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April 9, 2019

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, DC 20554

Re: *Written Ex Parte Communication*, GN Docket No. 18-122

Dear Ms. Dortch:

Attached hereto, for the Commission's and industry's consideration in the above-referenced proceeding, is a proposed "Transition Implementation Process" developed by the C-Band Alliance ("CBA"). The Transition Implementation Process contains details about the CBA's proposed approach to clearing 200 MHz (inclusive of a 20 MHz guard band) of the C-Band in 18-36 months for terrestrial 5G use should the CBA's proposal be adopted by the Commission. Specifically, the document describes the work the member companies of the CBA, in partnership with their customers and other stakeholders, have done, are doing, and would undertake to clear spectrum in a manner that would ensure uninterrupted service to existing satellite customers.

The Transition Implementation Process also describes the CBA's efforts, carried out with input from customers and others, to develop technical and logistical solutions designed to protect against interference from 5G operations and thereby ensure that satellite customers continue to enjoy the high quality and reliability they expect from the C-band. Additionally, the document details proposed spacecraft launch plans and timing, discusses how and when cleared spectrum could be made available to 5G operators, and outlines the ground impacts of spectrum clearing, including the anticipated sequencing of installing filters in every eligible receive antenna in the continental United States. The Transition Implementation Process is the result of many hours of careful planning, thorough discussion, and detailed technical analysis spearheaded by the CBA.

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The CBA looks forward to continuing to work with the Commission, customers, and other stakeholders to expeditiously facilitate 5G operations in the C-band while ensuring the protection of existing satellite services.

Respectfully submitted,

/s/

Jennifer D. Hindin
Counsel for the C-Band Alliance

Attachment



Transition Implementation Process

APRIL 9, 2019

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I. Overview

In 2017, the Federal Communications Commission (“FCC” or “Commission”) initiated a proceeding to examine expanding flexible use of the 3.7-4.2 GHz band (“Mid-Band Proceeding”).¹ Subsequently, the Commission released a Notice of Proposed Rulemaking (“C-Band NPRM”) to consider whether and how to reassign a portion of the 3700-4200 MHz band (“C-Band”) to terrestrial mobile operations.² In response to these efforts, the C-Band Alliance (“CBA”) has consulted with industry stakeholders and refined its proposal to clear 200 MHz (inclusive of a 20 MHz guard band) of C-Band spectrum for swift 5G deployment.³

As incumbent operators in the C-Band, the satellite-operator members of the CBA understand the critical import of C-Band spectrum and seek to ensure that any shared access to the C-Band be designed to protect existing users. Consequently, the CBA’s proposal is designed to both free-up spectrum for use by 5G operators and protect incumbent satellite users’ use of this critical spectrum.

This document contains details about the CBA’s proposed approach to clearing a portion of the C-Band. It provides information about how and when the CBA proposal, if adopted by the Commission, would clear spectrum and details the work the CBA is undertaking and would undertake to clear spectrum efficiently. This document is comprised of two main sections:

- Section II: “Work performed” – the CBA recognizes the significance of bringing terrestrial 5G services to the American public as quickly and efficiently as possible. To that end, CBA member companies have started planning and developing technical solutions designed to protect incumbent C-Band users while making spectrum available to 5G operators. This section details those efforts.
- Section III: “Post-order implementation plan” – this section details spacecraft launch plans and timing, how and when cleared spectrum could be made available, and the ground impacts of clearing.

Given their knowledge and experience in the space segment, the member companies of the CBA are well positioned to facilitate a smooth transition for incumbent satellite customers and Mobile Network Operators (“MNOs”) seeking to deploy 5G services in the C-Band. The CBA’s proposed plan endeavors to make 5G in the C-Band a reality without displacing the broadcasters and content providers that serve more than 100 million US homes each year. The CBA believes its proposal is the fastest way to make C-Band spectrum available for 5G because the proposal anticipates the expected changes in the demand for C-Band satellite service; provides for the construction of additional satellites to ensure capacity equilibrium for CONUS coverage; and offers

¹ *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, GN Docket No. 17-183, 32 FCC Rcd 6373 (2017).

² *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, GN Docket No. 18-122 (rel. July 2018) (the “C-Band NPRM”).

³ See, e.g., Reply Comments of the C-Band Alliance, MB Dkt. No. 18-122 (Dec. 7, 2018).

solutions to the technical challenges associated with sharing the C-Band with terrestrial 5G services.

II. Work performed

A. High-level timeline

As depicted below, the CBA began intensive efforts to prepare for 5G operations in the C-Band in 2017. Seven key elements of those efforts that have occurred to date are discussed in further detail herein.

ID	Task Name	2017		2018												2019			
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Space Capacity planning and design	[Blue bar spanning from Nov 2017 to Dec 2018]																	
2	Customer needs assessment	[Blue bar spanning from Jan 2018 to Sep 2018]																	
3	Technical specification development	[Blue bar spanning from Jan 2018 to Dec 2018]																	
4	Filter design and testing	[Blue bar spanning from Mar 2018 to Dec 2018]																	
5	Space grooming plan	[Blue bar spanning from Oct 2018 to Dec 2018]																	
6	Data validation and analysis	[Blue bar spanning from Oct 2018 to Dec 2018]																	
7	Implementation preparation	[Blue bar spanning from Jan 2019 to Apr 2019]																	

B. Space capacity and customer needs assessments

In early 2018, the CBA space operators each separately assessed their existing fleet plans, current customer demand, and contractual obligations to assess the amount of spectrum that could be cleared. Their initial proposal based on that information was that incumbent users would need 350 MHz to meet projected demand. The CBA members proposed to make 100 MHz available for 5G use, plus a 50 MHz guard band to protect incumbent satellite services.

The member companies engaged with their customers in the summer of 2018 to assess the customers' needs for C-Band capacity over the next several years. At the same time, the CBA began testing prototypes of the filter they had developed with the goal of reducing the size of the guard band while still protecting incumbent services.

Finally, CBA member companies revisited their spacecraft deployment plans. Spreading customers across more satellites and extending the life of their respective fleets would allow CBA satellite-operator members to free-up more spectrum. The combined results of these activities allowed the CBA members to revise their proposal and agree to clear 200 MHz, inclusive of a smaller 20 MHz guard band. End-state fleet loading plans have been filed with the FCC and loading plans without customer-specific information have been established on record at the FCC.

C. Technical specification development

The CBA's planning efforts also have included consideration of technical specifications necessary to protect satellite earth stations from interference from 5G transmissions. Through analysis and testing, the CBA determined the maximum 5G signal emissions allowable at satellite earth stations and subsequently proposed specifications and rules to the FCC to ensure 5G base station transmissions, both in-band and out-of-band, will

not exceed the maximum allowable levels at earth stations. In conjunction with the CBA-designed 5G rejection filter⁴ installed at earth stations, the CBA-proposed rules allow 5G operators to utilize C-band spectrum between 3700 MHz and 3880 MHz without disrupting incumbent satellite services in 3900 MHz to 4200 MHz

The analysis performed has been filed on the record at the FCC in the CBA technical filings. The CBA encourages the FCC to adopt these technical rules in conjunction with the filter specs the CBA has submitted to ensure incumbent users are protected.

D. Filter design and testing

The CBA has determined that filters will be necessary to mitigate interference to C-Band incumbents from 5G signals. Thus, the CBA has designed, refined, and tested nearly a dozen filter prototypes. These prototype filters are currently being distributed to select existing customers to assess their effectiveness and afford customers an opportunity to provide the CBA with feedback. The filters were designed specifically for C-Band spectrum and assume 200 MHz (inclusive of a 20 MHz guard band) being made available to 5G operators. The CBA has also held two live filter demonstrations at Intelsat's Ellenwood, Georgia teleport, the most recent of which was held the week of April 1. Dozens of customer and cable industry representatives were in attendance.

The CBA technical team members have performed iterative testing and specification revisions over the past year to ensure the specification sufficiently protects the incumbent users from interference. Testing data and results have been made available to the FCC, incumbents, and potential 5G carriers in the spectrum.

E. Space grooming plan

CBA member companies also have each utilized their internal fleet management resources to determine the most efficient way to migrate customers on their respective satellite fleets to clear spectrum while assuring continuity of service. Among the elements considered were:

- Satellite capabilities and performance;
- Orbital location field of view, restrictions, cable penetration;
- Protection schemes available on the satellites and across the fleet;
- Contract obligations and future commercial needs;
- Channel line-up and programming requirements; and
- Specific mobility and government customer constraints and requirements.

Once these key elements were accounted for, each company's fleet manager determined the most efficient sequence of moves. Customer-specific information has not been shared between CBA member companies. Where technical mitigating circumstances required the sequencing of certain moves, these were accounted for as well. The moves were then analyzed graphically over time to confirm that they are achievable. Customers were also consulted to ensure they could migrate their services based on the proposed new fleet plan.

The CBA member companies have each separately prepared customer-specific migration and sequencing plans that contain the proposed timing, frequency, and new transponder or satellite location for each customer. The CBA member companies have

each separately shared and discussed these plans with most of their respective customers, answered any questions, and accepted feedback.

F. Data validation and analysis

Because the accuracy of the location and operating information for earth stations eligible for protection is critical to ensuring C-Band spectrum can be cleared efficiently and effectively, the CBA has undertaken to analyze and validate the data available in the FCC's International Bureau Application Filing and Reporting System ("IBFS"). In addition, the CBA performed virtual site surveys of many of the sites to generate inputs that are critical to any plan, including:

- The number and exact location of earth stations per Partial Economic Area ("PEA");
- Characterizations of the sites by user type;
- Antenna counts per site at select sites;
- The count of cable headend sites registered in the database; and
- The count of Simulsat antennas (complex, multi-feed antennas) at each cable headend site.

CBA resources have begun to scrub the IBFS data and compare it to internal sources and lists to understand how complete and accurate the data are. Additionally, the CBA has built an enhanced database and visualization tool to allow the CBA data analysis team to update the data where errors or omissions (e.g., incorrect coordinates) are found. The tool also allows the CBA to accurately identify earth stations within a certain distance of a PEA boundary, which could enable the release of spectrum to a sub-set of PEAs within 18 months of a Final order (as discussed in detail in section III.C, below).

G. Implementation preparation

If the FCC adopts the CBA's proposal in the Mid-Band Proceeding, the CBA will be ready to start clearing spectrum and implementing solutions for interference mitigation very shortly after the CBA is authorized to proceed. The CBA has defined workflows that support processes such as data collection, logistics and inventory management, installation scheduling, and billing and reimbursements. In addition, the CBA is working to design and structure support systems to manage the volume of work required to reallocate a portion of the C-Band. Also, because streamlining interactions with equipment installers is critical to achieving quick and precise spectrum clearing, the CBA is working with installation vendors to understand their core competencies, geographical reach, and ability to meet the scale requirements of C-Band clearing.

The CBA has held detailed scope and capability discussions with six implementation companies, as well as with several equipment manufacturers and suppliers. Requests for quote are currently in process with these vendors to validate pricing and capacity considerations. The team being assembled by the CBA is fully capable of supporting the production and installation requirements necessary to support the timeline proposed by the CBA.

III. Post-order implementation plan

A. Launch of new satellites

In addition to the efforts described above, the CBA is also taking steps to prepare for events that would occur *after* a Final order, such as the acquisition of new satellites. The time required to procure, build, and launch Geosynchronous Earth Orbit satellites usually extends beyond 36 months. In an effort to shorten that timeframe, the CBA is working with satellite manufactures to expedite the process significantly. Doing so requires:

- Increased commonality between satellite components;
- A fast, parallel manufacturing process; and
- Specific grouping and arrangement of the launch schedule, usually on the critical path.

Under the CBA's proposal, eight new satellites will be required to clear spectrum for 5G operations while protecting incumbent users.⁴ Of the eight new satellites, two would replace impaired satellites that cannot currently use the full C-Band spectrum and that will not be replaced if satellite operators continue to make use of 500 MHz of C-band downlink spectrum; two would be ground spares in the event of a launch failure;⁵ one would be an in-orbit spare that is required to meet customer service restoration engagement in a 300 MHz environment; and three would be replacements for satellites that are nearing end-of-life and will require replacing for continuity of customer services.⁶ Those three satellites will not be replaced if satellite operators continue to make use of 500 MHz of C-band downlink spectrum.

Two CBA member companies (SES and Intelsat) are negotiating with U.S. satellite manufacturers for the proposed new satellites. A provisional contract is close to final with one U.S. manufacturer, and two CBA member companies (SES and Intelsat) have received proposals from other U.S. manufacturers and are prepared to conclude negotiations rapidly. To meet the 36-month timeline, multiple satellite manufacturers and launch providers will need to work simultaneously. Should the FCC adopt the CBA's proposal, the two CBA members (SES and Intelsat) will finalize contracts for these spacecrafts. Below, for illustrative purposes only, is a timeline of the anticipated manufacturing and launch schedules for the eight new satellites.

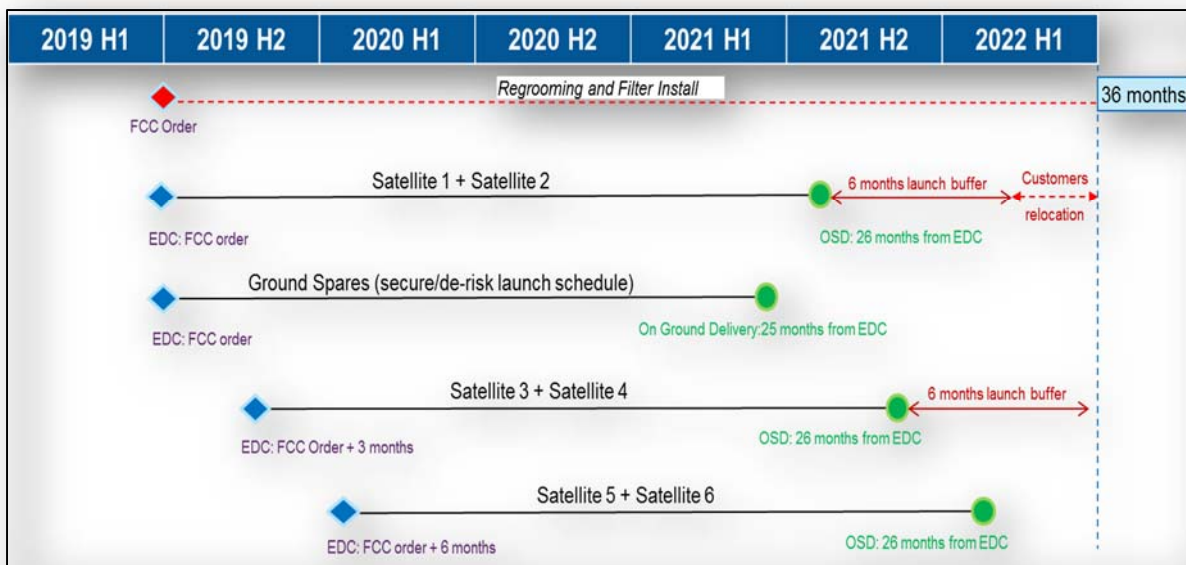
⁴ To minimize disruption and provide timing certainty, the CBA has developed a space segment plan that incorporates the following principles:

- Cable distribution locations are the most critical given the number of antennas. The penetrated video neighborhoods (which require specific view angles) are prioritized. The procured satellites must therefore be assigned to existing and licensed locations. The plan also undertakes the re-seeding of some of these locations to augment the number of fully penetrated slots.

- Broadcasting locations and Data/Government services are redistributed and densified across the CONUS arc while minimizing the customers disruption.

⁵ The CBA proposes to launch the satellites two at a time on the same launch vehicle, so two spares are needed to replace the satellites in case of a launch failure.

⁶ To clear the 200 MHz proposed, CBA member companies need to continue providing service from their current orbital locations and will need to replace the existing satellites at their end of usable life.



B. Ground impacts that must be mitigated

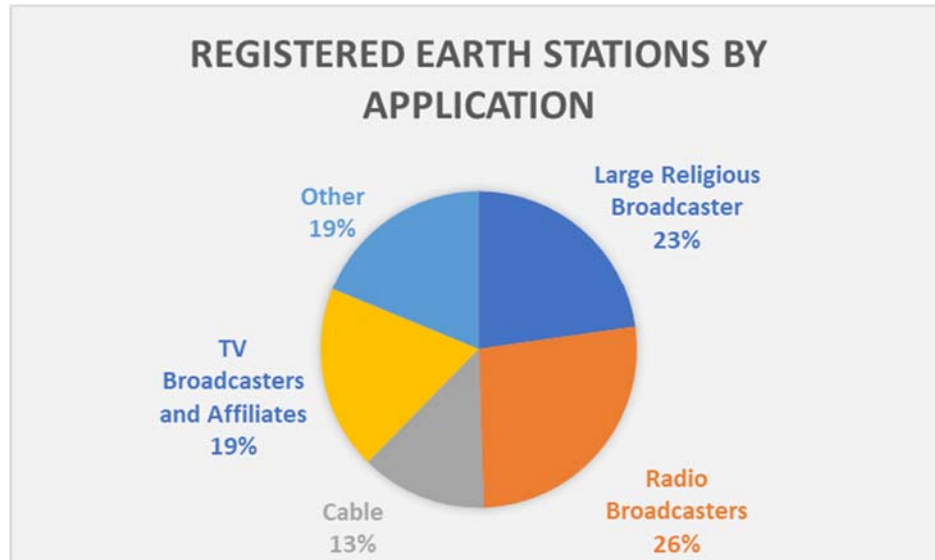
Clearing and sharing C-Band spectrum with 5G operators has direct implications for satellite operators, service providers, and end users. The CBA's proposed plan considers these impacts, and accounts for them as follows:

- All downlink C-Band antennas in CONUS will require the installation of a 5G rejection filter, whether the service it receives is moving frequencies or not. Under the CBA's proposal, the cost of installing these filters would be paid (or reimbursed) by the CBA whether installed by the CBA or the customer.
- Migrating customers in the lower end of the C-Band to a new transponder on the same satellite requires a frequency change. In these cases, the operators would be required to simultaneously transmit the signal in both the old and new frequency range while receive antennas are retuned or repointed. Under the CBA's proposal, the cost of the additional space capacity for this "dual illumination" and out of pocket expenses incurred by moving would be paid (or reimbursed) by the CBA.
- In cases where a customer is switching satellites, all the receive antennas will need to be repointed to the destination satellite if the earth station does not have an antenna pointed at the destination satellite. In addition to providing additional space capacity for dual illumination, the CBA under its proposal would pay (or reimburse) the costs associated with installers or end users repointing antennas.
- In cases where equipment on the ground cannot be repointed or retuned, it will need to be replaced. Under the CBA's proposal, the CBA would pay (or reimburse) the expenses associated with replacing equipment.
- Finally, in cases where content providers move to orbital locations at which some cable headends do not have an antenna pointed, the CBA under its proposal would pay for (or reimburse) an antenna seeding program to ensure all cable headends could take these services in their new location.

Additional information regarding the specific customer and end users' costs that would be covered under the CBA's proposed plan can be found in the CBA's ex parte letter dated April 3, 2019.⁷

C. Categories and counts of registered earth stations

The CBA's analysis of the IBFS antenna license/registration data shows several major categories of users—depicted in the graph below—that need filters and may need to be groomed. The scope of work for each category is also outlined below.



- Large Religious Broadcaster and Radio Broadcasters – represent almost half of the earth station sites that require protection. Both services will be in the upper 300 MHz when the clearing begins, and the CBA proposes that filter implementations begin immediately following a Final order adopting the CBA's proposal. Typically, the sites each host one antenna per site. The CBA has identified partners that can assist with these installations.
- TV Broadcasters and Affiliates – are moving in all phases of the plan, and their timing is dependent on where they are currently located. The CBA proposes that filter installation and other ground changes required to support the grooming effort begin immediately following a Final order adopting the CBA's proposal. For each major broadcaster, there are approximately 200 affiliate sites to remediate, each with multiple antennas.
- Cable – there are about 2,000 headend sites in the IBFS database. Each site has 5-15 antennas pointed at most of the broadcast and cable arc satellites. Given the number of services each takes from existing video neighborhoods, close

⁷ Letter from Henry Gola, Counsel to the C-Band Alliance (Apr. 3, 2019).

coordination between the operators, content providers, and cable headends is imperative. Because every content owner that moves on the satellite could potentially spawn a change (in frequency, polarization or satellite) and every cable headend subscribes to a unique set of content services, it is important to be deliberate about content provider moves. The CBA proposes to move some of the content providers in months 1-12 and the balance in 19-30. Filter implementations at the cable headends will be targeted for months 13-18 and 31-36. This method would allow cable headends to focus on grooming activities and filtering activities first, followed by filter implementations separately without the need to coordinate changes on a service-by-service basis.

- Other – this group includes teleports, mobility applications, international services being downlinked in CONUS, etc. The specific needs of these end users will be further determined once work begins and in response to callout campaigns.

D. Potential early tranche within 18 months

The CBA proposal proposes the release of 200 MHz in 18-36 months. Much of the clearing is dependent on the launch of new satellites and will be ready at the end of the range. However, after reviewing all the data itemized in section II, and with the understanding that mobile operators would like to begin deploying 5G networks as soon as possible, the CBA has developed a plan to release some spectrum near the low end of the date range.

The CBA has developed a plan, for FCC consideration and approval, that involves spectrum being cleared and released in two tranches. The first tranche (“T1”) would be 60 MHz with a 20 MHz guard band and would be released in 46 of the top 50 PEAs (referred to herein as the “top 46 PEAs”) within 18 months of a Final order. T1 would be located specifically in the spectrum range of 3700-3780 MHz. The remaining spectrum in those 46 PEAs (from 3760-3880 MHz) and the full 180 MHz in all the other PEAs would be released no later than 36 months of the Final order.

E. Ground impacts of an early tranche – Red/Blue filters

In the event of a Final order that allows for an early tranche spectrum release followed by a second spectrum release (“T2”), two types of filters will be required to mitigate 5G interference to existing antennas. Any antenna operating in the top 46 PEAs⁸ that is operating in the upper 300 MHz (3900-4200 MHz) at the 18-month mark will be fitted with an end-state 180x20 MHz filter (the “Blue filter”). Blue filters reject all radio frequency signals transmitted in the lower 200 MHz, including those from 3700-3780 MHz, and will protect incumbents.

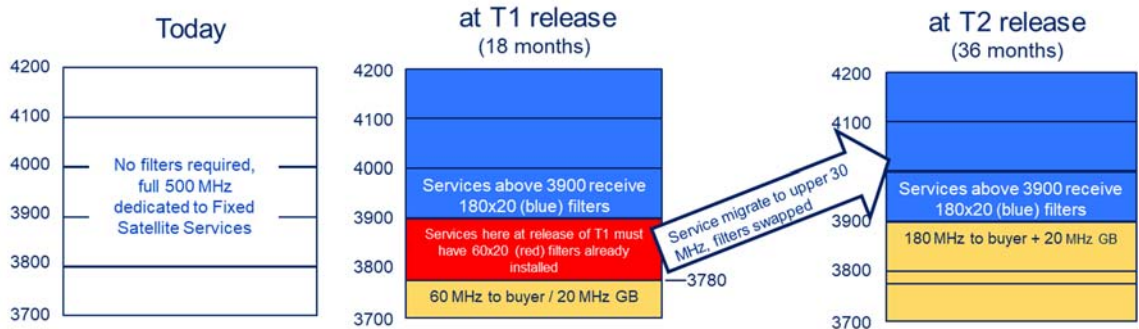
For those antenna in the top 46 PEAs operating in the 3780-3900 MHz range at the 18-month mark, a temporary 60x20 MHz filter (the “Red filter”) must be installed. The Red filter would prevent those antennas from receiving the signals correctly operating in this

⁸ Note that references to antenna in the top 46 PEAs includes any antennas within a 40 km radius around the applicable PEA as well as those within the borders of the PEA. The CBA proposes to provide Red filters to antennas within 40 kms of the top 46 PEAs to ensure their services do not receive interference.

range because having no filter would subject these antennas to interference from the first tranche 5G signals.

By the end of 36 months, all services will have been migrated into the upper 300 MHz and all downlink antenna will require a Blue filter. Those that had a Red filter installed will have it swapped out for a Blue filter. Costs associated with these filters and their installation would be paid for or reimbursed by the CBA.

The visual below depicts the filters by spectrum range over time:



F. Telemetry, Tracking, and Command (“TT&C”)/Gateway sites

Satellite operators would also be directly impacted in two additional ways by clearing the lower 200 MHz of the C-Band for 5G operations.

First, some C-Band satellites are hardwired with TT&C carriers in the lower MHz range. To control, monitor and operate those satellites, the CBA members need continued access to the lower 200 MHz. Currently this occurs at approximately 10 sites in CONUS associated with the various satellite operators. Each operator requires one primary and one backup for every satellite over CONUS.

In addition, satellite operators use the full 500 MHz of C-Band to downlink international satellite services that would continue to operate in the lower 200 MHz, but also need to downlink in CONUS for a variety of uses, such as monitoring international feeds from a CONUS Gateway teleport. Centralizing these downlinks at CBA member teleports could mitigate this obstacle given the limited number of services expected to require such an approach.

Initially, the CBA member companies believed that 14 sites would be necessary to retain full downlink access to support TT&C and Gateway needs. All 14 sites are currently using the lower frequencies to operate satellites and trunk customer services to terrestrial transport. The CBA member companies estimate that the exclusion zones for in-band interference for these types of earth stations could be as much as 150 km per site. Acknowledging that 14 such exclusion zones would create network restrictions for mobile operators that would affect the deployment of 5G in certain metropolitan markets, the CBA member companies have agreed to consolidate TT&C and Gateway sites into no more than four sites and to ensure those sites are in the least impactful areas possible.