

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)
)
Expanding Flexible Use of the) GN Docket No. 18-122
3.7 to 4.2 GHz Band)

To: The Commission

REPLY COMMENTS OF THE BROADBAND ACCESS COALITION

Robert S. Koppel
Lukas LaFuria Gutierrez & Sachs, LLP
8300 Greensboro Drive, Suite 1200
Tysons, VA 22102
bkoppel@fcclaw.com
Counsel to the Broadband Access Coalition

Claude Aiken
President and CEO
WISPA
4417 13th Street #317
Saint Cloud, FL 34769

Michael Calabrese
Director, Wireless Future Program
Open Technology Institute at New America
740 15th Street, NW, Suite 900
Washington, DC 20005
calabrese@newamerica.org

December 11, 2018

TABLE OF CONTENTS

SUMMARY	ii
I. Introduction	1
II. The Record Reflects Strong Support for Maximizing Use of the 3.7 GHz Band by Authorizing P2MP Operations to Share with Incumbent FSS Operations	4
III. Deployment of Fixed P2MP Broadband Service Will Not Affect Clearing the Lower Portion of the Band for Flexible Use	7
IV. P2MP Can Responsibly Share the 3.7 GHz Band with FSS Operators	9
V. Eliminating the “Full-Band, Full-Arc” Policy Will Maximize Sharing without Impairing Real-World FSS Operations	15
VI. The Commission Must Require FSS Operators to Submit the Data Necessary to Enable Sharing of the 3.7 GHz Band	19
VII. 3.7 GHz Band Spectrum is Important to Bridging the Digital Divide	23
VIII. Opportunistic Access	27
IX. Conclusion	28
Exhibit 1 - Broadband Access Coalition – Technical Report	

SUMMARY

The Broadband Access Coalition's ("Coalition") proposal to share 300 megahertz of spectrum in the 3.7 – 4.2 GHz band (the "3.7 GHz band" or "C-band") for point-to-multipoint ("P2MP") operations garnered significant support in the record from a diverse group of commenters; broadband providers, equipment manufacturers, and consumer groups hailed the ability of this underutilized band to facilitate the provision of gigabit or near gigabit broadband to unserved and underserved rural Americans. Opponents to this plan raise arguments that ignore the historical sharing of Fixed Satellite Service ("FSS") and point-to-point operations in the band, reveal self-serving and speculative pecuniary interests, and rely upon worst-case and incorrect technical assumptions that try, but fail, to show that sharing is not feasible.

First, conspicuously absent from any opposition to sharing is the acknowledgement that fixed services have successfully shared the 3.7 GHz band with earth stations in the band for decades. By contrast, it is widely recognized that sharing between FSS earth stations and mobile operations is not feasible, and thus, will require the re-packing of earth stations from the lower 200 megahertz to the upper 300 megahertz of the C-band. The Coalition's proposal for sharing between fixed P2MP operations and FSS operations is not fundamentally different from sharing between fixed point-to-point ("P2P") operations and FSS operations: prior frequency coordination is required before P2P links can be deployed, and prior frequency coordination would be required before P2MP access points can be deployed. P2MP coordination simply considers multiple possible fixed link paths within a defined sector, rather than a single fixed link path. By applying Part 101 coordination methods, made more precise with updated models that account for clutter loss and terrain shielding, P2MP operations can provide interference protection to incumbent earth stations while promoting spectrum efficiency that will enable more intensive terrestrial use, consistent with Commission objectives.

Second, it is apparent from the record that satellite interests opposed to sharing are doing so to preserve their ability to monetize all 500 megahertz at some point in the future, and the introduction of P2MP would stand in the way of this future multi-billion dollar windfall. The economic analysis submitted by Intel/Intelsat/SES makes this point crystal clear:

If this [Coalition] proposal is implemented, satellite operators will lose the ability to *use* the C-Band more intensively. This will negatively impact the ability to *repurpose* spectrum to support 5G in the future and diminish the C-Band’s ability to meet future demand for satellite services if it is not cleared.”¹

There can be little doubt that helping to meet the demand for broadband in unserved and underserved rural areas should outweigh the speculative interests of a few satellite firms. Further, the combined value of FSS and P2MP in the upper 300 megahertz of the 3.7 GHz band will far exceed the value of FSS alone, inasmuch as P2MP would be required to protect incumbent FSS operations.

Third, the technical analysis submitted by the satellite operators, which purports to show that sharing is not feasible, is predicated on a worst-case analysis and incorrect assumptions, and thus cannot be given credibility. The Technical Report appended to these Reply Comments addresses the flaws in the technical analysis. Moreover, predictions that the distance separation required to protect earth stations would foreclose meaningful P2MP deployment reflects a basic lack of understanding of the rural fixed wireless business model – a model that does not require nationwide coverage, nor even a large-area footprint to be successful. Equally untrue and unavailing are unsupported claims that there is sufficient spectrum already available in other band for fixed wireless deployments – this is simply not the case.

Fourth, there was broad support for eliminating the antiquated “full-band, full-arc” policy. The satellite interests do not provide, nor can they provide, any evidence that each and

¹ Joint Comments of Intel/Intelsat/SES, Appendix A at 35 (emphasis added).

every FSS earth station needs access to all 500 megahertz (or 300 megahertz, after re-packing) across the entire spectrum arc at all times. In a world where commercial spectrum is in high demand, preserving the “full-band, full-arc” policy would be wholly inconsistent with the public interest in maximizing the use of the spectrum. The Coalition proposes instead a “when and where needed” protection scheme implemented through frequency coordination.

In sum, the barriers that the satellite industry attempts to erect cannot overcome the public interest in making more intensive terrestrial use of the 3.7 GHz band. The Commission should adopt rules that enable the upper 300 megahertz of the band to be coordinated and shared among incumbent FSS earth stations and new P2MP operators. There is no better near-term opportunity to help bridge the digital divide and enable more rural Americans to participate in the digital economy.

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)
)
Expanding Flexible Use of the) GN Docket No. 18-122
3.7 to 4.2 GHz Band)

To: The Commission

REPLY COMMENTS OF THE BROADBAND ACCESS COALITION

The Broadband Access Coalition (“Coalition”) hereby submits its Reply Comments in response to certain of the Comments submitted in the above-captioned Notice of Proposed Rulemaking (“NPRM”).¹

I. Introduction

In its Comments, the Coalition emphasized that enabling fixed point-to-multipoint (“P2MP”) networks to share 300 megahertz of spectrum in the 3.7 – 4.2 GHz band (“3.7 GHz band” or “C-band”) would advance the Commission’s goal of addressing the persistent divide that leaves rural Americans on the wrong side of the digital economy.² By adopting coordination and sharing rules that provide “real world” interference protection to Fixed-Satellite Service (“FSS”) earth stations – even after a portion of the 3.7 GHz band is cleared for flexible use licensing – the Commission can make available mid-band spectrum tailor-made for rural coverage and urban capacity. Simply put, this proceeding does not have to reduce solely into a

¹ *Expanding Flexible Use of the 3.7 to 4.2 GHz Band, Order and Notice of Proposed Rulemaking*, GN Docket No. 18-122, FCC 18-91 (rel. July 13, 2018) (“NPRM”). Unless otherwise noted, all Comments referenced herein were filed in this docket on October 29, 2018.

² See Comments of the Broadband Access Coalition (“Coalition Comments”) at 8-11.

zero-sum “race to 5G,” but can make a significant amount of spectrum available for both mobile and fixed use cases without compromising Commission objectives.

Standing in the way of this “win-win-win” opportunity is the FSS industry, which continues to cling to the outdated “full-band, full-arc” approach that would foreclose spectrum sharing that can be achieved through proven frequency coordination methods. Although these satellite interests see no problem with monetizing 200 megahertz of spectrum under a market-based process they propose to control, their self-interest in selling or warehousing spectrum they never paid for renders them tone-deaf to calls for sharing the 300 megahertz that would remain because they refuse to accept that spectrum sharing can be successfully coordinated. Further discrediting their assertions are flawed technical assumptions that purport to show that, even if sharing were permitted, the limitations on such sharing would “prevent P2MP from being deployed in a meaningful way across the United States in the C-band”³ – wrongly suggesting that P2MP will be prominent in urban areas and requires a nationwide footprint to implement a successful business model. Like Chicken Little’s cries that “the sky is falling,” these claims should be rejected.

In fact, accommodating fixed P2MP in 300 megahertz of spectrum will create more opportunities for economic growth by facilitating the provision of gigabit or near gigabit broadband to unserved and underserved rural Americans. Other than a few outliers that seek to clear the entire C-band, the mobile industry is focused on gaining access to 200 megahertz of flexible use spectrum and thus can claim no “loss” of value if the Commission allocates the remaining 300 megahertz for more intensive fixed use. Likewise, the satellite industry will

³ Comments of the C-Band Alliance (“C-Band Alliance Comments”), Technical Annex at 15.

suffer no “loss” in value from sharing spectrum because the frequency coordination process will ensure that their earth stations are protected from harmful interference.

The Coalition’s proposal for sharing between fixed P2MP operations and FSS operations is not fundamentally different from sharing between fixed P2P operations and FSS operations that have co-existed in the 3.7 GHz band for decades. Prior frequency coordination is required before P2P links can be deployed in the 3.7 GHz band and prior frequency coordination would be required before P2MP access points can be deployed. P2MP coordination simply considers multiple possible fixed link paths within a defined sector, rather than a single fixed link path.

The Coalition understands that incumbents – whether government or commercial – are generally reluctant to embrace spectrum sharing with their services. Certain incumbent cable and broadcast interests question the P2MP business case in the re-packed 3.7 GHz band.⁴ The FSS industry disingenuously speculates that there is sufficient spectrum in other bands available for fixed wireless broadband such that sharing the 3.7 GHz band should not be authorized. Assuming these arguments have credence, which they do not, these are not legitimate reasons for the Commission to maintain needless barriers to unused spectrum that can be shared using simple and well-proven methods. The Commission must look beyond the myopic and self-focused rhetoric of incumbents and act in the interest of the public.

⁴ See, e.g., Comments of the American Cable Association (“ACA Comments”) at 14. See also Comments of The Telecommunications Industry Association (“TIA Comments”) at 8 (“the introduction of a dedicated [P2MP] service with very uncertain market potential could lead to unnecessarily clustering this valuable band”); Joint Comments of Intel Corporation, Intelsat License LLC, and SES Americom, Inc. (“Intel/Intelsat/SES Comments”) at 8 (“The Broadband Access Coalition proposal . . . acknowledges that P2MP use produces less benefit than competing terrestrial 5G uses or the satellite operations P2MP would displace.”).

II. The Record Reflects Strong Support for Maximizing Use of the 3.7 GHz Band by Authorizing P2MP Operations to Share with Incumbent FSS Operations

A diverse set of commenters strongly supports the Coalition’s proposal to facilitate more intensive, coordinated P2MP use in a meaningful portion of the 3.7 GHz band. In their joint Comments, Frontier and Windstream support the allocation of up to 320 megahertz for P2MP shared with FSS earth stations, stating that the 3.7 GHz band “is prime spectrum for rural fixed wireless deployment. This spectrum enables high-bandwidth applications while still allowing for non-line-of-sight deployments over considerable distance.”⁵ In recommending specific rule changes, Google observes that Part 101 should be amended to “enable a greater diversity of terrestrial deployments, while still protecting FSS incumbents . . . and retaining the ability to clear part of the 3.7 – 4.2 GHz band for flexible use.”⁶ Motorola Solutions explains that “[d]ue to the widespread use of the band, [Motorola Solutions] does not believe it is possible to clear a majority of the band” and that “[t]he shared portion is best suited for well-contained, localized uses. . . .”⁷ Starry similarly states that “[f]ixed services should be permitted on a shared point-to-multipoint basis in any portion of the band not determined to be available for exclusive-use licensing.”⁸

Consumer and industry groups strongly support allocating the upper portion of the 3.7 GHz band for P2MP licensing. The Public Interest Spectrum Coalition urges the Commission to authorize P2MP use in the portion of the 3.7 GHz band that is not cleared for exclusive flexible use licensing, stating that “P2MP operators should be authorized to coordinate use under an

⁵ Comments of Frontier Communications Corporation and Windstream Services, LLC (“Frontier/Windstream Comments”) at 3.

⁶ Comments of Google LLC (“Google Comments”) at 2-3.

⁷ Comments of Motorola Solutions, Inc. at 2, 3.

⁸ Comments of Starry, Inc. (“Starry Comments”) at 6.

expedited Part 101 process – and ultimately through an [automated frequency coordination] system – and acquire interference protection rights on a first-in basis.”⁹ PISC further explained that “[t]his certainty for at least a portion of the spectrum used to serve rural and other underserved areas will help smaller providers attract investment capital and to leverage opportunistic access to additional spectrum....”¹⁰ In a similar vein, the Broadband Connects America Coalition “strongly supports the Commission’s proposal to open unused spectrum in the 3.7-4.2 GHz band for a licensed, point-to-multipoint fixed wireless service that empowers providers to extend high-speed broadband to underserved areas.”¹¹ The Dynamic Spectrum Alliance, a global organization with a mission to promote spectrum sharing, acknowledges the Commission’s recognition of “the promise of state-of-the-art radio technologies by proposing to permit fixed point-to-multipoint operations . . . [to] allow broadband providers to reduce the cost of deploying networks through the use of radio hubs that can complete fixed links with multiple endpoints....”¹²

Qualcomm appears to oppose the allocation of any spectrum for fixed P2MP service in the 3.7 GHz band, suggesting that the Commission “should look to repurpose a certain amount of spectrum nationwide, *i.e.*, hopefully the entire band, in order to create spectrum access opportunities for multiple licensees.”¹³ Nokia contends that “public interest demands require a plan and path forward for clearing additional spectrum in the band over and above the recently proposed 200 MHz” and raises the notion that “perhaps the entire 500 MHz” can be cleared over

⁹ Comments of the Public Interest Spectrum Coalition (“PISC Comments”) at 19-20.

¹⁰ *Id.* at 20.

¹¹ Comments of the Broadband Connects America Coalition (“Broadband Connects Comments”) at 16.

¹² Comments of the Dynamic Spectrum Alliance (“DSA Comments”) at 5.

¹³ Comments of Qualcomm Incorporated (“Qualcomm Comments”) at 3.

time.¹⁴ But these commenters, both of which rely primarily on the mobile market for their revenues, ignore the economic and consumer benefits of ensuring the availability of mid-band spectrum to serve rural Americans in places where 5G services will not be deployed soon by the large mobile carriers. In fact, it is more likely that, with low barriers to entry, high-capacity fixed wireless broadband, industrial IoT and other use cases can evolve and thrive and, yes, also offer 5G services in rural areas of the country. Moreover, other commenters reject the notion that the entire band can or should be cleared for exclusive licensed use given the ongoing need for FSS earth station operations.¹⁵

Qualcomm further argues that “it is premature” to authorize P2MP “until more information is available on how the band will be transitioned to mobile use” and that “[o]pening this band for such Part 101 operations at this point in time would prejudice the potential uses for this band and curtail the full use of the 3.7 to 4.2 GHz band for mobile services.”¹⁶ This argument should be rejected. First, as explained in the next section, coordinated sharing by P2MP will not impair the re-packing of FSS operations into the upper portion of the band. As a provider of computer chips for the mobile industry, Qualcomm naturally dismisses any argument that might impact its future revenues and ignores entirely the present benefits inherent in removing barriers to spectrum use that have hindered our country’s ability to drive broadband to millions of rural Americans that demand, but lack, broadband access today. No party contends that there is not a persistent rural divide and that spectrum – especially mid-band spectrum – can help solve this national problem. The NPRM and a whole host of commenters do not “prejudge”

¹⁴ Comments of Nokia at 7.

¹⁵ See, e.g., Comments of NCTA – The Internet & Television Association (“NCTA Comments”) at 8.

¹⁶ Qualcomm Comments at 6-7 (footnote omitted).

potential uses of the band, but seek to ensure that the twin objectives of making spectrum available for both licensed flexible use and more intensive use can be achieved.

Based on the overwhelming record advocating sharing of 300 megahertz of the 3.7 GHz band, vague and self-serving proposals to clear the entire 500 megahertz for a single use case are contrary to the public interest, disruptive to incumbent operations, and impractical.

III. Deployment of Fixed P2MP Broadband Service Will Not Affect Clearing the Lower Portion of the Band for Flexible Use

The Coalition recognizes that FSS operations in the lower portion of the 3.7 GHz band will need to be cleared in order to enable flexible use operations. To ensure that P2MP operations in the upper portion of the 3.7 GHz band will not impair the re-packing of FSS operations into the upper portion of the band, the Coalition proposed comprehensive rules governing P2MP operations. Commenters agree that “fixed broadband deployments will not impede partial band clearing for flexible use.”¹⁷

The touchstone of any spectrum sharing regime, and one that the Coalition embraces, is to “do no harm” to incumbent operations. Notwithstanding, the FSS industry disingenuously asserts that sharing the upper portion of the 3.7 GHz band with P2MP “would foreclose 5G use of the C-band downlink,”¹⁸ and simply ignores the Coalition’s proposals that will ensure that FSS operations can be relocated to the upper portion of the 3.7 GHz band without any impediments, and can continue to operate without harmful interference. To be crystal clear, permitting P2MP operations in the upper portion of the 3.7 GHz band will *not* require FSS earth

¹⁷ See Google Comments at 8.

¹⁸ C-Band Alliance Comments at 39. See also *id.* at 41 (“Restricting full-band, full-arc protection of FSS earth stations and allowing P2MP deployments would effectively render this [re-packing] process impossible.”); Intel/Intelsat/SES Comments at 9 (“a command and control decision to force P2MP in the C-Band Downlink will impair future 5G use of the band by greatly reducing the flexibility and incentive for FSS operators to clear spectrum.”)

station operators “to work around new P2MP links”¹⁹ Rather, the Coalition’s proposal would provide the necessary flexibility for FSS earth station operators to access the transponders and channels they may need to accommodate re-packing, by requiring P2MP licensees to comply with the following proposed rules:

- P2MP radios operating in the 3.7 GHz band – both access points and client devices – must be frequency agile and thus capable of operating across the entire 3.7 GHz band and able to accommodate any 20-megahertz channel assignment(s).
- P2MP access points must be capable of accessing the internet, and must be software upgradeable so that they can communicate with a future automated database over the internet. Client devices must be capable of following instructions from the associated access point to rapidly change channels, power and/or bandwidth as necessary.
- FSS operators seeking to change the satellites or transponders with which they communicate would be required only to notify a single database (*e.g.*, ULS, an authorized frequency coordination entity, or an automated database).
- P2MP operators would be required to poll the database at an interval frequent enough to accommodate FSS earth station operational changes.
- Licensed P2MP operators in the 3.7 GHz band must relinquish any channel needed by an FSS operator necessary to clear the flexible use portion of the lower 3.7 GHz band if that channel can no longer be frequency coordinated for P2MP use.

Clearly, the Coalition’s proposals will accommodate the concerns of the FSS industry that, in order to clear the lower portion of the 3.7 GHz band, “FSS operators must have free rein to reallocate transponders and frequency channels among satellite users.”²⁰ The Coalition fully recognizes that FSS operators must retain the flexibility to access any frequencies in the upper portion of the 3.7 GHz band during the re-packing process, and the Coalition’s proposals will provide such flexibility to FSS operators.

¹⁹ C-Band Alliance Comments at 39.

²⁰ *Id.* at 41.

IV. P2MP Can Responsibly Share the 3.7 GHz Band with FSS Operators

The FSS industry conjures economic and technical arguments in its campaign to obstruct sharing of a portion of the C-band for fixed P2MP use.²¹ These “doom and gloom” arguments are both flawed and reveal the ultimate objective of the FSS industry: to maintain exclusive use of the upper portion of the 3.7 GHz band in the hope that, at some future time, they can extract additional windfall profits from the “sale” of this spectrum.²²

In opposing sharing between FSS earth stations and P2MP, the Intel/Intelsat/SES economic analysis opines that “[i]f this [Coalition] proposal is implemented, satellite operators will lose the ability to *use* the C-Band more intensively.”²³ The discussion in the Coalition’s previous filings in this proceeding and in Section III, *supra*, demonstrate that the Coalition’s proposal to share the upper 3.7 GHz band would not “displace” satellite operations.²⁴ But, tellingly, the very next sentence of that report shows Intel/Intelsat/SES’s true colors: “This will negatively impact the ability to *repurpose* spectrum to support 5G in the future and diminish the C-Band’s ability to meet future demand for satellite services if it is not cleared.”²⁵

To translate, the satellite industry wants to retain the flexibility to sell all 500 megahertz at some point in the future, and the introduction of P2MP would stand in the way of this future windfall. But the Commission must do what is best for the public interest, not the speculative pecuniary interests of the FSS industry – and sharing the spectrum for more intensive terrestrial use will provide the greatest economic benefits to Americans.

²¹ See, e.g., Comments of the Satellite Industry Association (“SIA Comments”) at 31; Intel/Intelsat/SES Comments at 8; C-Band Alliance Comments at 40-49.

²² As discussed *infra*, certain vendors to the mobile industry support clearing the band of all uses, including FSS earth stations, so as to maximize their future potential sale proceeds.

²³ Intel/Intelsat/SES Comments, Appendix A at 35 (emphasis added).

²⁴ *Id.* at 8.

²⁵ *Id.* (emphasis added).

SIA further asserts that “[a] simple cost-benefit analysis makes clear that the proposals in the Notice to hamstring C-band FSS operations in order to allow new P2MP deployment must be rejected.”²⁶ But SIA doesn’t provide any empirical cost-benefit analysis, apparently believing the Commission should accept its unsupported rhetoric at face value. An appropriate economic analysis must compare the value of FSS C-band services to the combined value of FSS C-band services *plus* the value of P2MP broadband services in geographic areas where spectrum sharing is feasible. Clearly, the combined value of FSS and P2MP will far exceed the value of FSS alone, inasmuch as P2MP would be required to not impair FSS operations. And because P2MP deployments in rural and other underserved areas would not “hamstring” FSS operations, any credible cost-benefit analysis would necessarily conclude that sharing C-band spectrum to accommodate two services is more valuable and efficient than leaving unused spectrum fallow.

Second, the satellite industry and others allege that FSS and P2MP users cannot share spectrum from a technical perspective.²⁷ This ignores the Coalition’s demonstrations in the record that P2MP can successfully share use of the 3.7 GHz band pursuant to well-established frequency coordination procedures. More specifically, the Coalition, together with Google, presented an extensive technical analysis to Commission staff showing how P2MP can effectively and efficiently share use of the 3.7 GHz band with incumbent FSS users, particularly in large, rural parts of the country, on both a co-channel and non-co-channel basis.²⁸ Unlike mobile deployments, fixed wireless spectrum use can be coordinated on a localized basis and by

²⁶ SIA Comments at 31.

²⁷ *See, e.g.*, Comments of Ericsson at 11 (though conceding that “some sharing could occur on a limited basis”); Comments of the Content Companies at 11 (in re-packed band, there is no feasible way to permit fixed wireless usage” and protect earth stations from harmful interference).

²⁸ *See* Broadband Access Coalition, Notice of Oral Ex Parte Presentation, GN Docket 17-183 and RM-11791 (March 29, 2018) (“Google/BAC Technical Presentation”). The technical analysis can be found at: <https://ecfsapi.fcc.gov/file/10329174176162/Notice%20of%20Ex%20Parte%20Meetings%20-%20Broadband%20Access%20Coalition%20and%20Google%20LLC.pdf>.

sector, taking advantage of various methods, including antenna directionality, beam tilt, and terrain shielding, to avoid causing harmful interference to earth stations.

The C-Band Alliance Comments include a technical annex purporting to show that FSS operations will require separation distances that “will significantly limit the areas within which P2MP operations . . . will be possible.”²⁹ Conveniently, the C-Band Alliance technical annex considers an earth station located at Virginia Beach, Virginia, a flat, coastal, urban area marked with none of the characteristics of the rural areas where the Coalition expects to be able to coordinate P2MP operations.³⁰ Moreover, as shown in the attached Coalition Technical Report, the C-Band Alliance relies on flawed assumptions that further distort its analysis.³¹ These include the use of atypical sector sizes, maximum transmitter power greater than that proposed by the Coalition, overstated interference in areas with heavy clutter, and overstated estimates of the number of cable head-ends requiring protection, especially in rural areas.³² As a result, the C-Band Alliance’s conclusion that co-channel separation distances of “up to 50 kilometers” is, despite its statements to the contrary:

an absolute worst-case scenario arrived at by using power levels well above those proposed by the Coalition, and by entirely failing to account for terrain or clutter shielding. Such analysis creates the absolute lowest efficiency in frequency use by providing vast, arbitrary, and needless co- and non-co-channel protections for incumbent systems.³³

²⁹ C-Band Alliance Comments, Technical Annex at 13.

³⁰ *See id.* at 18.

³¹ *See* Coalition Technical Report attached as Exhibit 1 hereto.

³² *See id.*

³³ *Id.* at 4. The Coalition opposes ACA’s proposal that the Commission hire a neutral third-party expert to examine the feasibility of sharing between FSS earth stations and P2MP. *See* ACA Comments at 14 - 15. The Coalition has demonstrated that, with appropriate frequency coordination, sharing is feasible. The Coalition does, however, support the establishment of a multi-stakeholder group to develop the specific technical criteria and procedures for FSS - P2MP frequency coordination. *See* Section VIII, *infra*.

But even if the technical annex can be given credibility, the C-Band Alliance’s substitution of its own business judgment for that of the Coalition’s members is presumptuous and contrary to the rural use case the Coalition is promoting. As the Technical Report makes clear, “[t]he Coalition does not expect P2MP operators to provide seamless nationwide coverage mobile-type coverage, but instead proposes that targeted P2MP deployments can be deployed in the 3.7 GHz band in certain geographic areas while still providing full protection for existing FSS operations.”³⁴ And providing high-throughput broadband service in the geographic areas where P2MP can coordinate successfully in the FSS portion of the band – rural areas – is precisely the public interest objective that should compel the Commission to encourage use of as much of the C-band’s still-unused spectrum as possible.

Decades of real-world experience with coordinated sharing in the 3.7 GHz band between high-power, tall-tower, point-to-point (“P2P”) FS and FSS operations demonstrate the feasibility of sharing. In 1988, there were over 39,000 P2P licenses, and in 1997, there were still over 13,000 P2P licenses sharing spectrum with FSS earth stations.³⁵ The Coalition’s proposal for sharing between fixed P2MP operations and FSS operations is based on the same Part 101 approach. Prior frequency coordination with FSS earth stations was required before deployment of P2P links and prior frequency coordination with FSS earth stations would be required before deployment of P2MP access points. P2MP coordination simply looks at multiple possible fixed link paths within a defined sector, rather than a single fixed link path.

³⁴ Exhibit 1 at 4.

³⁵ NPRM at ¶ 9.

The Comments demonstrate strong support for the feasibility of sharing the 3.7 GHz band between P2MP and incumbent FSS earth station operators. Frontier and Windstream fully agree with the Coalition, noting that:

While we understand that certain existing users may be concerned about harmful interference, we believe that productive coexistence with fixed wireless is possible. *Frontier, for instance, relies on C-Band earth stations as the eighth largest multichannel video provider, but in our predictive judgment, we can work toward rules that protect existing users while unleashing the benefits of new productive uses.*³⁶

Starry similarly observes that:

There should be no basis on which the Commission should conclude that the band cannot be shared between FSS and fixed point-to-multipoint operations. This is not a binary question. Instead, the question is what is the protection criteria, how does it impact the utility for fixed, and what tools can be leveraged to mitigate interference (technical or financial).³⁷

The Public Interest Spectrum Coalition concurs:

Regardless of how much spectrum becomes available for flexible use in the near term it is entirely feasible and desirable to authorize P2MP fixed wireless to ‘operate on a secondary basis *vis-à-vis* FSS in any part of the band which FSS continues to operate during a transition period . . . and, thereafter, on a frequency coordinated basis to protect actual FSS operations.’³⁸

The FSS industry and other commenters that object to sharing note that 16,500 C-band earth stations have now been registered in the IBFS database.³⁹ The registration of additional earth stations does not undermine the technical showing of the Coalition and Google that sharing

³⁶ Frontier/ Windstream Comments at 4 (emphasis added).

³⁷ Starry Comments at 8 n. 23.

³⁸ PISC Comments at 12, *citing* NPRM at ¶ 116. *See also* Broadband Connects Comments at 16 (“Coordinated, shared us of the ongoing FSS band by fixed wireless providers can make a major difference in bringing connectivity to areas where the business case has been lacking for fiber-to-the-home connections.”).

³⁹ *See, e.g.*, SIA Comments at 10 and 32 (“the [Coalition’s] analysis of the feasibility of P2MP operations in C-band downlink spectrum is premised on earth station deployment numbers that do not reflect the recent flood of registrations.”); ACA Comments at 14.

is feasible.⁴⁰ Nor does it undermine the fact that FSS earth stations and P2P links have successfully shared the 3.7 GHz band for decades.

At most, the recent registration of additional earth stations may reduce the size of the geographic areas where sharing is feasible. But the consumer benefits and economic value of sharing, where feasible, remain unchanged. The business case for deployment of P2MP in rural areas is something that rural broadband service providers, not earth station operators, are best situated to address. As the Broadband Connects America Coalition points out, rural America and particularly the modern agricultural industry “relies on high-speed broadband.”⁴¹ And while fiber networks are practical in some places, today P2MP is critical to reach rural Americans and to support agriculture investment.⁴²

In all events, further earth station operational data, and subsequent analysis of that data, is necessary to assess the scope of geographic opportunities for sharing.⁴³ For example, the Coalition is aware that, in many instances, new earth stations were registered at the same site as existing earth stations. To the extent that P2MP operators seek to share the 3.7 GHz band on co-channel basis (using appropriate distance separation), it makes no difference if there is one earth station or 20 earth stations at the same site. Further, as explained below, a typical FSS earth station uses far less than the 500 megahertz of C-band spectrum, in many cases as little as 23 megahertz and sometimes, as in audio broadcast feeds, much less. To the extent that many of these newly registered earth stations use only one or two transponders, or only a portion of a

⁴⁰ The thousands of newly registered earth stations demonstrate that the Commission’s requirement (and information campaign) to register receive-only C-band earth stations has been quite successful.

⁴¹ Broadband Connects Comments at 14 – 15.

⁴² *See id.*

⁴³ As AT&T points out “[t]he record requires much further development. . . . At this point . . . the record suggests that (i) there may be excess C-band capacity; (ii) C-band spectrum might potentially be used more efficiently; and (iii) there likely is some ability to shift . . . C-band uses to alternative frequencies. . . .” Comments of AT&T (“AT&T Comments”) at 8.

transponder, the opportunities for non-co-channel sharing will hardly be impacted. Until real-world frequency data is filed for earth stations, the impact of these new earth station registrations on the scope of P2MP sharing cannot properly be assessed.

Finally, the Coalition reiterates that P2MP licensees will be able to change frequencies rapidly if an incumbent FSS earth station operator needs to change frequencies, even after the re-packing process is completed. In the event that an incumbent FSS earth station operator needs to move to frequencies occupied by a P2MP licensee, and that channel can no longer be coordinated, the P2MP operator will be required to vacate that channel almost immediately. Specifically, consistent with the process set forth in Section III above, the Coalition proposes the following process:

- FSS operators seeking to change satellites or transponders would be required only to notify a single database (*e.g.*, ULS, an authorized frequency coordination entity, or an automated database).
- P2MP operators would be required to “poll” the database at an interval frequent enough to accommodate FSS earth station operational changes.
- If such an operational change is outside the scope of the prior frequency coordination, the P2MP operator would be required to vacate the impacted frequencies within fifteen minutes.

V. Eliminating the “Full-Band, Full-Arc” Policy Will Maximize Sharing without Impairing Real-World FSS Operations

The FSS industry disingenuously contrives a parade of horrors if the “full-band, full-arc” policy is eliminated. For example, the C-Band Alliance claims that “terminating full-band, full-arc protection and permitting new P2MP services would leave earth stations vulnerable to harmful interference if they change frequencies or antenna pointing.”⁴⁴ The C-Band Alliance

⁴⁴ C-Band Alliance Comments at 42 – 43. *See also* SIA Comments at 21 (“Satellite 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”)

also asserts that “the flexibility to change satellites is needed to allow FSS customers to benefit from competition among satellite operators,” and that eliminating the full-band, full-arc policy will undermine such competition.⁴⁵ AT&T contends that “full-band, full arc” flexibility is necessary because it “enhances an earth station licensee’s ability to obtain competitive satellite services”⁴⁶ NCTA argues that neither other stakeholders nor the Commission have suggested alternatives that provide the same level of flexibility for earth station operators to switch satellites quickly and allow for “continued itinerant operations for newsgathering and live events.”⁴⁷

The “full-band, full-arc” policy should be eliminated in favor of a “when and where needed” protection scheme implemented through frequency coordination. The FSS industry does not provide, nor can it provide, any evidence that each and every FSS earth station needs access to all 500 megahertz of spectrum across the entire spectrum arc at all times.⁴⁸ And yet, the decades-old “full-band, full-arc” policy requires that frequency coordinators seeking available spectrum for FS operations must assume that every single FSS earth station is always using all 500 megahertz of spectrum in the band across the entire spectrum arc. In a world where commercial spectrum is in high demand, preserving the “full-band, full-arc” policy would be wholly inconsistent with the public interest in maximizing the use of spectrum.

There is broad and strong support in the record for eliminating the “full-band, full-arc” policy. Verizon asks the Commission to “replace the full-band, full-arc coordination policy with

⁴⁵ C-Band Alliance Comments at 43. *See also* SIA Comments at 23 (“The full-band, full-arc policy is . . . necessary to enable meaningful competition for satellite services.”)

⁴⁶ AT&T Comments at 13.

⁴⁷ *See* NCTA Comments at 24 – 25.

⁴⁸ The Coalition recognizes that after re-packing, FSS operations will operate in less than 500 megahertz of spectrum. Regardless, the FSS industry does not provide, nor can it provide, any evidence that after re-packing, each and every earth station will require access to all 300 megahertz of spectrum all of the time.

a new approach that grants protection for ‘those frequencies, azimuths and elevation angles and other parameters reported as in regular use’⁴⁹ Microsoft states that “much of the 500 megahertz of capacity in the 3.7 GHz band lies fallow in many areas across the country” as a result of the “full-band, full-arc” policy.⁵⁰ Starry “support[s] the proposal to base coordination of protected earth stations on real-world information regarding those earth stations”⁵¹

To properly address this issue, it is important to understand the Coalition’s proposal regarding the “full-band, full-arc” policy. The Coalition strongly supports eliminating the current policy insofar as it requires FS operators to coordinate as if each and every FSS earth station is using all 500 megahertz of spectrum in the 3.7 GHz band all of the time. As the Coalition has frequently explained, a typical FSS earth station uses far less than the 500 megahertz of C-band spectrum.⁵²

The Coalition supports replacing the “full-band, full-arc” policy with a “when and where needed” policy. Under this approach, FSS earth station operators would retain their current licenses or registrations, and would be permitted to access, *as needed*, any C-band satellite and transponder without having to seek prior approval from the Commission. In whatever portion of the 3.7 GHz band that FSS earth station operators are permitted to access on an as-needed, real-world basis (*e.g.*, the upper portion of the band after spectrum in the lower band is cleared for

⁴⁹ Comments of Verizon at 11. *See also* Comments of T-Mobile USA, Inc. at 19 (“The Commission should ... eliminate the full-band, full-arc coordination policy”); PISC Comments at 13-16.

⁵⁰ Comments of Microsoft Corporation (“Microsoft Comments”) at 5.

⁵¹ Starry Comments at 4. *See also* DSA Comments at 13-14; PISC Comments at 13-14.

⁵² Collection and analysis of data regarding actual frequency usage by each earth station is essential to better understanding this matter. While cable head-ends may access many C-band transponders, television and radio stations typically access only a few transponders, and religious networks and specialty distribution services (such as the AP network) often use only one transponder or a portion of a transponder. The FSS industry has been exceedingly tight-lipped about actual spectrum usage, pointing only to one or two cases of cable head-ends accessing wide swaths of the C-band, while saying nothing about other use cases.

flexible use), sharing the band with P2MP services poses no obstacles to FSS flexibility to change transponders or satellites due to outages or new contracts. The only responsibility for FSS operators would be to notify the database. After such notification, P2MP licensees would be required to almost immediately accommodate any satellite or transponder changes required by FSS operators.

Likewise, FSS earth station operators will have the flexibility to enter into new contracts with satellite operators, and thus, the Coalition’s proposal will not adversely impact competition among satellite operators. The Coalition’s proposal also ensures that reliability is not adversely impacted. While the FSS operators argue that they need “full-band, full-arc” to maintain five 9s reliability,⁵³ the Coalition’s “when and where needed” and rapid accommodation by P2MP operations will ensure such reliability without the need for the inefficient and archaic “full-band, full-arc” system.

NCTA takes a more measured approach to the debate regarding the “full-band, full-arc” policy.

The Commission should not end its full-band, full-arc policy. *However, if the Commission intends to move forward, it must first put in place an adequate alternative that will result in equivalent protection for earth station operators. Such operators must be allowed to change frequencies and antenna pointings on short notice without prior approval or burdensome notification requirements*

...⁵⁴

⁵³ See Monica Allevan, *C-Band Alliance reiterates 200 MHz is the ‘right number’ at 3.7-4.2 GHz*, FierceWireless (Nov. 14, 2018, 9:53am), https://www.fiercewireless.com/wireless/c-band-alliance-reiterates-200-megahertz-right-number-at-3-7-4-2-ghz?mkt_tok=eyJpIjoiTWpnNE1qSTBZVGhoWm1RMylsInQiOiIxM2MzZ2lodE9DRHRtU2hKdVpyZGVVoSGhEKzR2TWZTOHNaZ3Nkc2lGMzBPUVo4YXFVVlladUpnSE9pMVprMDI3cDh4ZFNPTnBxQVBvUzhia0FFNlBnbFFucG1kdFBKtWdpK2JKVTNKeGRWSjJSOVFNc2VRSEpVOVhRdGVmQnVGTSJ9&mrkid=65721408

⁵⁴ NCTA Comments at 27 (emphasis added).

The Coalition submits that its proposals meet NCTA’s concerns by providing interference “protection for earth station operators,” and allowing such operators “to change frequencies and antenna pointings on short notice without prior approval or burdensome notification requirements.”

The FSS industry overstates the impact on transportable earth stations if the “full-band, full-arc” policy is eliminated. For example, the C-Band Alliance asserts that operations by transportable earth stations will be drastically reduced because “[f]lexibility to access the full C-Band Downlink is also essential for live coverage of breaking news, sporting events and entertainment programming.”⁵⁵ C-band transportable earth stations uplink video programming in the 5.925 – 6.425 GHz band, which is not under consideration in this proceeding. These transportable earth stations use the 3.7 GHz band downlink to monitor, at the remote location, the video feed to the satellite.⁵⁶ What the FSS industry conveniently neglects to explain is that the downlink monitoring does not require broadcast quality video, and thus, in the unlikely event of intermittent interference, the material functionality of the transportable earth station will not be impacted.

VI. The Commission Must Require FSS Operators to Submit the Data Necessary to Enable Sharing of the 3.7 GHz Band

There is broad support for the Commission’s proposal to “develop a more complete record on existing FSS operations in [the 3.7 GHz] band [by requiring] earth station operators to

⁵⁵ C-Band Alliance Comments at 44.

⁵⁶ *See, e.g.*, NCTA Comments at 26 (“While the [transportable] trucks use C-band uplink to deliver the live programming back to the [Network Operations Centers], the trucks rely on downlink spectrum in the 3.7 – 4.2 GHz band to monitor onsite the quality of the video they are delivering and to verify use of the correct uplink frequency”)

file additional information on their existing facilities.”⁵⁷ This information is absolutely critical to maximize sharing of the band by terrestrial users.

Commenters broadly agree that additional data regarding FSS earth station operations is “necessary to maximize efficient utilization [of the 3.7 GHz band] by other services.”⁵⁸ As Google stated in previous comments, “[w]ith actual knowledge of FSS frequency use, frequency separation could enable P2MP broadband connectivity to serve as many as 120 million Americans.”⁵⁹ Microsoft states that “it is essential that FSS earth station operators be required to file additional operational information In particular, FSS earth station operators must be required to provide the specific frequencies or transponders in use on a daily basis.”⁶⁰ T-Mobile concurs that “[t]he additional proposed information collection is necessary . . . to show exactly how the band is used.”⁶¹ Stressing the need to have accurate information, T-Mobile further states that “*satellite operators* should confirm the certifications and information provided by earth station users.”⁶² As T-Mobile’s comments show, the need for more accurate information is vital to enable sharing.

Not surprisingly, the FSS industry and earth station operators oppose any requirement to submit additional information. For example, the C-Band Alliance asserts that providing such information “would impose costly and time-consuming burdens on FSS users.”⁶³ The Coalition

⁵⁷ NPRM at ¶ 41.

⁵⁸ See Google Comments at 15 – 17 (“Having more granular data available, particularly the specific frequency ranges over which registered earth stations operate and the actual antenna patterns of the earth station dishes, will greatly improve analytical accuracy.”)

⁵⁹ *Id.* at 5, citing Google/BAC Technical Presentation.

⁶⁰ Microsoft Comments at 7.

⁶¹ Comments of T-Mobile at 18-19

⁶² *Id.* at 19.

⁶³ C-Band Alliance Comments at 50.

respectfully disagrees. Fundamentally, access to licensed spectrum protected from interference is a privilege accorded to FSS earth station operators. That privilege must be accompanied by basic responsibilities. In a world of spectrum scarcity, incumbent spectrum users cannot be excused from basic reporting obligations – particularly where the spectrum is capable of being shared for high-value uses. FSS operators have managed to avoid providing data about their operations for many decades, but that luxury has long since reached its logical end.

Users of other licensed, interference protected spectrum bands are required to submit, and regularly update, operational data regarding their location and the specific frequencies that they are using, in addition to other technical data. Every ULS licensee must provide, and update, such data. For example, there are more than 27,000 licenses for P2P service in the 5925 – 6425 MHz band.⁶⁴ Among other data points, P2P licensees must report the specific frequencies they are using, and update the database whenever there is a change in these frequencies.

In fact, registered receive-only earth station operators in the 3600 – 3700 MHz band ultimately will be required to register and update their operational parameters, with such registration information available to all approved Spectrum Access Systems (“SAS”).⁶⁵ Although there are fewer earth stations operating in this portion of the C-band, the scope of the task – and thus, the purported burden – on earth station operators is no different than what the Coalition proposes.

⁶⁴ See *Report to Congress Pursuant to Section 1008 of the Spectrum Pipeline Act of 2015, as Amended by the Ray Baum’s Act of 2018*, GN Docket No. 14-177, FCC 18-1128 (rel. Nov. 2, 2018) at ¶ 21. Further, “[e]ach of these licenses authorizes one or multiple point-to-point links.” *Id.* at n.84.

⁶⁵ See 47 C.F.R. § 96.17. Registrations will be listed at www.fcc.gov/cbrs-protected-fss-sites. In addition to annual registration 30 days before the end of the calendar year, FSS earth station licensees are also required to update registration information upon making changes to their operational parameters. See 47 C.F.R. § 96.17(d).

The information to be collected from FSS operators, most notably the frequencies that are used daily, is readily available. Entering this information into an on-line database may take some time, but it is largely a one-time task. Subsequent updating of the record to reflect occasional small changes is not a large task, because for most operators nearly all of the information remains unchanged for many years.⁶⁶

The Coalition recommends that the Commission consider whether the responsibility to initially provide and/or update such data be placed on the satellite operators rather than the earth station operators.⁶⁷ In light of the multi-billion dollar windfall that the satellite operators stand to gain if the Commission authorizes private market deals to clear spectrum in the lower portion of the band for flexible use, the Coalition suggests that the operational and/or financial responsibility to provide earth station operating data could be placed on the satellite operators, who have the expertise and financial resources necessary to accomplish this task.⁶⁸

⁶⁶ See NCTA Comments at 25 (“operators [are] not required to change frequencies or repoint antennas frequently ...”)

⁶⁷ See, e.g., *id.* at 24 (“If the Commission enables shared fixed P2MP use of remaining FSS spectrum and imposes [reporting] obligations, earth station operators may incur additional costs that should be reimbursed”) and at 35 (“Listing specific transponders and frequency use would be a new requirement for earth stations operators (and could likely be readily provided by a handful of space station operators instead.”))

⁶⁸ Intelsat estimates that clearing the lower portion of the band for flexible use could cost \$2 billion. See, e.g., Peter B. de Selding, *Intelsat estimates cost to clear/relocate U.S. satellite C-band spectrum at \$2 billion*, Space Intel Report, Oct. 30, 2018, <https://www.spaceintelreport.com/intelsat-estimates-cost-to-clear-relocate-u-s-satellite-c-band-spectrum-at-2-billion/>. The Coalition takes this estimate with a mountain of salt. Regardless, the estimated value of the 200 megahertz of spectrum to be cleared is in the tens of billions of dollars. See, e.g., Kerrisdale Capital, June 2018, <https://www.kerrisdalecap.com/wp-content/uploads/2018/06/Intelsat-and-SES.pdf> (estimating the market value of 400 megahertz of C-band spectrum at approximately \$60 billion). The Coalition submits that the satellite operators will have more than enough financial resources to undertake the reporting and updating of earth station data. Further, the C-Band Alliance has committed to reach out to all incumbent earth station operators to provide new filters and technical assistance in connection with the re-packing process. As part of that outreach, it would make sense to also require the satellite operators to gather, and upload to the database, the requisite operational information.

The Coalition appreciates that the satellite industry approaches this process with some concerns. To alleviate these concerns, it is essential that the satellite industry participate in a multi-stakeholder group that will consider ways to best implement existing coordination techniques and, ultimately, automated frequency coordination that incorporates industry-approved protection and sharing algorithms.

VII. 3.7 GHz Band Spectrum is Important to Bridging the Digital Divide

In another attempt to de-legitimize the interests of the Coalition and the rural Americans that are demanding access to broadband, the fixed satellite industry disingenuously argues that it is “completely unnecessary” for the Commission to authorize P2MP services in the 3.7 GHz band because there are “myriad other bands in which P2MP could be provided to meet any demonstrated need for more spectrum.”⁶⁹ Without any support whatsoever, the C-Band Alliance further asserts that “WISPs have not shown that additional spectrum is needed to expand fixed broadband to currently unserved areas – indeed, spectrum is likely to be plentiful in communities which lack wireless broadband operations.”⁷⁰ These arguments must be rejected.

The C-Band Alliance appears to lack any understanding of the spectrum constraints facing fixed wireless broadband access providers. First, the Coalition filed its petition for rulemaking in June of 2017 precisely because existing spectrum bands used for fixed wireless broadband access are inadequate to keep pace with consumer demand for more and more bandwidth to support video streaming and other bandwidth-intensive applications. Yes, fixed wireless broadband providers typically rely on a variety of spectrum bands, but those frequencies

⁶⁹ C-Band Alliance Comments at 45; *see also* SIA Comments at 24-25.

⁷⁰ *Id.* (footnote omitted). The C-Band Alliance’s use of the phrase “lack *wireless* broadband operations” is either a red herring to divert the Commission’s attention away from the lack of *fixed* broadband operations or else represents a fundamental failure to understand the needs of millions of rural Americans to have broadband access in their homes, whether it is furnished by wire or wireless technology.

are congested and cannot accommodate gigabit or near-gigabit speeds. Commissioner O’Rielly stated it clearly: “it is undisputed that the exponential growth of wireless data, especially over unlicensed networks, has led to severe congestion in our highly-prized spectrum bands, particularly 2.4 and 5 GHz.”⁷¹

While it is not necessary for the Coalition to satisfy the standard the satellite industry contrives, a quick survey of the spectrum bands identified by the C-Band Alliance unsurprisingly disproves its premise.⁷²

- *500-700 MHz Band* – The *unlicensed* portion of the band – TV white spaces – has been largely underutilized as a result of regulatory obstacles and the ongoing broadcast station re-pack that creates uncertainty over the amount of spectrum that may be available in a given market.
- *900 MHz Band* – This unlicensed band consists of 26 megahertz that is shared with unlicensed consumer devices and utility metering, as well as licensed Location Monitoring Service operations. As one of the first unlicensed bands to be used by WISPs for fixed broadband, it is completely saturated. There is no more capacity available to provide service to the public, and equipment sales and installation are, and have been for several years, largely limited to replacing old equipment that has reached its end of life, or serving small clusters of customers in particularly hard-to-reach, typically wooded, locations.
- *2.4 GHz Band* – Likewise, for many years this unlicensed band also has been extremely congested. There is no remaining capacity for WISPs to expand service in this band, which is shared with consumer devices including Wi-Fi, Bluetooth, and microwave ovens. WISPs are not making significant new deployments in this band.

⁷¹ *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, ET Docket No. 18-295 and GN Docket No. 17-183, FCC 18-147 (rel. Oct. 24, 2018), Statement of Commissioner Michael O’Rielly.

⁷² The C-Band Alliance cites to a report prepared by The Carmel Group in 2017. See C-Band Alliance Comments at 45 n.117. The C-Band Alliance conveniently ignores language in that report stating that “[t]he growing acceptance of spectrum sharing is further increasing availability and capacity for fixed wireless, with greater overall spectral efficiency.” The Carmel Group, *Ready for Takeoff: Broadband Wireless Access Providers Prepare to Soar with Fixed Wireless*, The BWA Industry Report: 2017 (2017) at 13, available at http://www.wispa.org/Portals/37/Docs/Press%20Releases/2017/TCG's_2017_BWA_FINAL_REPORT.pdf. The C-band exemplifies these sharing possibilities and the Coalition’s proposal would maximize its benefits.

- *3.65 GHz Band* – When the Commission made this 50 megahertz of spectrum available in 2008 on a “lightly licensed” basis, WISPs became early adopters in light of the congestion existing in the 900 MHz, 2.4 GHz, and 5 GHz bands. In the past ten years, the heavy use by WISPs, utilities, municipalities, and others has resulted in increasing constraints on spectrum use. This band has been subsumed into the 3.55-3.7 GHz CBRS band, which is still not operational, and licensing has been frozen since 2015.
- *5 GHz Band* – As the “workhorse” band, the 5 GHz U-NII bands are heavily utilized by WISPs. However, this band cannot accommodate the needs of rural consumers, especially given the lack of capacity and opportunities in other spectrum bands. This band is extremely sensitive to line-of-sight impairments such as foliage, and its P2MP power limit is lower than licensed bands. Thus, its usable range is limited. As this band rapidly fills to capacity, interference issues will increase and quality of service will suffer, with few – if any – alternatives available.
- *28 GHz, 39 GHz, and 40 GHz Bands* – These bands are not used by fixed wireless operators; they are licensed bands that will be auctioned, primarily to mobile operators. In any case, they are only usable for short distances and therefore are not suitable for last-mile coverage in the rural areas where C-band earth stations are less plentiful. These bands provide little value to rural consumers.⁷³

Second, there are no guarantees that any future spectrum bands will be available to WISPs on terms that will allow them to use the spectrum to provide fixed rural broadband service. The C-Band Alliance cites to the Citizens Broadband Radio Service (“CBRS”) as one example, claiming that WISPs can acquire Priority Access Licenses and/or operate on a General Authorized Access basis “[o]nce the CBRS regulatory framework adopted by the Commission in 2015 is fully implemented.”⁷⁴ The C-Band Alliance conveniently ignores the fact that, over

⁷³ SIA disingenuously creates the false comparison that “[t]he total bandwidth available in these bands is more than 10 GHz, dwarfing the limited spectrum in the C-Band downlink frequencies that P2MP proponents seek to use for terrestrial broadband.” SIA Comments at 25. Of course, spectrum bands used by fixed wireless providers are shared with other unlicensed uses (*e.g.*, baby monitors, home routers, garage door openers), and the vast majority of the spectrum SIA includes is in the millimeter wave bands, which are not suitable for rural broadband for the reasons explained above. Further, SIA’s simplistic approach is a backward-looking comparison that is irrelevant to the Commission’s objectives to make spectrum available for both flexible use and more intensive terrestrial use to meet growing consumer demand.

⁷⁴ C-Band Alliance Comments at 45-46.

strenuous objection from stakeholders representing rural broadband and a diverse number of other use cases, the Commission in 2018 – not 2015 – made substantial changes to the license size, term and renewability provisions of its CBRS rules that will greatly reduce the ability of WISPs to obtain access to priority licensed spectrum in the band.⁷⁵ And while the WISP industry is urging the Commission to adopt rules that will make other spectrum bands available, there can be no assurance that these efforts will be successful, when those bands might be available, what technical constraints there may be, when equipment may be commercially available, and a host of other unknowns. Most importantly, it cannot be determined that the spectrum that may be available for rural deployment in these other bands will be sufficient to keep pace with consumer demand. Rural service in particular requires spectrum below 6 GHz, which is capable of serving the longer distances required in such areas, but it also needs wide enough channels to support high speeds.

Third, the C-Band Alliance accepts at face value the mobile industry’s claims that they need more spectrum – and, precisely, 200 megahertz in the 3.7 GHz band – for future 5G services, but is unwilling to accept that others also demand mid-band spectrum. Thanks to the rules adopted in the *2018 CBRS Order*, the mobile industry is poised to make extensive use of the CBRS band, which calls into question whether their need for another 200 megahertz in the C-band is “completely unnecessary” as well.

From the C-Band Alliance’s narrow perspective, the “primary objectives” of this proceeding are limited to (1) determining how much money the satellite operators can get to “sell” 200 megahertz of spectrum, and (2) foreclosing shared use of 300 megahertz.⁷⁶ The

⁷⁵ See *Promoting Investment in the 3550-3700 MHz Band*, Report and Order, GN Docket No. 17-258, FCC 18-149 (rel. Oct. 24, 2018).

⁷⁶ C-Band Alliance Comments at 44.

Commission’s primary objectives, however, include a much broader mandate – promoting both flexible use in the lower portion of the band and more intensive terrestrial use in upper portion of the band.⁷⁷ In seeking to achieve these twin goals, the Commission should not fall victim to misinformed and self-serving rhetoric that ignores the benefits that sharing 300 megahertz of the 3.7 GHz band can bring. To accept the C-Band Alliance’s argument is to forever consign rural Americans to ever-slowng fixed broadband access as more and more consumers use more and more bandwidth on the same amount of congested spectrum.

VIII. Opportunistic Access

In its Comments, the Coalition urged the Commission to allow P2MP licensees to have opportunistic access to the lower 200 megahertz segment both before and after the band is cleared for flexible use services, including any guard band between the two band segments.⁷⁸ Starry agrees, encouraging the Commission “to create a shared underlay in the flexible-use portion of the band . . . on a non-interference basis and only in the frequencies or geographies unoccupied by a flexible-use licensee.”⁷⁹ The Dynamic Spectrum Alliance echoes this position, pointing out that the use of a geographic database will allow the Commission to permit “fixed links in an area where a new flexible-use licensee has not begun service,” thereby preventing valuable spectrum from going unused in rural areas.⁸⁰ DSA further suggests that fixed users be required to periodically query a database to determine whether new flexible use operations have commenced in the area and, if so, to reduce power or cease operating if necessary to protect the

⁷⁷ See NPRM at ¶¶ 49, 58 – 115.

⁷⁸ See Coalition Comments at 30; *see also* Frontier/Windstream Comments at 7 (urging the Commission to allow P2MP “in the very near term”).

⁷⁹ Starry Comments at 6.

⁸⁰ DSA Comments at 12 – 13.

licensee's operations.⁸¹ The Broadband Connects America Coalition and PISC similarly advocate for the temporary, opportunistic use of the flexible use portion of the band until such time as licensees deploy service.⁸²

The Commission has implemented a similar “use it or share it” regime for CBRS. Section 96.25(c)(1) permits opportunistic use in areas where a PAL is not in use or where a CBSD does not contact the SAS for seven days within a default protection contour. Unlicensed use of TV white space operates under a similar regulatory model that permits continued opportunistic use of the 600 MHz band post-auction in areas where the new flexible use licensee has not commenced service.⁸³ Following this trend, the Commission can enable the same sort of coordinated, opportunistic use in the C-band.

IX. Conclusion

There is no better or cost-efficient way for rural consumers to gain access to high-speed internet service than through spectrum, and there is no better or spectrally-efficient way to achieve that objective than through shared, mid-band spectrum. Those who seek to deny this objective do so to preserve an antiquated, decades-old full-band, full-arc policy that has been superseded by spectrum sharing enabled by databases and propagation modeling that will provide “when and where needed” protection to FSS incumbents. The Commission should adopt

⁸¹ See DSA Comments at 13. DSA also recommended that “the Commission should delegate development of the database to a representative group of industry stakeholders, such as the WinnForum, which has hosted the private sector process of developing the technical implementation of automated coordination and interference avoidance for the CBRS band.” See *id.* at 6-7.

⁸² See Broadband Connects Comments at 4; PISC Comments at 19-21.

⁸³ See 47 C.F.R. § 15.712. PISC similarly noted that “[w]ith the benefit of a geolocation database (the AFC), the Commission can once again adopt the same “use it or share it” approach that it has already adopted for GAA use of vacant PAL spectrum (in CBRS) and for unlicensed use of locally-vacant flexible use spectrum in the post-incentive-auction 600 MHz band.” PISC Comments at 20.

the Coalition's proposal, supported by many stakeholders, and begin the multi-stakeholder process that will enable more and better broadband deployment to rural Americans.

Respectfully submitted,

BROADBAND ACCESS COALITION

By: /s/ Robert S. Koppel
Robert S. Koppel
Lukas LaFuria Gutierrez & Sachs, LLP
8300 Greensboro Drive, Suite 1200
Tysons, VA 22102
bkoppel@fcclaw.com
Counsel to the Broadband Access Coalition

/s/ Claude Aiken
Claude Aiken
President and CEO
WISPA
4417 13th Street #317
Saint Cloud, FL 34769

/s/ Michael Calabrese
Michael Calabrese
Director, Wireless Future Program
Open Technology Institute at New America
740 15th Street, NW, Suite 900
Washington, DC 20005
calabrese@newamerica.org

December 11, 2018

Exhibit 1

Broadband Access Coalition – Technical Report

Rebuttal of C-Band Alliance Technical Annex

Introduction

In the NPRM, the Commission proposed that point-to-multipoint (“P2MP”) operations share the upper portion of the 3.7 GHz band with incumbent Fixed-Satellite Service (“FSS”) earth stations. The C-Band Alliance opposes this proposal, and attaches a Technical Annex to its Comments purporting to demonstrate the “infeasibility” of such sharing because “significant separation distances between P2MP facilities and FSS receive earth stations will be required.”¹

The C-Band Alliance Technical Annex fails to demonstrate that P2MP operations cannot successfully share the 3.7 GHz band with incumbent FSS earth stations. The Technical Annex makes a number of material errors and erroneous assumptions about the nature of fixed operations that distorts its conclusions and makes them unreliable. These are discussed below.

Notably, the Technical Annex relies on a case study of the Virginia Beach, VA area. The Virginia Beach area presents the worst possible case for P2MP/FSS earth station sharing, and would never be viewed by the Coalition as a good candidate for sharing.

Virginia Beach has a particularly flat terrain, surrounded closely by large areas of inland waters and bordered by the Atlantic Ocean to the east. The nearest point to the geographic coordinates of the Virginia Beach earth station (the Norfolk State site, call sign E050120) where the ground elevation exceeds even 10 meters above mean sea level appears to be more than 28 kilometers to the west. In addition, the area is not heavily forested. As a result of the flat terrain and lack of forestation, terrain shielding and clutter loss would be minimal.

Further, Virginia Beach, Virginia’s largest city, is a large urbanized area, and thus, is not a target market for the P2MP operations envisioned by the Coalition. Rather, as the Coalition has made clear in its FCC filings, P2MP operations are much more likely in rural areas where there are fewer earth stations and the earth stations are spread further apart, and where mid-band spectrum can provide coverage to rural consumers that lack access to high-throughput broadband.

Material Errors and Erroneous Assumptions

Sectorization

Table 2 of the Technical Annex assumes that fixed P2MP operations will use a base station with three 120-degree sectors. This would highly unlikely. A far more common mode of operation, *if* full-circle coverage could be coordinated, would be to use four 90-degree sectors. This would permit alternating frequency reuse between adjoining sectors if two frequencies were available.

¹ Comments of the C-Band Alliance, Technical Annex at 13.

The Technical Annex notes that P2MP operators “may use omnidirectional antennas.”² Although the Commission may have contemplated omnidirectional antennas in its NPRM, in its Petition, the Coalition proposed a “maximum sector radius” and in its Comments, the Coalition specifically proposed that the maximum arc of a sector should be 90 degrees.³ In all events, an omnidirectional antenna would not have anywhere near 20 dB gain.⁴ Fixed operation, unlike mobile, does *not* seek to provide blanket coverage of a large geographic area and does not need to “fill in” coverage gaps along roadways. Instead, it is targeted towards clusters of fixed users.

Transmitter Power

The Technical Annex assumes a P2MP base station transmitter power of 32 dBm, *even though the Coalition has specifically proposed limiting conducted power to 30 dBm (1 watt).*⁵ The Technical Annex apparently reverse engineered this erroneous assumption by taking the 50 dBm EIRP limit and assuming that antenna gain could not exceed 18 dBi.⁶ This assumption would be correct for an antenna with a 120-degree sector, but is erroneous for an antenna with a narrow horizontal beam, as would typically be used on client-side devices. The Technical Annex fails to take into account that the 20 dB gain implicit in the Coalition proposal is most applicable to *client* devices (user equipment), and to *narrow* sectors (*e.g.*, 30 degrees), and the two power limits (EIRP and conducted) both operate to limit P2MP power.

Clutter Loss

The Technical Annex cites to ITU-R P.452-16 as a propagation model that is expected to provide clutter losses. The good news is that this is a far more sophisticated approach than F-curves or simple radii. The bad news, however, is that this propagation model does not properly account for clutter loss at C-band frequencies. The model specifically states that “[t]he maximum additional [clutter] loss is 20 dB above 0.9 GHz, and progressively less at lower frequencies, down to 5 dB at 0.1 GHz.”⁷ What the model does not account for is that operations at 4 GHz have far more clutter sensitivity than operations at 0.9 GHz. WISPs make relatively light use of the 902 - 928 MHz band today, but what use is made, in areas where the noise level is low enough, is generally done because of the far better clutter penetration at 900 MHz than higher frequencies. Thus, the impact of clutter in the model cited by the Technical Annex is greatly understated.

² *Id* at 17.

³ Comments of the Broadband Access Coalition at 24. The Coalition further noted that “if a P2MP operator can coordinate for a 360 degree circle, using four or more independently-coordinated sectors, the operator should be licensed to operate in all direction from its access point.” *Id.* at 24 n. 68.

⁴ See Broadband Access Coalition, Notice of Oral Ex Parte Presentation, GN Docket 17-183 and RM-11791 (March 29, 2018) (“Google/BAC Technical Presentation”), which assumes a base station gain of 17 dBi and CPE gain of 16 dBi.

⁵ Comments of the Broadband Access Coalition at 24.

⁶ Technical Annex at n. 12.

⁷ ITU-R P.452-16 (07/2015) at 18.

But it gets worse. *The Technical Annex admits that it does not use clutter loss at all*: “Note that clutter attenuation was not included in the simulation because for short distances the clutter model is not accurate without precise terrain/building data.”⁸ Thus, the Technical Annex substantially overstates the likelihood of interference in areas where heavy clutter, such as forest, separates the FSS earth station from the point-to-multipoint users.

Path Loss and Terrain Shielding

The Technical Annex relies primarily on distance from the earth station to determine if there would be unacceptable interference. Simply declaring a fixed exclusion zone around each earth station, regardless of other factors, results in a wholly insufficient analysis, and ridiculous over-protection for earth stations.

Several tools exist to determine the required protection against interference. The most primitive is the radius, simply stating that potential interferer *n* may not operate within *x* kilometers of the protected point. This tool is wholly inefficient, and thus, is rarely used for *fixed* service protection, though it sometimes finds use in mobile applications. A variation of this tool is to analyze both distance and elevation. For example, Part 15, subpart H of the FCC’s Rules uses this methodology to protect broadcast signals from TV White Space operation. The protected areas of the TV stations themselves are computed using another rather primitive method, “F-curves,” developed in the 1950s and simple enough for hand calculation. These F-curves are used to generate coverage contours based on power and height above average terrain, but do not take more granular terrain data into account.

Frequency coordinators for Part 101 fixed stations, on the other hand, take into account other important factors. For example, Part 101 frequency coordinators consider terrain, and thus determine whether or not a specific path is, in fact, usable, and also whether links in that path will interfere with any other licensees alongside, in front of, or behind the target. This methodology creates a “keyhole” protection zone around the path. Decades ago, such coordination was originally done manually, but now it is done more rapidly and precisely with the help of computers. In the future, such coordination is likely to be automated, as the Commission notes in the NPRM.⁹

The impact of a terrain-based model is most keenly felt in areas where the terrain is most rugged. This includes many rural mountainous areas where the need for fixed broadband service is greatest. Mountainous terrain can, of course, provide excellent shielding. Furthermore, operation of fixed transmitters at different elevations than earth stations must also be factored in to interference analyses. The Technical Annex notes that “[a]t the short distances considered the geometry is indeed less favorable when the P2MP is at a lower height such as 10 meters, because the point-to-multipoint height is now closer to the earth station antenna height.”¹⁰ By the same token, P2MP operation in mountainous terrain is far less likely to interfere with an earth station even just a few miles away if the two are greatly separated in elevation, or if the slope of the mountain itself is in the path.

⁸ Technical Annex at 23.

⁹ NPRM at ¶ 124.

¹⁰ *Id* at 25.

In the CBRS band, which must protect FSS as well as government incumbents, and which must protect PALs against interference from other PALs and from GAA, more elaborate interference protection is provided by the SAS. Radar and FSS are protected against interference using the Irregular Terrain Model (ITM), a propagation prediction methodology that takes terrain, though not clutter, into account. For protection of PALs and grandfathered broadband systems, a blended model using eHata and ITM is used. That is an empirical model that predicts typical losses for links of a given type of location (*e.g.*, urban, suburban). The SAS then aggregates the level of interference from all potential interferers to ensure that the total interference is below a level deemed harmful.

The full weight of the SAS is not required, but automated frequency coordination, supported by the Coalition, will promote greater sharing while ensuring protection for incumbent earth stations. For example, to ensure protection of FSS earth stations, coordination could initially utilize the same interference criteria as used in Part 96 (CBRS). Aggregate protection levels defined in 47 C.F.R. § 96.17 are enforced by evaluating all co-channel operations within 150 km and non-co-channel operations within 40 km. These are not, however, exclusion zones, merely the radius beyond which interference is not worthy of consideration even in the aggregate.

Finally, the concerns expressed in the Technical Annex regarding non-co-channel and out-of-band interference are overstated. Path loss impacts both co-channel and non-co-channel operations equally. Coordination, which takes into account path loss, will ensure interference protection from non-co-channel and out-of-band interference.

For the reasons set forth above, the fixed protection radii relied upon by the Technical Annex are not appropriate. Because P2MP base station locations will be known and fixed, and user locations will be limited by rule and prior coordination, it is entirely practical to compute, as part of the coordination process, a path loss value to the protected earth station. Even the clutter-less ITM methodology is far superior to a simple radius or F-curve. And better models than ITM exist. Public clutter databases, such as the National Land Cover Database, are available.

Conclusion

The assumptions and resultant conclusions in the Technical Annex are badly flawed for many reasons. The purported requirement for separation distances “up to 50 kilometers” for co-channel operation is an absolute worst-case scenario arrived at by using power levels well above those proposed by the Coalition, and by entirely failing to account for terrain and clutter shielding. Such analysis creates the absolute lowest efficiency in frequency use by providing vast, arbitrary, and needless co- and non-channel protections for incumbent systems. The Annex further misstates the Broadband Coalition’s use case by implying continuous coverage. The Coalition does not expect P2MP operators to provide seamless nationwide mobile-type coverage, but instead proposes that targeted P2MP deployments can be deployed in the 3.7 GHz band in certain geographic areas while still providing full protection for existing FSS operations.