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

In the Matter of	)	
	)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band	)	GN Docket No. 18-122
	)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	GN Docket No. 17-183 (Inquiry Terminated as to 3.7-4.2 GHz)
	)	
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

REPLY COMMENTS OF THE AMERICAN CABLE ASSOCIATION

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December 11, 2018

TABLE OF CONTENTS

I. INTRODUCTION 1

II. THE COMMISSION SHOULD REFARM UP TO 50 MHz FOR 5G BY A MECHANISM THAT IS BASED ON, OR AT LEAST FULLY TAKES INTO ACCOUNT, USER RIGHTS 3

III. CBA'S RECOMMENDATION RAISES LEGAL AND COMPETITIVE CONCERNS 11

IV. AN AUCTION MECHANISM IS GENERALLY WITHIN THE COMMISSION'S AUTHORITY 15

V. IN ANY "MARKET-BASED" APPROACH, USERS' CONSENT SHOULD BE REQUIRED 16

VI. POINT-TO-MULTIPOINT SERVICE SHOULD NOT BE INTRODUCED IN THE BAND EXCEPT UNDER STRICT CONDITIONS 17

VII. CONCLUSION 21

ATTACHMENT: PROFESSOR WILLIAM ROGERSON PAPER

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REPLY COMMENTS OF THE AMERICAN CABLE ASSOCIATION

I. INTRODUCTION

The comments shed significant light on the correct path to be followed by the Commission to balance and reconcile several conflicting objectives in connection with the 3.7-4.2 GHz band—a band that is heavily used today by American Cable Association ("ACA") members and others to receive video content by satellite, and that also holds possible but untested promise for use in other services.

No more than 50 MHz to be refarmed. The Commission should attempt to clear at most 50 MHz of spectrum for 5G. Replicating the lost spectrum by means of building additional satellites to use more intensively the remaining frequencies seems conceivable for a 50 MHz amount but difficult to credit for 150 or 200 MHz.

The process should take into account all stakeholder rights. Perhaps most importantly, the Commission should fully take into account the rights not only of satellite operators but also

of users. The 5G refarming could be effected by an auction mechanism that compensates not only satellite operators but also users as well as the public; the "holdout" problem, which is presented by CBA as the most significant hurdle to such a mechanism, is in fact resolvable by properly designed auctions.

In distributing a portion of the proceeds from an auction to FSS users and FSS operators, the FCC should proceed from the principle that both categories of incumbents should be compensated for all of their costs, including prior investment and opportunity costs. Contrary to CBA's argument,[1] users should not be limited to their "reconfiguration and relocation costs."

The idea of dispensing with an FCC auction and entrusting just a coalition of satellite operators to conduct a private one instead is fraught with competitive concerns and legal problems arising both under the antitrust laws and the Communications Act. But, if the FCC were nevertheless to allow a satellite operator coalition to negotiate divestitures of C-band rights, this approach should be contingent on a coalition of users having a seat at the negotiating table, and on an agreement reached both by operators and users on the terms for relinquishing their use of a portion of the spectrum. The Commission should also take measures to avert the risks to competition (including higher prices for C-band services in light of the reduced bandwidth available and the risk of collusion) that the coalition approach entails.

No spectrum divestitures and new sharing obligations at the same time. ACA believes that it would be impossible, or at least detrimental to the public interest, to attempt to have it all. The FCC should not take away part of the Fixed-Satellite Service ("FSS") spectrum to earmark it

[1] Comments of the C-Band Alliance, GN Docket No. 18-122, at ii (Oct. 29, 2018) ("CBA Comments").

for 5G, and then shoehorn yet another terrestrial point-to-multipoint ("P2MP") service in the spectrum that remains for satellite backhauls.

II. THE COMMISSION SHOULD REFARM UP TO 50 MHz FOR 5G BY A MECHANISM THAT IS BASED ON, OR AT LEAST FULLY TAKES INTO ACCOUNT, USER RIGHTS

Amount of spectrum to be refarmed. If the Commission decides to reallocate the lower part of the spectrum for 5G, it should start small, reallocating up to the lower 50 MHz of the band in geographic regions where the spectrum is most highly valued. The Commission should resist, at least in the first instance, calls to refarm as much as 150 or 200 MHz of the spectrum. CBA and its satellite operator members claim that the construction and launch of new satellites will make up for the 150 or even 200 MHz loss.[2] ACA is skeptical about these claims. To begin with, the satellite coalition's assessment as to how many satellites would be necessary to make up for the deficit has not appeared to vary significantly between the 150 MHz and the 200 MHz loss scenarios. This is somewhat strange, as one would assume that the satellite operators would not propose to launch more satellites than necessary in the event of a 150 MHz refarming; therefore, one would expect the loss of an additional 50 MHz to require additional satellite construction in order to fully compensate for the forfeited spectrum.

Moreover, some simple calculations suggest that the loss of 200 MHz requires many more new satellites than a deficit of 50 MHz. In the attached paper, Professor William Rogerson of Northwestern University calculates how many new satellites would be required to make up for the spectrum loss and preserve the current satellite capacity. The current number of C-band operational transponders is uncertain, as CBA has not released that information. There are

[2] CBA Comments at 18.

approximately 24 operational satellites today,[3] which, at 24 transponders per satellite, would translate into 576 transponders. The Kerrisdale Report estimates that about 540 transponders on these 24 satellites are operational today.[4]

Accordingly, Professor Rogerson has made two calculations: how many new satellites would be required to receive total C-band satellite capacity of 576 transponders in the event of a spectrum loss ranging from 50 MHz to 200 MHz; and how many new satellites would be required to preserve total C-band capacity of 540 transponders for the same range of spectrum loss. His conclusions? For a loss of 200 MHz, 16 new satellites would be needed to preserve total operational capacity of 576 transponders, and 15 new satellites would be needed to preserve total operational capacity of 540 transponders.

Protecting consumers. These calculations strongly indicate that a much lower number of new satellites to be launched means either that the number or resolution of video networks that can be backhauled by satellite would be reduced, and/or that the number of competitive choices would go down. Specifically, while previously a programmer could contract with either Intelsat or SES for the transport of its video channels, the reduction in total satellite capacity would likely mean that, in some cases, that programmer would only have one choice. The harm to consumers would be substantial in all cases—reduced number of channels, reduced resolution quality, foregone opportunity for resolution improvements such as 4K, and/or higher prices. The Commission should not accept any of these outcomes.

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[3] *See* Comments of the American Cable Association, GN Docket No. 17-183, at 6 & Exhibit 3 (Oct. 2, 2017) ("ACA NOI Comments").

[4] *See* Kerrisdale Capital Management, LLC, *Intelsat S.A. & SES S.A.: To the Moon*, at 31 (June 2018), https://www.kerrisdalecap.com/wp-content/uploads/2018/06/Intelsat-and-SES.pdf ("Kerrisdale Report").

The risk of harm to consumers is far from academic. The experience of Eagle Communications ("Eagle"), an ACA member, with Wi-Max is instructive for the perils of out-of-band emissions from a ubiquitous service, casts doubt on the effectiveness of filters, and militates in the direction of refarming only a small amount of spectrum for 5G and preserving a guard band much broader than what CBA now claims is enough.[5] The unlicensed operations that the Commission has allowed in the 3,550-3,700 MHz band in the Citizens Broadband Radio Service proceeding[6] have been the source of debilitating problems for the reception of video backhauls by Eagle's cable headends in Kansas, Nebraska and Colorado.

Eagle has experienced tiling as a result of Wi-Max operations, affecting as many as three satellite dishes at the same headend, as many as five to six video channels on one system, and precipitating substantial customer complaints. The symptoms of the problem are easy to diagnose, but solutions are hard and far from automatic. First, Eagle must identify the frequency and location of the interfering operation in order to determine the proper class of filter or shielding solution. Thereafter, Eagle must find the product that works best within its class because not all filters are the same. For Eagle, this has precipitated a trial-and-error process, which involves the payment of large amounts (ranging from $600 to more than $1,000) for each filter without any assurance that it will be effective. Filters have proven of dubious effectiveness. For example, when Eagle has used a "band pass" filter designed to allow 3.7-4.2 GHz transmission to "pass," it has discovered that a Wi-Max signal emanating from, say, 3.6

[5] CBA Comments at 5 ("[T]he C-Band Alliance and its satellite members have agreed to make available up to 200 MHz (3.7 GHz to 3.9 GHz), including a 20 MHz guard band, for terrestrial mobile use, based on the commitment to clear the spectrum in 18-36 months.").

[6] 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 (2015).

GHz, may nevertheless overcome the defenses of the filter and get through, particularly if it is two or three times more powerful than the victimized video signal. Eagle has thus been forced to experiment with more stringent filters that only pass the 3,780 to 4,200 MHz band. This in turn suppresses reception of wanted video signals—those transmitted by the lower C-band satellite transponders, interfering with the enjoyment of the video service paid for by Eagle's customers.

The moral? As ACA has cautioned,[7] the Commission should be mindful to first do no harm. Too large a spectrum forfeiture, or too narrow a guard band, would only aggravate these problems and leave distributors and users with no recourse to a different C-band transponder in the event of interference.

Refarming method. The refarming of C-band spectrum for 5G should take into account the rights of earth station operators. To be sure, the possibility of a mechanism based on user rights has not escaped the Commission's attention. In connection with incentive auctions, the NPRM asks whether "provision of supply by licensed earth stations can substitute for provision by FSS operators."[8] In connection with capacity auctions, too, the NPRM asks: "[a]t the time of any incentive auction, could satellite customers or earth stations in their own right be eligible to offer capacity?"[9]

In ACA's view, the answer is that, even though the disposition of satellite operator rights may be simpler, user rights should be fully taken into account in the refarming process, and care

[7] ACA NOI Comments at 3-11.

[8] Expanding Flexible Use of the 3.7 to 4.2 GHz Band, GN Docket No. 18-122, Order and Notice of Proposed Rulemaking, 2018 WL 3435167, *31 ¶ 105 (2018) ("*NPRM*").

[9] *NPRM* *31 ¶ 106. The *NPRM* continues: "[f]or example, could they make available capacity through mechanisms such as substituting services (e.g. fiber) to fulfill their capacity needs, reducing the amount or quality of programming distributed, or using greater compression to reduce the capacity required to carry a given amount of programming or data?" *Id.*

should be taken that the proceeds from any such disposition, whether by auction or by another mechanism, should be apportioned equitably between operators and users.

The CBA opposes an FCC auction and claims that its particular variant of a private sale is necessary because of the "holdout" problem: because the C-band rights are non-exclusive, the spectrum would not be cleared if any one licensee holds out. To put the point simply, if SES were willing to forfeit part of its license for $1 million, and Intelsat wanted $10 million, SES's willingness would not be enough to clear the spectrum, as the holdout Intelsat's rights would persist. Specifically, the Brattle Report claims that the need for CBA's "market-based approach" arises from what the Brattle Group describes no fewer than fourteen times as a "regulatory failure,"[10] and at least twice as "ill" or "poorly defined" rights of the license holder.[11] This is incorrect on all counts; the Brattle Report prescribes the wrong solution because it is solving the wrong problem. There is no regulatory failure to be fixed in the C-band, and the FCC is not guilty of ill-defined C-band rights. The rights in question were well-defined for the use that they allowed, and the holdout issue that is implicated in refarming can be addressed by means other than CBA's way of conducting a private sale.

The geometry of geostationary satellite locations allows many satellites to reuse the same spectrum so long as each is removed from each other at no less than two degrees on the

[10] *See, e.g.*, Coleman Bazelon, Maximizing the Value of the C-Band, The Brattle Group, at iii, 8-9 (Oct. 29, 2018) (attached as Appendix A to Joint Comments of Intel Corp., Intelsat License LLC, and SES Americom, Inc., GN Docket No. 18-122 (Oct. 29, 2018)) ("Brattle Report").

[11] *See, e.g., id.* at 24 ("The Market-Based Approach eliminates problems due to poorly defined legal rights and the public goods issues that arise"); *id.* at 30 ("The proposed mechanism fails to address the underlying market and regulatory failures and does not resolve the crucial problems stemming from ill-defined legal rights).

geostationary arc above the equator, and complies with certain power and emission limits.[12] This means that a user can receive fourteen video streams from transponder 18 (4,060-4,076 MHz) on the Galaxy 15 satellite located at 133ºW.L., and can also receive fourteen different video streams from transponder 18 on the AMC 11 satellite located two degrees away at 131ºW.L.[13] In these circumstances, non-exclusive rights are not only *not* ill-defined, but the most sensible and efficient choice. Indeed, satellite operators and users alike have benefited from spectrum reuse and the lack of exclusivity that is necessary to achieve it in the satellite realm.

But now, the CBA invokes this benefit as a problem because it may allow each of its members to hold out and block a refarming of the spectrum. Essentially, therefore, the CBA is asking the Commission to avoid a problem that the coalition members would themselves create—exercise their non-exclusive right to block reallocation of the spectrum.

But the Commission could avert the holdout problem in many ways. For one thing, the Commission could exercise its modification authority under Section 316,[14] modify the satellite operators' licenses (and users' registrations) to reduce them by 50 MHz, and in return promise operators and users a portion of the proceeds from a 5G auction of that 50 MHz of spectrum.

Alternatively, the Commission can, again, modify the satellite operators' licenses, and reissue them rights based on the operational transponder capacity of each. The Commission

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[12] *See* 47 C.F.R. § 25.140; *see also* Licensing Space Stations in the Domestic Fixed-Satellite Service and Related Revisions, 48 Fed. Reg. 40233-01, 40233 (Sept. 6, 1983) (adopting a final rule of "orbital separations to 2° between domestic satellites operating in the 4/6 GHz and 12/14 GHz bands").

[13] *See* Galaxy 15 at 133.0ºW, LyngSat, https://www.lyngsat.com/Galaxy-15.html (last visited Nov. 26, 2018); *see also* AMC 11 at 131.0ºW, LyngSat, https://www.lyngsat.com/AMC-11.html (last visited Nov. 26, 2018).

[14] 47 U.S.C. § 316 (a)(1) ("Any station license . . . may be modified by the Commission . . . if in the judgment of the Commission such action will promote the public interest, convenience and necessity . . . .").

would then invite satellite operators to tender these modified nationwide rights in a reserve incentive auction. That modification of C-band rights would automatically resolve the holdout problem, as one entity's holding out would affect only its own transponder capacity allotment. Bidders not tendering their shares would pay a predetermined amount based on market transponder leases to use up to 50 MHz of spectrum on some of the transponders of the companies tendering their shares. That will allow the bidders not tendering their shares to make up for the loss of the lower 50 MHz of C-band spectrum. The auction would proceed until enough transponder capacity is tendered to clear 50 MHz of spectrum. The incentive auction should allow relinquishment of capacity so long as no fewer than two operators, each with no fewer than a specified number of transponders, remains. Then the Commission would hold a forward auction of 5G licensees under the same general rules outlined above (the amount bid at the incentive auction would serve as the reserve price, any difference above the reserve will accrue to the U.S. Treasury).

While an auction mechanism has the significant advantage of ensuring a portion of the proceeds for the public, ACA is open to an appropriately structured non-auction mechanism, so long as it fully protects user rights.

The distribution of the proceeds from divestiture of the C-band spectrum is another area where ACA cannot agree with CBA. The CBA members appear to try to reserve for themselves the upside from that divestiture. According to the CBA comments, the coalition members will be reimbursed for "their prior investment and opportunity costs."[15] FSS users, on the other hand, will be confined to their "reconfiguration and relocation costs."[16] This is unreasonable. Both

[15] CBA Comments at 22.

[16] *Id.* at ii.

categories of incumbents should be reimbursed for their prior investment and opportunity costs. Both should partake of the value of the spectrum that market forces dictate. Imagine a house subject to a lease. The landlord is free to sell the house, but it will remain encumbered by the lease unless she buys out the lessee's rights for the lease's remainder. The amount needed for this buyout will depend on the market, not on the cost of relocating the lessee to a property the landlord deems fit.

How, then, should the proceeds from an incentive auction (or from a forward 5G auction or a non-auction mechanism) be distributed between operators and users? There are a number of possible solutions.

Negotiation/baseball rules arbitration. First, the satellite coalition, which is already in existence, should be asked to negotiate an apportionment percentage with a coalition of users. If there is a broad agreement, the FCC will simply observe it unless there are compelling public interest considerations not to do so. If there is no broad agreement, then the parties will submit to binding baseball rules arbitration, with the arbitrator having to pick the apportionment offer closer to the fair market value of the parties' respective rights. All of this can be accomplished in short order—30 days for negotiations, another 30 days for public comment on a broad agreement if there is one, 90 days for baseball rules arbitration if there is no agreement.

At the conclusion of the process, the FCC can proceed with the auction mechanism described above; the bidding operators would bid on relinquishing their rights to transmit on the band, and a portion of the proceeds would be distributed to users based on the formula.

Market forces. A second alternative is a formula that approximates the working of market forces. The Brattle Report itself concedes that, of the more than $19.7 billion it estimates in reallocation costs, the majority are those incurred by the user. Specifically, the Brattle Group

estimates that the value of the lost satellite assets is about $7.3 billion, while the "estimated lost economic value of all C-band earth station assets" is higher at $12.4 billion.[17] This ratio may be an adequate approximation of the relative value to which each category of incumbents—operators and users—is entitled. Game theory would also assist in allocation: all other things being equal, Nash equilibrium predicts that the benefits of the agreements between operators and users are split equally between them.

Hybrid approach. Third, the first and second approach can be combined, with the arbitrator being directed to use the formula in gauging market value and picking the apportionment offer closer to it.

III. CBA'S RECOMMENDATION RAISES LEGAL AND COMPETITIVE CONCERNS

CBA's approach is not only unnecessary to resolve the holdout problem and misguided in reserving opportunity and investment costs for the satellite operators; it also raises legal and competitive concerns that may be hard to overcome. A coalition consisting exclusively of satellite operators will have price setting as its core mission, and it will be difficult to compartmentalize prices for the spectrum these operators are licensed to operate in and prices for the services they provide on that spectrum. Put differently, the prices that the coalition will set out to negotiate for divesting some of the C-band spectrum depend crucially on the price that its members can command for services that use the remaining spectrum. Conversely, the price of the CBA members' satellite services provided on the remaining spectrum depends on the price that the CBA can negotiate for divesting spectrum. The C-band spectrum is fungible and its uses for 5G and satellite services compete with one another. CBA will be negotiating the price for

[17] *See* Brattle Report at 22.

one use even as each of its members negotiates prices for the other. But this creates a risk that the spectrum price set by CBA will act as a floor for their satellite service prices.

In light of these concerns, the defense of a joint venture mounted by CBA[18] seems rather perfunctory and does not come to grips with key antitrust precedent.[19] Indeed, due to these substantive antitrust difficulties, it is perhaps no surprise that the Coalition does not state it is pursuing a business review letter from the Department of Justice.[20]

Even if the antitrust concerns are allayed, the competition concerns would remain. The CBA members would be irrational if they did not price the services to be provided over the remaining spectrum at a price that justifies their not refarming the spectrum to higher-value uses for 5G. Based on the Brattle Group's valuations of 5G and C-band use of the spectrum, the refarming opportunity is likely to lead to price increases for satellite services in an attempt of the satellite operators to make the spectrum that they are keeping as profitable as the spectrum they are divesting. Specifically, the Brattle Report values the 5G use of the spectrum at between $96 million (for 100 MHz) and $65 billion (for 500 MHz) based on a number of international

[18] CBA Comments at 32-37.

[19] *See Nat'l Collegiate Athletic Ass'n v. Bd. of Regents of Univ. of Oklahoma*, 468 U.S. 85, 113-14 (1984); *see also Am. Needle, Inc. v. Nat'l Football League*, 560 U.S. 183, 197 (2010); 1A Phillip E. Areeda & Herbert Hovenkamp, Antitrust Law at § 2100f (4th ed. 2018).

[20] Business review is a voluntary process that permits businesses concerned about a proposed action (*e.g.*, a joint venture) to get an insight on the enforcement intention of the DOJ's Antitrust Division regarding their proposed action. Parties may request a business review letter from the Antitrust Division, which would detail its intentions if the parties engage in the proposed conduct. The Antitrust Division's response generally provides three options: the Division does not intend to bring an enforcement action; it declines to state its enforcement intentions; or it will sue if the proposed conduct takes place. *See What is a Business Review?*, Department of Justice, Antitrust Division (June 25, 2015), https://www.justice.gov/atr/what-business-review ("Persons concerned about the legality under the antitrust laws of proposed business conduct may ask the Department of Justice for a statement of its current enforcement intentions with respect to that conduct pursuant to the Department's Business Review Procedure.").

auctions.[21] A look at the price per MHz per pop fetched for mobile wireless spectrum in recent U.S. auctions suggests strongly that the true valuation will be towards the high end. By comparison, the net present value of the C-band based on satellite use is approximately $7.3 billion.[22] This suggests that satellite operators might have to raise prices as much as 900% (the $65 billion at the high end of the Brattle Group's estimate of 5G proceeds compared to the $7.3 billion net present value of satellite service revenues[23]) just to reach the point of indifference as to the more productive use of the spectrum.

And, even if the Commission simply ruled that the remaining spectrum will be dedicated to satellite use, the satellite operators may well choose to drive prices up because there will be little downside to that strategy. First of all, refarming will cement the existing virtual duopoly, as the diminished spectrum will make new entry impossible for all practical purposes. What is more, a virtual monopoly may result if the bandwidth reduction means no capacity is available on another operator's system for certain video content. Faced with a price increase by SES, a purchaser can now turn to Intelsat. But what if Intelsat no longer has transponder space available to accommodate customers fleeing from a price increase?

The circumstances are also ripe for tacit coordination in the ordinary course. Indeed, the existence of the coalition will facilitate such coordination further by making more information available to the coalition members. And even if prices are pushed so high that fiber becomes an alternative, the migration of users can be used by the satellite companies to later pressure the FCC to reconsider its rule and allow more spectrum to be refarmed to 5G. The Commission

[21] Brattle Report at 13-14.

[22] *See* Brattle Report at 22.

[23] *See* Brattle Report at 17.

should thus take measures to avert the risks to competition that the coalition approach entails, including submitting C-band satellite operators to a condition requiring a rate freeze for at least four years, and ensuring expedited review of any change in their prices for at least three years thereafter.

Nor is the CBA correct that this case falls within an exception to the FCC's obligation to allocate initial licenses by auction in the event of mutual exclusivity.[24] It is true that, under Section 309(j)(6)(E), the Commission is still under "the obligation in the public interest to continue to use engineering solutions, negotiation, threshold qualifications, service regulations, and other means in order to avoid mutual exclusivity in application and licensing proceedings."[25] But what CBA proposes would simply contract out the resolution of mutual exclusivity to one of the private parties with a stake in the outcome. Essentially, if the FCC still conducted comparative hearings to choose among mutually exclusive applications, CBA's proposal is the equivalent to anointing one of the five applicants as the referee and ask that applicant to choose one among its own applications and the other four. That does not satisfy either Section 309(j)(6)(E) or *Ashbacker*.[26]

CBA is correct that the Commission has granted initial licenses under a new service or spectrum allocation without auction in a number of cases. But in all of these cases, the entity receiving the license planned to use productively the newly refarmed spectrum itself. In no such

[24] 47 U.S.C. § 309(j).

[25] *Id.*

[26] *Ashbacker Radio Corp. v. FCC*, 326 U.S. 327 (1945).

cases did the new licensee plan to sell bare spectrum to others and substitute a private auction for the competitive bidding contemplated by Section 309(j).[27]

IV. AN AUCTION MECHANISM IS GENERALLY WITHIN THE COMMISSION'S AUTHORITY

Contrary to CBA's argument,[28] the Commission has the authority to refarm a portion of the C-band spectrum by auction. The ORBIT Act, which prohibits the Commission from assigning "by competitive bidding orbital locations or spectrum used for the provision of international or global satellite communications service,"[29] does not bar auctions of such spectrum for non-satellite use, as shown in the MVDDS auctions.[30] Second, in this case, the spectrum to be auctioned may no longer be allocated to the satellite service and will thus not qualify as spectrum used for "the provision of international or global satellite communications service" by definition. Furthermore, the C-band spectrum is used, at least primarily, for the

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[27] *See, e.g.*, Improving Public Safety Communications in the 800 MHz Band, *Report and Order*, 19 FCC Rcd. 14969 (2004) (in which the Commission reconfigured the 800 MHz band to avoid increasing interference issues between the users of the band, assigned Nextel (the largest commercial 800 MHz spectrum holder at the time) the role of paying for relocation of certain other spectrum holders, and modified some of Nextel's 800 MHz licenses to permit Nextel to operate in the 1.9 GHz band as a result of the costs Nextel would bear in relocating other spectrum holders and also relinquishing part of the 800 MHz band).

[28] CBA Comments at 60 ("[I]ssuing new licenses for terrestrial mobile use to auction winners without clear authority to repack—or at least to fully-protect—non-participants may risk violating the Commission's statutory obligation under Section 309(j)(6)(E) to avoid mutual exclusivity").

[29] Open-Market Reorganization for the Betterment of International Telecommunications Act, Pub. L. No. 106-180 (2000) ("ORBIT Act").

[30] *See Northpoint Technology, Ltd. v. FCC*, 414 F.3d 61, 73 (D.C. Cir. 2015) (concluding that the language of the ORBIT Act was ambiguous, and that it was "possible to construe the provision to forbid the FCC from auctioning 'orbital locations or spectrum' only when that spectrum is to be 'used for the provision of international or global satellite communications services,' but not spectrum that is to be used for provision of domestic, non-satellite-based communications services. Because of this ambiguity, we defer to the Commission's reasonable interpretation.").

provision of domestic programming backhaul, and the satellite operators provide no evidence that it is used for international or global satellite communications service. And finally, the spectrum would be reallocated for 5G use, and would no longer be allocated to satellite service in the first place. Such a reallocation would be amply within the FCC's authority. Section 303(y) authorizes the Commission to provide for flexible spectrum use if "(1) such use is consistent with international agreements to which the United States is a party; and (2) the FCC finds, after notice and an opportunity for public comment, that (A) such an allocation would be in the public interest; (B) such use would not deter investment in communications services and systems, or technology development; and (C) such use would not result in harmful interference among users)."[31]

V. IN ANY "MARKET-BASED" APPROACH, USERS' CONSENT SHOULD BE REQUIRED

If the Commission decides to proceed with the mechanism proposed by CBA, it should revise it to ensure earth station users have a seat at the table and are a party to any agreement that would refarm parts of the C-band spectrum. If, instead of an agreement, the rules contemplate the creation of a committee, user representatives should participate in such a committee with equal rights and votes to those of the satellite operator representatives. Any such process should fully include users as well as operators. The Commission should give parties a short period of time to organize themselves in appropriate groups and appoint representatives for the purpose of negotiating a comprehensive agreement. The Commission should make clear that all such

[31] 47 U.S.C. § 303(y); *see also* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, *Notice of Proposed Rulemaking*, 27 FCC Rcd. 12357, 12366-67 ¶ 23 (2012) (while that regime has been codified in Parts 24 and 27 of the Commission's rules, there does not appear to be a prohibition against using it for Part 25, which governs satellite spectrum).

negotiations should be undergirded by the principle that an agreement should equally protect the rights of operators and users.

VI. POINT-TO-MULTIPOINT SERVICE SHOULD NOT BE INTRODUCED IN THE BAND EXCEPT UNDER STRICT CONDITIONS

The P2MP parties' proposal is unworkable in the best of cases; it would be especially damaging to the ability of C-band users to receive video programming if they have to contend with the double whammy of losing spectrum to 5G outright and also losing protection for much of the remaining spectrum for the purpose of accommodating the P2MP service. BAC's and DSA's proposals are precisely premised on the loss of full-band, full-arc protection. BAC and DSA argue that the current full-band, full-arc coordination policy for earth stations should change so that earth station operators are entitled to protection only for those frequencies, azimuths, and elevation angles and other parameters reported as in regular use.[32]

BAC claims that "a typical FSS earth station uses far less spectrum, as little as 23 [MHz]."[33] This is incorrect. BAC itself admits that the estimate is not statistically derived but rather based on one anecdote about one user, Associated Press, which appears to make sporadic use of the spectrum. And BAC offers no evidence to support parlaying one user's experience into that of the "typical" FSS earth station.

In fact, the evidence proves the contrary. As ACA has pointed out, each multi-channel video distributor ("MVPD") that uses the C-band for video programming receives dozens, hundreds, or even thousands of video streams by satellite. A simple review of the LyngSat database shows that at least 2,000 streams of video programming are transmitted on the C-

[32] *See, e.g.*, Comments of the Broadband Access Coalition, GN Docket No. 18-122, at 16-17 (Oct. 29, 2018) ("BAC Comments"); Comments of Dynamic Spectrum Alliance, GN Docket No. 18-122, at 13-15 (Oct. 29, 2018).

[33] BAC Comments at 16.

band.[34] Each MVPD headend needs access to a large subset of these channels. In fact, other evidence shows that Comcast receives as many as 6,600 separate video streams through that spectrum.[35] Take an ACA member using the C-band to receive the video channels it provides to its subscribers. The fact that an Associated Press earth station in the vicinity of that member's headend uses a small fraction of the entire 500 MHz of spectrum should have little bearing on the needs of the ACA member and the protection to which it is entitled.

And the fact that a distributor currently receives video streams occupying, say, a total of 250 MHz out of the 500 MHz of C-band downlinks does not mean the remaining spectrum is serving no important use both to provide competitive choice and to assure reliability. Take a distributor who receives Viacom programming on a 36 MHz transponder[36] using the 3,700-3,736 MHz frequency band on an Intelsat satellite located at 97ºW.L. The distributor pays Viacom for the content as well as the content's transport to its headend, and Viacom pays Intelsat. But Intelsat's price is constrained by the ability of Viacom and the distributor to turn to SES, which may provide the same programming on another transponder using different C-band spectrum on its satellite at 101ºW.L. As CBA states, "[b]y preserving its existing FSS licensing policies, including full-band, full-arc authorization of earth stations, the Commission can continue to support vibrant competition for FSS services."[37]

Reliability, too, requires some redundancy in the not infrequent cases of transponder outage or failure. As Comcast notes, "[t]he ability to quickly shift frequencies, azimuths, and/or

[34] *See* ACA NOI Comments at 6 & Exhibit 3.

[35] CBA Comments at 13.

[36] *See* 2000 Biennial Regulatory Review, *Notice of Proposed Rulemaking*, 15 FCC Rcd. 25128, 25183 (2000) ("C-band and Ku-band satellite systems typically have transponder bandwidths on the order of 36 MHz or more.").

[37] CBA Comments at 39.

elevation angles is one of the key factors that makes the C-Band as reliable as it is and that allows it to function correctly from both business and operational perspectives."[38] In the words of the Satellite Industry Association, "[s]atellite service customers rely heavily on the flexibility provided by the Commission's long-standing policy in favor of full-band, full-arc earth station licensing, which is essential to ensure service continuity, take advantage of competition, resolve interference, accommodate changes in demand driven by advanced services, and support coverage of live news, sports, and entertainment events."[39] And, as the Content Companies state, they "rely on full-band, full-arc coordination to quickly transition to alternative satellites or frequencies for both planned and unplanned events."[40]

But price discipline would be relaxed or entirely absent under the BAC and DSA plans if the MVPD could only claim protection for the C-band spectrum currently used to receive video programming. In such a regime, the distributor would have to request from the Commission or a coordinator access to additional spectrum from a different location. The need to request access would cause delay and switching costs in the best case; in the worst case, access may be impossible to grant if a P2MP provider has already coordinated its use of that spectrum, since it is currently not used for video backhaul in the region. In all cases, the disruption to consumers would range from non-trivial to devastating.

[38] Comments of Comcast Corp. and NBCUniversal Media, LLC, GN Docket No. 18-122, at 32 (Oct. 29, 2018).

[39] Comments of the Satellite Industry Association, GN Docket No. 18-122, at 21 (Oct. 29, 2018) ("SIA Comments"); *see also id.* at 23 ("The full-band, full-arc policy is also necessary to enable meaningful competition for satellite services.").

[40] Comments of the Content Companies, GN Docket No. 18-122, at 9 (Oct. 29, 2018) ("Content Companies").

Thus, eliminating the full-band, full-arc policy would sharply curtail competitive choices and produce a set of monopolies, with each earth station being captive to one satellite operator.

These difficulties would only be compounded if the lower portion of the C-band were to be refarmed to 5G, necessitating repacking. With the loss of the low C-band spectrum, networks transported in those frequencies (say the Viacom family of networks) would need to find a new home in the upper portion of the band. This means that each MVPD that needs access to Viacom would need to use a larger percentage of the remaining C-band spectrum for the same number of networks than it does today. As CBA states, "[d]enser use of the available C-band Downlink spectrum will magnify the effects of any satellite or transponder outage, increase the likelihood that interference issues will arise, and constrain the capacity available to meet growing customer requirements and cover live events."[41] If the spectrum available is reduced, its full use is all the more imperative. In the Content Companies' words, "full-band, full-arc coordination is likely to become more important in a crowded, repacked C-band. In this more difficult spectral environment, the Content Companies and other programmers will find it necessary to change satellites and/or frequencies more often in an attempt to mitigate interference to downlinks."[42]

And so, the reference of BAC to non-co-channel sharing is a euphemism for the new P2MP service gaining access to channels that MVPDs need but are no longer able to use. The automated coordination system envisioned by BAC is based on the same flawed premise and also presents the difficulties aptly cited by parties such as the Satellite Industry Association.[43]

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[41] CBA Comments at 44.

[42] Content Companies at 10.

[43] SIA Comments at 28 n.88 ("[I]t is not clear that a database approach would reduce the burdens on earth station operators. In any event, the database mechanism – which has not yet been tested for its ability to manage interference to the small number of earth stations using the CBRS

Nor do the P2MP service proponents contend with the fact that what was previously thought to be a universe of 4,700 earth stations has ballooned to 16,500 earth stations and counting, hampering coordination further.

At most, the Commission should modify the full-band, full-arc policy only for those earth stations designated as "occasional-use only," and preserve it for "regular-use" stations. Users should be allowed to self-designate. In the event of a challenge, MVPD users should be entitled to the presumption of regular use.

As for co-channel sharing, ACA does not object to the introduction of P2MP service outside exclusion zones that ensure a sufficient distance (at all events, no less than 50 miles[44]) from all registered earth stations to ensure no co-channel interference.

VII. CONCLUSION

The Commission should take cautious actions that take into account C-band users' and the public's rights, consistent with ACA's comments and these reply comments.

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spectrum – cannot be presumed to be reliable for protection of the exponentially greater number of earth stations that require protection in the 3.7-4.2 GHz band.").

[44] CBA Comments Technical Annex at 2 (citing an Ericsson analysis).

Respectfully submitted,

/s/

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December 11, 2018

CALCULATION OF THE ADDITIONAL NUMBER OF SATELLITES REQUIRED TO MAINTAIN EXISTING C-BAND DOWNLINK TRANSMISSION CAPACITY IF SOME C-BAND SPECTRUM IS REPURPOSED TO OTHER USES

December 11, 2018

by

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1. INTRODUCTION

A 500 MHz band of spectrum usually referred to as the C-Band is currently used primary by the video programming and distribution industry to deliver feeds of video programming to over 16,000 individual head-ends of MVPDs all over the country that in turn distribute this programming to their subscribers. A fleet of 24 geosynchronous satellites owned by four different satellites operators delivers these feeds. The FCC is currently considering the possibility of repurposing some of this spectrum for mobile 5G use.

Holding the capital stock of existing satellites constant, if a share of the 500 MHz of spectrum currently used for video downlinks was reassigned to some other use, this would reduce the capacity of the satellite industry to provide video downlinks. If this capacity was reduced, this would reduce the intensity of competition between the four satellite operators, thus resulting in increased prices for video downlink services which would in turn ultimately be passed on to MPVD subscribers in the form of higher subscription fees. It could also limit the distribution of some programming and/or limit the extent to which MPVDs will be able to expand their use of downlink capacity to deliver higher resolution programming such as 4K programming to their subscribers. The effects would be especially severe in rural and less dense areas where delivery of video feeds by fiber would be extremely expensive if not impossible.

This short paper will present calculations showing how much new satellite capacity would need to be created to replace repurposed spectrum in order to maintain the same capacity to provide downlinks.

Section 2 explains and derives the general formula for calculating the increment in satellite capacity required to replace repurposed spectrum depending on two variables, the amount of spectrum that is repurposed and the number of operational transponders on existing

satellites. Section 3 reports results for some potentially relevant values of these variables. Section 4 draws a brief conclusion.

2. THE GENERAL CALCULATION

The units of equipment carried by satellites that transmit video signals are referred to as transponders. An individual satellite can carry up to 24 transponders. All of the calculations presented below will maintain the following assumptions:

(i) There are 24 existing satellites that are each currently allowed to use 500 MHz of spectrum; and
(ii) Each newly launched satellite will carry 24 fully functional transponders.

Since there are 24 existing satellites and each satellite can hold a maximum of 24 transponders, the largest number of operational transponders deployed on existing satellites is 576. Kerrisdale Capital reports that there are actually 540 operational transponders on the existing satellites.[1] To allow for the possibility that there may be fewer than 576 operational transponders, the number of operational transponders will be allowed to be a variable, denoted by n, that can be set to any value between 0 and 576. The next section will report results both for n = 576 and n = 540. The results are very similar in either case.

The number of MHz of C-Band spectrum that are repurposed to some other use will also be allowed to be a variable, denoted by x, that can be set at any value between 0 and 500.

The question that this section will answer can now be formally posed. Suppose that x MHz of spectrum are repurposed to other uses where x is some number between 0 and 500. Also suppose that there are n fully functioning transponders on existing satellites where n is some number between 0 and 576. This section will derive the formula which provides the number of new satellites that would have to be launched in order for the resulting satellite system to provide

[1] Kerrisdale Capital, *Intelsat S.A. & SES S.A. To the Moon*, June 2018.

the same downlink capacity as is currently available.

The key point to recognize is that the total capacity of a satellite system to transmit video signals is given by multiplying the total number of transponders deployed by the number of MHz the transponders are allowed to use.

Since there are n fully functioning transponders on existing satellites and each satellite is currently allowed to use 500 MHz, the capacity of existing satellites to transmit signals is given by

$$500n. \tag{1}$$

Now suppose that x MHz of spectrum is repurposed to some other use where x can be any number between 0 and 500. The remaining number of MHz available for use is then

$$(500-x). \tag{2}$$

If y new transponders are created then the total number of transponders will become

$$n+y. \tag{3}$$

The total capacity of the new system will therefore be given by multiplying the expressions in equations (2) and (3) together. This yields

$$(500-x)(n+y). \tag{4}$$

Since equation (1) provides the capacity of the existing system and equation (4) provides

the capacity of the new system, the capacity of the new system will be equal to the capacity of the old system if and only if the expression in equation (1) is set equal to the expression in equation (4). This yields the following equation.

$$500n = (500-x)(n+y) \tag{5}$$

Solving this equation for y yields

$$y = nx/(500-x) \tag{6}$$

Since each new satellite can carry 24 transponders, the number of new satellites required is equal to the number of new transponders required divided by 24. Let s denote the number of new required satellites. It is given by

$$s = nx/24(500-x) \tag{7}$$

3. RESULTS FOR ILLUSTRATIVE PARAMETER VALUES

This section will report the values of y and s for two values of n and three values of x. The first value of n for which results will be reported is n = 576 which is the maximum possible number of fully functional existing transponders that could exist. The second value of n for which results will be reported is n = 540 which is the number of operational transponders on existing satellites reported by Kerrisdsale Capital. It will be seen that the results are very similar for either value of n. The three values of x for which values will be reported are x = 50, x = 100,

and x =200. These span the range of values commonly suggested or considered. Of course, larger values of x will require more satellites to be launched.

The results for n = 576 are presented in Table 1. Replacing 50 (100, 200) MHz of spectrum would require creating, respectively, 64 (144, 384) new transponders which would require launching, respectively, 2.7 (6, 16) new satellites. The results for n = 540 are presented in Table 2. Replacing 50 (100, 200) MHz of spectrum would require creating, respectively, 60 (135, 360) new transponders which would require launching, respectively, 2.5 (5.6, 15) satellites.

4. CONCLUSION

Simply repurposing existing C-band spectrum to new uses without launching new satellites would harm the video programming and distribution industry and its subscribers by reducing the amount of downlink capacity available. This short paper has shown how to calculate the number of new satellites that would need to be launched in order to maintain existing downlink capacity. If 50 MHz of spectrum was repurposed it would be necessary to launch between 2 and 3 new satellites to maintain existing downlink capacity. If 100 MHz of spectrum was repurposed, it would be necessary to launch between 5 and 6 new satellites to maintain existing downlink capacity. If 200 MHz of spectrum was repurposed, it would be necessary to launch between 15 and 16 new satellites to maintain existing downlink capacity.

Table 1
The Number of New Transponders and Satellites Required to Replace Various Amounts of Repurposed Spectrum Given That Existing Satellites Have 576 Operational Transponders

x	y	s
50	64	2.7
100	144	6
200	384	16

Table 2
The Number of New Transponders and Satellites Required to Replace Various Amounts of Repurposed Spectrum Given That Existing Satellites Have 540 Operational Transponders

x	y	s
50	60	2.5
100	135	5.6
200	360	15