commission should not proceed to authorize new uses unless the record demonstrates, through interference analyses and testing, if appropriate, that such uses will not cause harmful interference to C-band incumbents. If incumbent operations can be protected, NCTA supports authorizing unlicensed use of the 6 GHz band, which is well-positioned to help address the unlicensed spectrum crunch, particularly if the Commission also authorizes unlicensed use of the 5.9 GHz band.

Respectfully submitted,

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