

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Expanding Flexible Use of the 3.7 to 4.2 GHz Band

GN Docket No. 18-122

Petition for Rulemaking to Amend and Modernize
Parts 25 and 101 of the Commission's Rules to
Authorize and Facilitate the Deployment of
Licensed Point-to-Multipoint Fixed Wireless
Broadband Service in the 3.7-4.2 GHz Band

RM-11791

Fixed Wireless Communications Coalition, Inc.,
Request for Modified Coordination Procedures in
Band Shared Between the Fixed Service and the
Fixed Satellite Service

RM-11778

**COMMENTS OF QUALCOMM INCORPORATED
on July 19, 2019 PUBLIC NOTICE**

Qualcomm is pleased to provide these comments on the FCC's July 19, 2019 Public Notice requesting further input on certain issues relevant to the agency's proposal to open up the 3.7 to 4.2 GHz band for flexible terrestrial uses.¹ To reiterate Qualcomm's overarching view in this proceeding, we support timely FCC action to open the entire 500 MHz-wide swath of much-needed exclusively licensed mid-band spectrum for 5G services as soon as possible.² The Commission's *NPRM* appropriately acknowledges the explosive growth in wireless communications services and the concomitant need to make additional mid-band mobile

¹ See FCC Public Notice, DA 19-678, "Wireless Telecommunications Bureau, Int'l Bureau, Office of Engineering and Technology, and Office of Economics and Analytics Seek Additional Comment In 3.7-4.2 GHz Band Proceeding," GN Docket No. 18-122 (July 19, 2019).

² See *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, FCC 18-91, GN Docket No. 18-122 (July 13, 2018) ("*NPRM*"); Qualcomm Comments (filed Oct. 29, 2018) and Reply Comments (filed Dec. 11, 2018).

spectrum available for flexible uses.³ The mobile wireless industry has explained repeatedly that timely action by the FCC and industry to open this band for flexible use is essential, so it can be incorporated into America's 5G mobile broadband networks as soon as possible.⁴ Use of the 3.7 to 4.2 GHz mid-band spectrum along with other licensed mid-band spectrum, such as Citizens Broadband Radio Service ("CBRS") band at 3.55-3.7 GHz, the 2.5 GHz band, and new spectrum directly below the CBRS band that is under active study by NTIA, along with low-band (sub-1 GHz) and high-band (millimeter wave) spectrum is crucial for enabling 5G to reach its full potential for the American public.

As explained herein, the FCC must reject the out-of-band emissions ("OOBE") limits the C-Band Alliance ("CBA") seeks to impose on mobile devices using the 3.7 to 4.2 GHz band because the CBA limits would require mammoth reductions in mobile transmit power levels and cripple 5G in this band. The CBA offers zero technical support for its proposed limits, which are orders of magnitude lower than the emissions levels allowed for spurious signals from many millions of intentional and unintentional emitters under longstanding FCC rules and are far lower than the limits the FCC adopted for the CBRS band years ago to protect the very same FSS receivers at issue here.

Notably, CBA member companies Intelsat and SES Americom supported the less onerous emissions levels that apply just above the 3.5 GHz CBRS band to protect these same

³ See *NPRM* at ¶¶ 1-8.

⁴ See, e.g., CTIA Comments, AT&T Comments, T-Mobile Comments, Verizon Comments (filed Oct. 29, 2018); see also Nokia Comments, Ericsson Comments, and Qualcomm Comments (filed Oct. 29, 2018).

satellite receivers.⁵ The CBA also completely ignores the negative implications for global harmonization given the more reasonable OOB limits that apply to this mobile spectrum band elsewhere around the world.

Qualcomm submits herein data showing the extreme, truly drastic, power reduction that 5G mobile devices would be forced to make in order to comply with the severe, unsupported OOB limits proposed by CBA. There is no basis for the Commission to adopt the CBA proposal, particularly in light of the data showing the proposal's adverse impact on 5G.

I. The CBA's Proposed OOB Limits Would Cripple 5G in the Band

The FCC must not adopt the extreme OOB levels the CBA wants to apply to new flexible use licensees in the 3.7 GHz band, ostensibly to protect the remaining satellite incumbents once the agency opens the band to licensed flexible use, because those limits will cripple 5G technology deployments in the band.

With zero support for several years now, the CBA has proposed and is still seeking the following OOB levels for mobile devices: -28 dBm/MHz at the band edge; -55 dBm/MHz between 20 and 40 MHz from the band edge; and -65 dBm/MHz beyond 40 MHz from the band edge.⁶ The CBA limits are orders of magnitude lower than the Part 15 general radiated emissions level of -41.3 dBm/MHz that applies to spurious emissions from millions and millions of devices in operation today including unintentional radiators, such as computers, printers, and RF receivers, as well as intentional radiators, such as keyless remote entry systems, Wi-Fi

⁵ See *Promoting Investment in the 3550-3700 MHz Band*, Report and Order at ¶ 131, GN Docket No. 17-258, FCC 18-149 (Oct. 24, 2018); see also Joint Reply Comments of Intelsat and SES Americom at 2, GN Docket No. 17-258 (filed Jan. 29, 2018).

⁶ See C-Band Alliance Comments (filed Oct. 29, 2018), Technical Annex at 10-11; C-Band Alliance *Ex Parte* letter (May 13, 2019) and attached Presentation "Overview of CBA-Proposed Rules" at 13.

equipment, and satellite ground station transmitters.⁷ The CBA offers no explanation why it requires mobile device signal attenuation well below the levels at which hundreds of millions of other ubiquitously deployed devices are allowed today to emit throughout the entire C Band.

The mobile device or user equipment (“UE”) OOB limits the CBA asks the Commission to impose would require massive reductions in mobile transmit power levels and thus cripple 5G in this band. As detailed below, imposing these limits would force 5G mobile devices operating in the new 3.7 GHz flexible use band to reduce in-band transmit power by at least 15 dB for an adjacent 20 MHz channel, at least 20 dB for an adjacent 40 MHz channel, and even greater attenuation for operating channels wider than 40 MHz — the optimal channel bandwidths for 5G.

The results of Qualcomm’s analysis of the mobile device signal attenuation (*i.e.*, back-off) required to comply with the CBA proposed limits are presented below. We analyzed the two 5G signal waveforms: DFT-s-OFDM (*i.e.*, Discrete Fourier Transform-spread-Orthogonal Frequency Division Multiplexing), and CP-OFDM (*i.e.*, Cyclic Prefix-Orthogonal Frequency Division Multiplexing). For a 20 MHz channel located at the upper edge of the new 3.7 GHz band, complying with the CBA-proposed limits would necessitate 15 to 16.5 dB of signal attenuation for operations with a full resource allocation and 13 dB of signal back-off for operations with a low resource allocation, relative to a maximum power level of 23 dBm EIRP. A 40 MHz channel located at the upper edge of the new 3.7 GHz band would require much greater transmit signal attenuation: 20 to 21 dB for operations with a full resource allocation and 23 dB for operations with a low resource allocation, relative to a maximum allowed power level

⁷ See 47 C.F.R. §§ 15.019 & 15.209.

of 23 dBm EIRP. Operations with wider channelization, such as the 50 MHz or 100 MHz channels that 5G was designed to support, would require even greater signal back-off.

CBA Proposed Limits - Power Back-off, dB				
Channel Bandwidth	Full Resource Alloc.		Low Resource Alloc.	
	DFT-s-OFDM	CP-OFDM	DFT-s-OFDM	CP-OFDM
40 MHz at channel edge	20	21	23	23
20 MHz at channel edge	15	16.5	13	13

The level of attenuation required to comply with the CBA limits is significantly worse, on the order of ten times worse, when compared to the attenuation required to comply with the emission limits that apply above the 3.5 GHz band under the FCC's CBRS rules.⁸ These data are provided below.

3.5 GHz CBRS Band Limits - Power Back-off, dB				
Channel Bandwidth	Full Resource Alloc.		Low Resource Alloc.	
	DFT-s-OFDM	CP-OFDM	DFT-s-OFDM	CP-OFDM
40 MHz at channel edge	10	11.5	10	11.5
20 MHz at channel edge	4.5	6	4.5	6

Thus, there can be no question that the levels of attenuation required to comply with the CBA limits would have a drastically negative impact on 5G in the 3.7 GHz spectrum band, particularly compared to other spectrum bands, including the immediately adjacent CBRS band.

In addition, although the foregoing data focus on the adverse impact of the CBA proposal on 5G operating in the uppermost channel in the new 3.7 GHz band, the CBA limits also would impose signal back-off on lower channels and also raise additional technical issues that could jeopardize global harmonization of devices that operate in this band.

⁸ See 47 C.F.R. § 96.41(e)(2) (emissions shall not exceed -25 dBm/MHz above 3710 MHz and -40 dBm/MHz above 3720 MHz).

Moreover, imposing a huge guard band in the 3.7 GHz band between 5G operations and the remaining satellite users to achieve the unnecessary OOB limits proposed by the CBA would not be an option because of the limited amount of spectrum the CBA is proposing to make available for 5G in the first place. Finally, as AT&T recognizes, CBA's proposed OOB signal attenuation levels for UEs are "considerably greater than what the CBA has proposed for base station equipment where filter size and cost are relatively less important and even orders of magnitude lower than the spurious emissions levels permitted under the Part 15 FCC rules for intentional and unintentional radiators"⁹ as Qualcomm notes above.

II. CBA's Members And Other Satellite Users Favor Much Less Stringent OOB Limits

The CBA offers no explanation why the OOB levels in the FCC's rules which apply today to emissions just above the CBRS Band to protect C-band satellite receivers¹⁰ will not protect those same receivers if and when they are confined to the upper portion of the 3.7 to 4.2 GHz band (assuming they are not moved completely out of the 3.7 GHz band¹¹). Indeed, Qualcomm believes it should be possible to impose the typical -13 dBm/MHz OOB limit that applies to most other mobile bands on new 3.7 GHz band flexible use licensees in areas where there are no adjacent C-band satellite operations.

⁹ See AT&T *ex parte* letter at 16 (filed May 23, 2019).

¹⁰ See 47 C.F.R. § 96.41(e)(2); see also *Promoting Investment in the 3550-3700 MHz Band*, GN Docket No. 17-258, Report and Order, FCC 18-149 (rel. Oct. 24, 2018), Appendix A, new Rule Section 96.41(e), 3.5 GHz Emissions and Interference Limits.

¹¹ Qualcomm encourages the Commission to continue exploring means of opening the entire 3.7 to 4.2 GHz band for exclusive, flexible use licensing. If all satellite users are relocated out of the C band or transitioned to fiber, Qualcomm agrees with T-Mobile and the Aviation Associations that aviation operations above 4.2 GHz need to be protected against any potential harmful interference from new flexible use operations that would be directly adjacent to the 4.2 GHz band. See T-Mobile Dec. 11, 2018 Reply Comments at 42; Aviation Associations June 19, 2019 *Ex Parte* letter at 3.

As noted above, CBA member companies Intelsat and SES Americom supported the less stringent 3.5 GHz CBRS OOB levels in comments filed last year.¹² Also, NCTA – The Internet & Television Association, whose members rely heavily upon satellite operations in the 3.7 to 4.2 GHz band, has recommended that the FCC adopt limits no tighter than the limits that apply to CBRS band emissions at the boundary separating new flexible use operations and remaining satellite incumbents.¹³ Finally, the ACA Connects Coalition, which represents incumbent C-band earth station users and wireless providers, strongly opposes the CBA emissions proposal for UEs.¹⁴ For all of these reasons, the FCC should not adopt the CBA proposal.

Finally, as Qualcomm previously has explained, when the FCC authorizes new flexible use licensees in the 3.7 to 4.2 GHz band, it should remove the OOB emissions restrictions that apply just above the 3.7 GHz band edge of the CBRS band.¹⁵ The satellite receivers these limits are intended to protect will no longer occupy the lower portion of the 3.7 to 4.2 GHz band, so the -25 dBm/MHz and -40 dBm/MHz limits that apply at 3710 MHz and 3720 MHz, respectively, would no longer serve their intended purpose and should be excised from the FCC’s rules.

¹² See n.5, *supra*.

¹³ See NCTA – The Internet & Television Association *ex parte* letter at 4 (filed July 2, 2018) (FCC should propose the 3.5 GHz band OOB limits and seek comment on means of enabling relaxation of those limits).

¹⁴ See ACA Connects, CCA, and Charter *ex parte* letter at 7 (filed July 2, 2019) (“UE emission mask requirements proposed by the CBA to protect adjacent satellite services ... are neither realistic nor reasonable and could cripple deployment of 5G services in the band”).


¹⁵ See *NPRM* at ¶ 169. See Qualcomm Comments at 9; Qualcomm Reply Comments at 4-5.

CONCLUSION

Qualcomm encourages the FCC to move forward to open the 3.7 to 4.2 GHz band for 5G in accordance with our filings in this docket. To ensure successful, long-term deployments of 5G technology, U.S. operators need additional licensed mid-band spectrum for 5G-based enhanced mobile broadband, massive IoT, and mission critical services as soon as possible, and the 3.7 to 4.2 GHz band provides a key addition to such spectrum resources.

Respectfully submitted,

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