

RECENT THIRD-PARTY SUPPORT FOR THE C-BAND ALLIANCE'S MARKET-BASED APPROACH

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The Public Interest Benefits of a Market-Based Solution for the C-Band

AVOIDING ECONOMIC AND
INFORMATIONAL MARKET FAILURES,
PROTECTING INCUMBENTS, AND
ACCELERATING 5G DEPLOYMENT

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November 13, 2019

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Executive Summary

This paper discusses how a Coasian market-based mechanism, such as the consortium proposed by the C-Band Alliance, can overcome market failures that lead to significant holdout problems, solve issues of informational complexity that lead to regulatory failures, maximize the amount of spectrum available in the marketplace while protecting incumbent operations, and ensure that the spectrum is put to its highest valued use. This approach, which is applicable in incentivizing incumbents to discover value creating spectrum repurposing well beyond the C-Band, fits in well with the FCC's light-touch approach to regulating the mobile market. This paper also discusses why the C-Band Alliance's revenue sharing mechanism, that is, that excess revenue should be returned to its members in proportion to their contribution to the creation of value, is in line with well-accepted economic tenets.

I. Introduction

A. Overview

"The market, not the government, is best positioned to drive innovation and investment in the wireless field." – FCC Chairman Ajit Pai (April 12, 2019)¹

This paper updates my prior analysis, which I filed in this proceeding in October 2018.² In that paper, I found that the C-Band Alliance's (CBA's) market-based proposal to repurpose the C-Band for 5G would maximize social utility within the shortest possible timeframe while preserving

¹ Margaret Harding McGill, "Trump rejects government intervention in 5G wireless networks," *Politico*, April 12, 2019, Accessed July 12, 2019, <https://www.politico.com/story/2019/04/12/trump-government-intervention-5g-wireless-networks-1352763>.

² FCC, "Expanding Flexible Use of the 3.7-4.2 GHz Band et al.," Order and Notice of Proposed Rulemaking, GN Docket No. 18-122 et al., FCC No. 18-91, Adopted July 12, 2018. ("C-Band Order and NPRM").

incumbent uses upon which hundreds of millions of Americans rely.³ I estimated that the value created by repurposing the C-Band spectrum will likely be measured in the many billions of dollars.⁴ This paper revisits the conclusions and analysis of my October 2018 study in light of intervening developments—in particular, the CBA’s updated proposal and Eutelsat’s withdrawal from the CBA. The updated proposals from the CBA build on its initial proposals and further clarify how the CBA approach can solve market and regulatory failures and leverage market mechanisms to efficiently put C-Band spectrum to higher valued uses.

In this paper, I discuss how the updated CBA proposal is an application of a Coasian market-based mechanism where well-defined property rights and a consortium structure that minimizes transactions costs creates the incentives for market participants to achieve regulators’ goals. It achieves this through overcoming market failures due to holdout problems, solving issues of informational complexity that lead to regulatory failures, putting in place incentives to transition the efficient amount of spectrum while protecting incumbent operations, and ensuring that the spectrum is put to its highest valued use. This approach, which is applicable in incentivizing incumbents to discover value creating spectrum repurposing well beyond the C-Band, fits in well with the FCC’s light-touch approach to regulating the mobile market.

In what follows, after a brief section on the updated CBA proposal, I discuss the public interest benefits created by this proposal. Then I put the CBA proposal in the larger context of how such a proposal can create incentives for incumbent spectrum holders to engage in efficiency enhancing repurposing of their spectrum that applies well beyond the C-Band.

B. Updated CBA Proposal

Since my initial analysis in October of 2018, the FCC’s proceeding to repurpose C-Band spectrum for terrestrial use to support 5G deployments has seen active engagement by the CBA itself and many other stakeholders, both on the importance of this band for 5G and the need to bring this

³ Coleman Bazelon, “Maximizing the Value of the C-Band,” Comments on the FCC’s NPRM to Transition C-Band Spectrum to Terrestrial Uses, pp. 14, October 29, 2018, https://ecfsapi.fcc.gov/file/102980223165/Intel_Intelsat_SES_Joint_NPRM_Comments%20Final%2010-29.pdf, (“Maximizing the Value of the C-Band”).

⁴ Coleman Bazelon, “Maximizing the Value of the C-Band,” p. 23.

spectrum to market in an efficient and timely manner.⁵ There have been filings from both proponents and opponents of the CBA proposal. Recently, Verizon has reiterated its support for the CBA proposal, noting that the most efficient way to repurpose the C-Band spectrum would be through a “private market auction and repacking of the band.”⁶ In contrast, ACA Connects has maintained its opposition to the plan.⁷ For its part, the CBA has explored technology that will allow it to repurpose 300 megahertz of spectrum without disrupting current operations and has made a commitment to protect incumbents in this band, as well as to protect consumers who receive service from this band.⁸ We explain these elements of the CBA’s approach in greater detail below.

With this additional year to engage with stakeholders, the CBA has revised and improved its initial proposal. The initial proposal from Intelsat and SES began with an offer to repurpose 150 megahertz of spectrum (100 megahertz of flexible use spectrum and a 50 megahertz guard band), although even that proposal had acknowledged that if “the terrestrial demand for mid-band spectrum is as robust as claimed, their market-based approach could result in additional spectrum being cleared in the future—but in a manner and timeframe that protects Intelsat’s and SES’s

⁵ Bret Swanson, “Filling the Mid-Band Spectrum Gap to Sustain 5G Momentum,” AEIdeas, American Enterprise Institute, April 24, 2019, accessed October 11, 2019, <https://www.aei.org/technology-and-innovation/telecommunications/filling-the-mid-band-spectrum-gap-to-sustain-5g-momentum/>.

⁶ Verizon *Ex Parte* on the “C-Band Order and NPRM,” p. 2, GN Docket No. 18-122, September 26, 2019, <https://ecfsapi.fcc.gov/file/10926608609101/Verizon%2009.24.19%20Ex%20Parte%20Meeting.pdf>.

⁷ ACA Connects *Ex Parte* on the “C-Band Order and NPRM,” GN Docket No. 18-122, September 26, 2019, <https://ecfsapi.fcc.gov/file/1092589840166/190925%20ACA%20Connects%20Ex%20Parte%20re%205G%20Plus%20Plan%20Supplement.pdf>.

⁸ Ex Parte Submission C-Band Alliance, GN Docket No. 18-122, p. 1, Oct. 28, 2019, <https://ecfsapi.fcc.gov/file/102834592770/CBA%20-%20Ex%20Parte%20Submission%20re%20300%20MHz.pdf>, (“CBA 300 MHz Ex Parte”); *See also*, Comments of the C-Band Alliance on the “C-Band Order and NPRM,” p. 9, GN Docket No. 17-183, 18-122, October 29, 2018, <https://ecfsapi.fcc.gov/file/1029067703990/C-Band%20Alliance%20NPRM%20Comments%2010.29.2018.pdf> (“CBA Oct. 29, 2018 Comments on C-Band Order and NPRM”); *See also*, FCC, “C-Band Order and NPRM,” ¶27-29 C-Band Alliance, Customer Commitment Ex Parte, GN Docket No. 18-122, filed April 3, 2019, <https://ecfsapi.fcc.gov/file/10403446622844/CBA%20-%20Customer%20Commitment%20Ex%20Parte%20-%2004-3-19.pdf>, (“Customer Commitment Ex Parte”).

customers and their businesses.”⁹ Subsequently, given market demand and input from many constituents, the CBA increased the amount offered to 200 megahertz (180 megahertz usable and a 20 megahertz guard band), and at the same time ensured that incumbents and its customers would be protected.¹⁰ Now after further market and customer input, and incorporating more advanced compression technology, the CBA is able repurpose 300 megahertz of spectrum for flexible use (280 megahertz for flexible use and a 20 megahertz guard band).¹¹ Thus, the CBA mechanism allows for a fast and efficient repurposing of spectrum – much more and quicker than would be achieved in an administrative process.

In terms of customer commitments, the CBA has earmarked “120% of the estimated spectrum clearing costs” and will be using it to pay for the cost of clearing the spectrum, the cost associated with repacking satellite services and expenses incurred by customers and end-users.¹² These reimbursed costs will include technical support, antenna and filter installation programs and other miscellaneous costs associated with the transition.¹³ The CBA has also been working to compile a list of all C-Band antennas in the U.S. to plan for a smoother transition of the spectrum and provide technical solutions to ease the transition.¹⁴ In addition, to clear the 300 megahertz of spectrum, there are plans to launch new satellites and the CBA is working with all involved parties to adopt state-of-the-art technology, such as high-efficiency video encoding, needed to clear more spectrum.¹⁵ Recently, the CBA has committed that it will be “fully responsible for all costs

⁹ Intelsat, SES, and Intel Notice of Ex Parte Presentation, on the “C-Band Order and NPRM,” GN Docket Nos. 17-183, 18-122, April 20, 2018, <https://ecfsapi.fcc.gov/file/1042067576471/as-filed%204-20-18%20ex%20parte%20notice.pdf>.

¹⁰ Ex Parte Letter of the C-Band Alliance, GN Docket Nos. 17-183 and 18-122, Oct. 23, 2018, <https://ecfsapi.fcc.gov/file/102344940213/CBA%20-%2010.22.18%20-%20Ex%20Parte%20Notice.pdf>.

¹¹ C-Band Alliance, “CBA 300 MHz Ex Parte,” Oct. 28, 2019.

¹² C Band Alliance, “Customer Commitment Ex Parte,” p. 8, April 3, 2019.

¹³ C Band Alliance, “Customer Commitment Ex Parte,” Attachment A, April 3, 2019.

¹⁴ C Band Alliance, “C-Band Antennas in the Continental U.S.,” August 20, 2018, accessed October 14, 2019. <https://c-bandalliance.com/c-band-antennas-continental-u-s/>. *See also*, Comments of the C-Band Alliance on the “C-Band Order and NPRM,” GN Docket Nos. 17-183, 18-122, August 7, 2019, <https://ecfsapi.fcc.gov/file/108071378423084/CBA%20-%20Comments%20to%20Other%20Proposals%20PN.pdf>.

¹⁵ C Band Alliance, “CBA 300 MHz Ex Parte,” Oct. 28, 2019; *See also*, C-Band Alliance Technical Ex Parte, “Tranche 1 Satellite Earth Station Analysis,” GN Docket No. 18-122, Oct. 31, 2019, <https://ecfsapi.fcc.gov/file/103150816652/Technical%20Ex%20Parte%20re%20Filter%20Analysis.pdf>, (“CBA Technical Ex Parte Oct. 31, 2019”).

necessary to implement the reallocation of 300 MHz of spectrum,” including costs such as technology upgrades, launching and replacing satellites and so on.¹⁶ Additionally, the CBA’s updated transition plan lays out a detailed plan and timeline for clearing this spectrum.¹⁷ This process, while challenging, will be the least disruptive path to getting more spectrum on the market while minimizing transaction costs. The CBA working with key customers to create additional clearing illustrates the Coasian proposition of using a market-based bargaining process to find the solution that maximizes value creation and public benefits from repurposing C-Band spectrum.

Overall, the developments in the increased amount of spectrum, the reduced size of the guard band, and customer commitments and technical parameters reflect input from would-be buyers, customers and earth station operators and demonstrate how market forces are able to take into account new information and craft a market-based solution.¹⁸

II. Public Interest Benefits of the CBA’s Updated Proposal which Continues to Solve Market and Regulatory Failures

As explained in detail in my October 2018 analysis, both market and regulatory failures in the C-Band prevent these valuable frequencies from being put to higher value uses.¹⁹ The central market failure is the overlapping nature of the rights to use the band, which prevents market forces (private market negotiations) from finding an efficient solution to put the C-Band spectrum to its highest valued uses. The central regulatory failure is that it is beyond any regulator’s capacity to acquire and process all of the information needed to efficiently repurpose the C-Band spectrum in

¹⁶ C Band Alliance, “CBA 300 MHz Ex Parte,” p. 2, Oct. 28, 2019; *See also*, (“CBA Technical Ex Parte Oct. 31, 2019”), Oct. 31, 2019.,

¹⁷ C Band Alliance, “Revised Transition Implementation Process,” GN Docket No. 18-122, November 8, 2018, <https://ecfsapi.fcc.gov/file/11081123220243/CBA%20-%20Updated%20Transition%20Implementation%20Process.pdf>.

¹⁸ Comments of the C-Band Alliance on the “July 19 Public Notice,” pp. 4, 26-27, GN Docket Nos. 17-183, 18-122, August 7, 2019, <https://ecfsapi.fcc.gov/file/108071378423084/CBA%20-%20Comments%20to%20Other%20Proposals%20PN.pdf>, (“CBA August 7 Comments”).

¹⁹ Coleman Bazelon, “Maximizing the Value of the C-Band.” *See also*, FCC, “C-Band Order and NPRM”; “CBA Oct. 29, 2018 Comments on C-Band Order and NPRM,” p. 2.

a timely manner. These market and regulatory failures impede industry and regulators as they try to find the optimal transition mechanism and amount of C-Band spectrum to repurpose for terrestrial 5G uses.²⁰

To clear socially optimal amounts of spectrum, an omniscient regulator would clear spectrum until the social cost of clearing one more megahertz of spectrum would just equal the benefit from repurposing that megahertz. The CBA proposal replicates this outcome because only the CBA members have the unique mix of information about the band needed to determine the social equilibrium. The other proposals in the C-Band proceeding cannot reach this optimal outcome because distortions generated by information asymmetries and market failures cause marginal private costs and benefits to diverge from marginal social costs and benefits. That is, the decisions made by private actors will not lead to the social optimum. By correcting the C-Band market failures, the CBA proposal incentivizes the transition facilitator (i.e. the CBA) to internalize the information inside the boundaries of the consortium that lead their private choices to align with the social optimum. That is, the CBA's incentives will be to repurpose spectrum up to the point where marginal social benefit equals marginal social costs, thereby maximizing social welfare. Such a Pareto-improving solution would be difficult to achieve under other proposals.

As discussed earlier in this paper, the amount of spectrum offered for repurposing has increased in line with the market signals about the increased demand for this mid-band spectrum for 5G, and with input from various stakeholders. Combining the best of a market-based solution and a managed transition that minimizes service disruption, the CBA proposal offers an efficient mechanism to make C-band spectrum available for terrestrial 5G use. The true public interest benefits of the CBA proposal, however, go well beyond any specifics of amounts and timing of reallocations. The proposal directly addresses the underlying market failures and puts in place the incentives for all stakeholders to discover the optimal solution to repurpose C-Band spectrum. The information gained throughout the process has informed the CBA and enabled it to make dynamically efficient decisions, such as how much spectrum to make available, when this spectrum should be made available, and how the initial investments to make spectrum available will interact with later, longer-term efforts to repurpose spectrum.

²⁰ FCC, "C-Band Order and NPRM," ¶ 59.

A. The CBA Proposal Solves the Holdout Problem

The CBA, acting as the Transition Facilitator, can solve the holdout problem that results from overlapping rights.²¹ Nonexclusive access to spectrum is a market failure that violates the 1st Welfare theorem – that a well working market maximizes welfare.²² Consequently, private transactions without a Transition Facilitator will not maximize economic efficiency. As discussed in my October 2018 analysis, by creating a Transition Facilitator and imposing clearly defined limits on providers that are not part of the Transition Facilitator, the nonexclusive rights are brought under common consideration. Ronald Coase’s 1937 paper, “The Nature of the Firm,” discussed how firms’ boundaries are determined by minimizing transactions costs.²³ If an activity is less costly to execute within a firm than through a market transaction, then value is increased if that activity is done within the firm. As Coase also pointed out, market forces will often lead firms to organize themselves to internalize such transaction costs to achieve more efficient outcomes.²⁴ The CBA Members are doing precisely that. The CBA is a mechanism that solves the “failure” created by the nonexclusive rights to use the C-Band. Through the voluntary formation of the consortium proposed by the CBA, the holdout problem is solved, as recalcitrant or uncooperative satellite providers will not benefit as much as cooperative ones. This brings the satellite operators under one “firm,” thereby creating an integrated entity with the ability and incentives to maximize efficiency and value creation for itself, and as a side benefit maximize efficiency and value creation for society.²⁵

²¹ Overlapping rights in the C-Band were an efficient solution to facilitate use of the band for satellite-based services. The holdout problem only emerges in the context of trying to repurpose portions of the band for terrestrial use. See Coleman Bazelon, “Maximizing the Value of the C-Band,” pp. 8 – 11.

²² Mas-Colell, Whinston and Green, Chapter 16, in *Microeconomic Theory*, (Oxford, England: Oxford University Press, 1995), <https://claseseconomia2015.files.wordpress.com/2016/03/microeconomictheory.pdf>.

²³ Ronald H. Coase, “The Nature of the Firm,” *Economica*, Vol. 4 (16), pp. 386–405, November 1937.

²⁴ Ronald H. Coase, “The Nature of the Firm,” *Economica*, 4 (16), pp. 386–405. 1937.

²⁵ Coleman Bazelon, “Maximizing the Value of the C-Band,” pp. 24. See also, Holman W. Jenkins Jr., “How the Government Can get Brave about Spectrum,” June 14, 2019, *The Wall Street Journal*, accessed October 11, 2019, <https://www.wsj.com/articles/how-government-can-get-brave-about-spectrum-11560552078>; T. Randolph Beard, George S. Ford and Michael Stern, “Innovation in Spectrum repurposing: The C-Band as a Principal-Agent Problem,” Phoenix Center Policy Bulletin No. 47, September 2019, <https://www.phoenix-center.org/PolicyBulletin/PCPB47Final.pdf>.

This approach works even without Eutelsat in the CBA, given its relatively small market share.²⁶ Eutelsat's revenues represent less than 5% of revenues created from C-band based services.²⁷ From outside the CBA, Eutelsat and its customers can readily be made whole, with any transition costs covered by the CBA. In fact, the CBA has publicly stated that all eligible satellite operators can opt to become a part of the CBA, and it has also committed to reimbursing reasonable transition costs for all earth stations, even those not registered with the FCC.²⁸ By not cooperating with the CBA to maximize value creation, Eutelsat will not be rewarded by sharing the gains earned by the CBA for conceptualizing and implementing the value creating transition. If Eutelsat rejoins CBA, it will share in the net proceeds in a non-discriminatory way.²⁹ As a factual matter, Eutelsat is unlikely to be a holdout.³⁰ Eutelsat has stated that it "continues to support the CBA's proposal of employing a secondary markets approach to rapidly clear a significant portion of the 3.7-4.2 GHz band for 5G wireless services,"³¹ In that regard, the CBA has proposed as part of its internal governance to share any value created based on the share of revenues generated by FSS operators for services using C-Band frequencies delivered to customers located in the continental United States.³² This is a sensible approach, supported by the underlying economics of the CBA's activities. Any revenue

²⁶ Bevin Fletcher, "Eutelsat CBA Exit Won't Impact C-band Proposal, Remaining Members Say," *Fierce Wireless*, September 4, 2019, accessed September 15, 2019, <https://www.fiercewireless.com/regulatory/eutelsat-cba-exit-won-t-impact-c-band-proposal-remaining-members-say>.

²⁷ Recently, Eutelsat announced it is withdrawing from the C-Band Alliance. The three remaining members, Intelsat, SES and Telesat, account for 95% of the U.S. C-Band revenues, and hence the departure of Eutelsat will not hinder the Alliance's ability to efficiently repurpose the C-Band spectrum. CBA, "C-Band Alliance Issues Response to Eutelsat Decision to Withdraw from Alliance," September 3, 2019, Accessed September 4, 2019, <https://c-bandalliance.com/wp-content/uploads/2019/09/FINALC-Band-Alliance-Response-Statement.pdf>.

²⁸ CBA Ex Parte on the "C-Band Order and NPRM," p. 1, GN Docket No. 18-122, September 24, 2019, <https://ecfsapi.fcc.gov/file/1092429169928/CBA%20-%20Ex%20Parte%20re%209-20-19%20OGC%20Meeting.pdf>, ("CBA ExParte on C-Band Order and NPRM").

²⁹ CBA, "CBA Ex Parte on the C-Band Order and NPRM," p. 1.

³⁰ Eutelsat Ex Parte Communication, GN Docket No. 18-122, November 7, 2019, [https://ecfsapi.fcc.gov/file/1108297359740/Eutelsat%20Ex%20Parte%20Notice%20\(FINAL%202019-11-07\).pdf](https://ecfsapi.fcc.gov/file/1108297359740/Eutelsat%20Ex%20Parte%20Notice%20(FINAL%202019-11-07).pdf).

³¹ Ex Parte Letter from Bruce A. Olcott, Counsel to Eutelsat S.A., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Sept. 19, 2019).

³² "CBA Oct. 29, 2018 Comments on C-Band Order and NPRM," p. 55, ("compensation to C-Band Alliance members will be based on their recent, already determinable, CONUS C-band revenues").

raised by the CBA from C-Band spectrum sold to terrestrial wireless operators will first be used to pay for the transition costs that are required to free up the spectrum. Whether CBA member or not, or customer of CBA member or not, all current users' costs from the transition will be reimbursed.³³ Any revenue retained by the CBA above and beyond these costs and any potential voluntary contribution to the Treasury will be distributed to its members as compensation for the efforts to conceive and implement the transition.

Any excess revenue should be returned to its members in proportion to their contribution to the creation of value. The economic value contribution of CBA members is the pre-transition opportunity cost of the spectrum resource deployed by those members. That opportunity cost is the economic value, more commonly known as profits, created by pre-transition uses of the C-Band spectrum.

The satellite industry has several features that make measuring profits created from C-Band services challenging. First, satellite services are characterized by large fixed and sunk investments accompanied by relatively smaller incremental margins. This means any gross margin calculation will not account for significant capital expenditures and any net income calculation that does account for depreciation and amortization of fixed assets is subject to somewhat arbitrary accounting procedures. Second, the capital accounting requirements are further complicated by the multi-band structure of most modern satellites. That is, the fixed costs of a satellite that serves the C-Band is shared in part by transponders for non-C-Band services, such as the Ku band. Consequently, the proportion of any satellite serving the C-Band impacts the costs allocated to the C-band, yet that allocation is determined by the design characteristics of the satellite. Additionally, not all satellites serve the full continental United States at sufficient power to provide value-creating commercial service. For instance, while Hipasat covers most of the United States and Arsat covers most of Florida, the power levels are such that it hinders service provision.³⁴ Others, such as ABS and StarOne do not serve the United States in any meaningful manner.³⁵ This further

³³ CBA, "Customer Commitment Ex Parte," April 3, 2019.

³⁴ The coverage maps for Hipasat and Arsat with the power level are from their website and from the FCC respectively, <https://www.hispasat.com/contenidos/web/0/194-h30w-6-2.pdf>, See also, Empresa Argentina de Soluciones Satelitales S.A., "To Add ARSAT-2 to the Permitted Space Station List," Petition for Declaratory Ruling, <https://www.hispasat.com/contenidos/web/0/194-h30w-6-2.pdf>.

³⁵ The coverage maps with the power level are from their websites, <http://www.absatellite.com/satellite-fleet/abs-6/>, <http://www.absatellite.com/satellite-fleet/abs-3a/>, http://www.starone.com.br/en/internas/satelite_c1/, <http://sky-brokers.com/uploads/a0/dc/a0dca599b10680904490110238d68721/ARSat-2-Satellite-Footprint.pdf>.

complicates calculating the value contribution to the U.S. by these carriers. The result of these factors is that allocating value by member profits would be difficult. And unnecessary. Domestic service revenues, however, are likely highly correlated with profits and much more straightforward to measure.

B. Optimizes the Amount and Timing of Spectrum Reallocated

The CBA proposal most efficiently optimizes the amount and timing of spectrum made available to the market. It has committed to clearing a total of 300 megahertz of spectrum (280 megahertz and a 20 megahertz guard band), with 100 megahertz of spectrum becoming available within 18 months in 46 of the top 50 PEAs from the date of an FCC Order.³⁶ The entire 280 megahertz of spectrum will be available throughout the continental US within 36 months from a CBA-led auction.³⁷

The CBA members uniquely understand the C-Band ecosystem, which allows it to achieve the threefold objective of 1) maximizing the amount of spectrum to be repurposed, 2) protecting incumbents by finding and implementing the least costly, least disruptive solution for clearing the band, and 3) minimizing the time to market for the cleared spectrum.³⁸

First, the CBA, as the Transition Facilitator, and its customers have all of the incentives in place to create value by repurposing additional frequencies when the benefits outweigh the costs. One concern expressed is that if the CBA had market power as a consortium, it would restrict spectrum supply, or would delay the transition to extract extra rents. However, the CBA does not have market power as the supply of spectrum is not just the C-Band, and the market for spectrum is not

³⁶ C Band Alliance, “CBA 300 MHz Ex Parte,” p. 1.

³⁷ C Band Alliance, “CBA 300 MHz Ex Parte,” p. 1.

³⁸ “CBA Oct. 29, 2018 Comments on C-Band Order and NPRM,” p. 9. *See also*, FCC, “C-Band Order and NPRM,” ¶27-29, https://docs.fcc.gov/public/attachments/FCC-18-91A1_Rcd.pdf; C-Band Alliance, “Customer Commitment Ex Parte,” GN Docket No. 18-122, filed April 3, 2019, <https://ecfsapi.fcc.gov/file/10403446622844/CBA%20-%20Customer%20Commitment%20Ex%20Parte%20-%204-3-19.pdf>. (“Customer Commitment Ex Parte”).

inelastic enough to make such a strategy profitable.³⁹ If it attempted to restrict the amount of spectrum made available and raise prices, the price increase would not compensate for the reduced quantity of spectrum sold.⁴⁰ Additionally, the CBA, as the Transition Facilitator, has an added incentive not to undersupply the market for terrestrial spectrum because doing so may create market dynamics that create market power for the purchasers of the repurposed spectrum.⁴¹

Another, and countervailing, concern raised is that satellite operators will not repurpose the socially optimal amount of spectrum because with excess capacity eliminated through repurposing, the higher prices they will obtain from video delivery will skew incentives.⁴² This is unlikely. We understand that at least one FSS satellite company has given its customers price commitments, thus setting the market and limiting the ability of the other companies to raise service prices. Furthermore, the value of C-Band in terrestrial mobile uses significantly exceeds the value of many C-Band based satellite services so any modest increases in the prices paid for satellite video services

³⁹ If the CBA chose to make 300 megahertz available instead of 400 megahertz, a plausible increase in price would be around 11%. But to achieve this price increase in this example, it would have to withhold one-fourth of the supply ($\frac{1}{4} = 100 \text{ megahertz} / 400 \text{ megahertz}$), forgoing a similar share of revenue. Assuming a price elasticity of -1 and a spectrum inventory of 900 megahertz (low and mid-band spectrum), we can compute the decrease in price that would occur if 400 megahertz and 300 megahertz of spectrum was supplied by the CBA. If 400 megahertz is offered, it would imply a 44% increase in quantity (calculation: $44\% = 400 \text{ megahertz} / 900 \text{ megahertz}$) and consequently a 44% decrease in price. If 300 megahertz is offered, it would imply a 33% increase in quantity (calculation: $33\% = 300 \text{ megahertz} / 900 \text{ megahertz}$) and a 33% decrease in price. Thus, withholding 100 megahertz, i.e. 11% of the quantity, would imply a price that would be 11% higher than if 400 megahertz of spectrum was offered. Coleman Bazelon, “Maximizing the Value of the C Band,” p. 37-38. *See also* Reply Declaration of Jeffrey A. Eisenach on the “C-Band Order and NPRM,” pp. 4, 17, GN Docket No. 18-122, December, 2018,

<https://ecfsapi.fcc.gov/file/1207392316779/Eisenach%20Declaration%20for%20Reply%20Comments%20of%20the%20C-Band%20Alliance.pdf>.

⁴⁰ Coleman Bazelon, “Maximizing the Value of the C-Band,” p. 38.

⁴¹ If the supply is too small, a market division strategy by the two largest bidders would be plausible and reduce demand from other bidders, leading to lower prices. As noted in the Auctionomics white paper, other mechanisms such as multi-round non-combinatorial auctions may suffer from collusive behavior and market splitting, which this current format does not. *See* Auctionomics, “FUEL for 5G: Flexible Use and Efficient Licensing,” White Paper Filed as C-Band Alliance Ex Parte, June 12, 2019, <https://ecfsapi.fcc.gov/file/1061231991411/CBA%20-%20Auctionomics%20white%20paper%20ex%20parte%206.12.2019.pdf>.

⁴² ACA – America’s Communication Association, “C-Band Order and NPRM Ex Parte Letter,” pp. 3, GN Docket No. 18-122, March 25, 2019, [https://ecfsapi.fcc.gov/file/1032583062787/\(as%20filed\)%20ACA%20Ex%20Parte%2025Mar2019.pdf](https://ecfsapi.fcc.gov/file/1032583062787/(as%20filed)%20ACA%20Ex%20Parte%2025Mar2019.pdf).

are unlikely to alter the choices made by satellite operators when they evaluate the costs and benefits of repurposing spectrum.⁴³

Second, the CBA has committed to protecting its customers from the adverse effects of relocation.⁴⁴ The satellite providers will be paying for new equipment in cases where customers and end-users require them. To this end, the CBA has earmarked “120% of the estimated spectrum clearing costs” and will be using it to pay for the cost of clearing the spectrum, all costs associated with repacking satellite services and expenses incurred by customers and end-users.⁴⁵ This CBA action is a clear commitment to ensure that customers are not any worse off after the relocation of a portion of the C-band spectrum.⁴⁶ And since the CBA benefits from any efficiencies in protecting incumbents, they are well-incentivized to find the most efficient transition approach. Assuring no stakeholder is worse off is an important foundation for creating efficient and welfare-enhancing voluntary repurposing of the C-Band.⁴⁷ With this foundation, further efficiency gains are more easily facilitated. For example, if economically advantageous, additional spectrum may be repurposed by some customers relinquishing use of C-Band services if the additional frequencies made available are more valuable to terrestrial operators.

⁴³ Coleman Bazelon, “Maximizing the Value of the C-Band,” p. 23.

⁴⁴ Intelsat Corporation, SES Americom Inc., Intel Corporation and C-Band Alliance, Notice of Ex Parte, GN Docket No 18-122, October 9, 2018, <https://ecfsapi.fcc.gov/file/100908982048/As%20Filed%20-%2010-09-18-Ex%20Parte%20-%20Intelsat%2C%20SES%2C%20Intel%2C%20C-Band%20Alliance.pdf>.

⁴⁵ C Band Alliance, “Customer Commitment Ex Parte,” p. 8, April 3, 2019.

⁴⁶ This commitment provides the foundation to ensure that any repurposing of C-Band spectrum is truly Pareto improving, meaning a change in the use of the band that makes some participants better off and none worse off.

⁴⁷ As promised in the Customer Commitment Ex Parte, the customers, such as various radio stations, will not be any worse off under this proposal as the CBA will reimburse all transition cost and has committed to launching new satellites to ensure sufficient capacity. *See also* C-Band Alliance, “Customer Commitment Ex Parte,” pp. 8; Ex Parte Letters from Amb-OS, April 30, 2019; INSP, April 24, 2019, https://ecfsapi.fcc.gov/file/10429141106282/ExParteSupport_CBA.pdf; The Spaceconnection Inc., April 1, 2019, <https://ecfsapi.fcc.gov/file/10401252681536/The%20SPACECONNECTION%20-%20Supprt%20Letter%20CBA%20-FCC.pdf>). The smaller satellite operators, will also be no worse off, as demonstrated by their support for the CBA proposal over other proposals (Olympusat, “C-Band Order and NPRM,” Ex Parte Letter, GN Docket No. 18-122, August 13, 2019, <https://ecfsapi.fcc.gov/file/10814796519041/Olympusat%20Letter%20to%20FCC%208-13-19.pdf>).

Third, the current FCC approach to clearing spectrum in a band with incumbent users, even without the problems created by nonexclusive spectrum rights, by using a reverse and forward auction, as in the case of the Broadcast Incentive Auction, takes significant time.⁴⁸ Such an approach would also be very risky. Two satellite operators—Intelsat and SES—account for 90–95% of the C-Band revenues in the U.S.⁴⁹ Consequently, designing an efficient reverse auction would be difficult and non-participation by either operator would sink the auction. By bringing these operators into common interest, the proposed CBA mechanism will resolve any uncertainty or ambiguity of rights – a prerequisite to any auction process. Equally importantly, the process can be fairly long and drawn-out with significant government involvement and cost.⁵⁰ Recognizing this experience, Chairman Pai recently said in an Open FCC meeting that an incentive auction

⁴⁸ Thomas K. Sawanobori and Robert Roche, “From Proposal to Deployment: The History of Spectrum Allocation Timelines,” CTIA, 2015, <https://api.ctia.org/docs/default-source/default-document-library/072015-spectrum-timelines-white-paper.pdf>.

⁴⁹ Kerrisdale Capital, “Intelsat S.A. and SES S.A. – To The Moon,” p. 28, June 2018, <https://www.kerrisdalecap.com/wp-content/uploads/2018/06/Intelsat-and-SES.pdf>.

⁵⁰ Early in the process that led to the Broadcast Incentive Auction, I testified before the U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Communication and Technology on April 12, 2011 about the merits of a broadcast incentive auction. The final 600 MHz spectrum will be cleared by 2020, 9 years later. See “Oral Testimony of Coleman Bazelon, The Brattle Group, Inc.,” U.S. House of Representatives, Committee on Energy and Commerce Subcommittee on Communication and Technology, April 12, 2011, https://brattlefiles.blob.core.windows.net/system/news/pdfs/000/000/231/original/oral_testimony_of_coleman_bazelon_apr_12_2011.pdf?1377791292. See also Paul Weiss, “FCC Allocates Initial \$12 Billion for Post Incentive Auction Repacking as House Members Urge FCC To Adhere to Repacking Deadline,” October 20, 2017, Accessed April 16, 2019, <https://www.lexology.com/library/detail.aspx?g=eb83d9e6-d43c-420b-9651-dcfe2f197346>; FCC, “Broadcast Incentive Auction and Post-Auction Transition,” Accessed September 4, 2019, <https://www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions>; Technology Policy Institute, “Don’t Be Disappointed by the FCC’s Incentive Auction,” January 17, 2017, Accessed April 16, 2019, <https://techpolicyinstitute.org/2017/01/17/the-fccs-incentive-auction-is-not-a-disappointment/>; R Street Institute Ex Parte Letter on the “C-Band Order and NPRM,” April 30, 2019, <https://ecfsapi.fcc.gov/file/1043017958806/3.7-4.2%20exparte%203.pdf>; Randolph J. May and Gregory J. Vogt, “A Free Market Approach Should Be Used to Reallocate C-Band Spectrum,” Perspectives from FSF Scholars, p. 4, Vol 14 (17), The Free State Foundation, July 17, 2019, accessed October 10, 2019, <https://freestatefoundation.org/wp-content/uploads/2019/08/A-Free-Market-Approach-Should-Be-Used-to-Reallocate-C-Band-Spectrum-071719.pdf>. See also, Will Rinehart, “Analyzing Plans to Reallocate C-Band for 5G Deployment,” Insight, p. 4, American Action Forum, October 7, 2019, accessed October 11, 2019, <https://www.americanactionforum.org/insight/analyzing-plans-to-reallocate-c-band-for-5g-deployment/>.

would delay the availability of mid-band spectrum.⁵¹ The CBA proposal brings this spectrum to market significantly more quickly than other proposals, and given the imperative of building a 5G ecosystem, a faster availability is important.⁵²

III. A New Policy Tool for Maximizing Spectrum Value

The CBA's market-based mechanism is an evolution of the auction mechanisms that the FCC has used to assign spectrum for more than two decades. This mechanism can be applied to other spectrum bands to spur spectrum availability without lengthy government intervention, and can serve as a model for reallocation in other bands. In the C-Band, the nonexclusive rights imply that there may be a holdout problem when repurposing this band. Other bands may also suffer from a similar holdout problem that inhibits socially beneficial repurposing of spectrum.

While the FCC has unparalleled expertise in conducting complex auctions, including reverse and incentive auctions, it has not addressed situations where property rights were not well-defined.⁵³ In fact, an auction without well-defined property rights would be impossible. Consequently, resolving the overlapping property rights problem is a prerequisite to any efficient solution. Working through these issues in a regulatory context will involve significant time and cost. In

⁵¹ Statement of Chairman Ajit Pai, "Transforming the 2.5 GHz Band," p. 2, WT Docket No. 18-120, Adopted July 10, 2019, <https://www.fcc.gov/document/fcc-transforms-25-ghz-band-5g-services-0/pai-statement>.

⁵² Daniel Lyons, "Secondary Markets Can Pave the Way for Rapid 5G Deployment," AEIdeas, American Enterprise Institute, March 21, 2019, accessed October 11, 2019, <https://www.aei.org/technology-and-innovation/telecommunications/secondary-markets-can-pave-the-way-for-rapid-5g-deployment/>. *See also*, Roslyn Layton, "Mid Band Spectrum Is the Next Critical Piece to Timely 5G Deployment," *Forbes*, May 1, 2019, accessed October 11, 2019, <https://www.forbes.com/sites/roslynlayton/2019/05/01/mid-band-spectrum-is-the-next-critical-piece-to-timely-5g-deployment/#76ba1f851922>.

⁵³ The 600 MHz Broadcast Incentive Auction involved a complex reverse and forward auction. A successful reverse auction was possible in that case because the property rights of broadcasters were well defined. See Paul Milgrom and Ilya Segal, "Designing the US Incentive Auction," 2013, https://milgrom.people.stanford.edu/sites/g/files/sbiybj4391/f/designing_the_us_incentive_auction_ha ndbook_milgrom-segal_final.pdf.

general, the FCC has used some variant of the sequential multiple round ascending auction to make spectrum available in bands where there are no incumbents. This is done in instances where the Commission can definitively determine how much spectrum to offer in the auction, the terms of deployment, and effort to make the spectrum available is separate from licensing by auction. However, in bands where it is unclear how many incumbent users to transition, such as in the 600 MHz television broadcast band, the FCC has employed a two-stage auction (a reverse and forward auction) to let the market determine spectrum supply and demand.⁵⁴ The CBA's market-based approach is an evolution of the auction-based approach that the Commission has adopted for efficient spectrum assignment. In bands with incumbent users and nonexclusive rights, it provides a path forward to encourage incumbents to engage in socially beneficial repurposing of their spectrum. As the current analysis shows, for the C-Band this approach is voluntary, fast, efficient, and protects incumbents, end-users, and consumers. The same may be true for other bands that also have similar market and regulatory failures.

The CBA proposal is a potential market-based solution that not only solves the current C-Band problem, but also shows a path forward for bringing more spectrum online to meet 5G or any future needs under circumstances where spectrum rights are not clearly defined and fully separable. The adoption of this policy for the C-Band signals the Commission's support for all incumbent spectrum users to examine their uses and propose efficiency enhancing reallocations that only they will have the knowledge to develop and implement.

That the current discussion about the C-Band is focused on how much to repurpose and how soon, is already a victory for this new policy approach. If the CBA members had not come forward with their proposal, it is highly likely that a protracted FCC proceeding would be ongoing for years to come. As previously noted, such a proceeding would have been hindered from the outset by a lack of reliable information needed to inform the FCC's reallocation decision. Instead, through the CBA consortium market-based approach, we know that 300 megahertz can be repurposed within 18-36 months and that the right incentives are in place so that additional spectrum may become available after that initial time period, without an overly involved FCC proceeding. If the CBA approach is successfully implemented in the C-Band, the Commission will be able to use this novel approach

⁵⁴ FCC, "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," Report and Order, GN Docket No. 12-268, Adopted May 15, 2014, <https://docs.fcc.gov/public/attachments/FCC-14-50A1.pdf>.

to incentivize incumbents to offer valuable spectrum in other bands that also suffer from market and regulatory failures.

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On C-Band Spectrum, Auction Speed Is All That Matters



Roslyn Layton Contributor ⓘ

[Enterprise & Cloud](#)

Evidence-based tech policy

UNITED STATES - MAY 15: From left, FCC Chairman Ajit Pai, commissioners Michael O'Rielly, Brendan ... [+] CQ-ROLL CALL, INC
VIA GETTY IMAGES

The important public policy debate regarding the C-Band—the critical radio spectrum between 3.7 gigahertz (GHz) and 4.2 GHz— offers a valuable opportunity to see how well policymakers make decisions to maximize opportunities for the American economy. Fourth generation wireless (4G) was an undisputed success, bringing the US global leadership in the smartphone enabled economy with almost 1 million jobs and [\\$100 billion](#) to the nation's economy with networks, technologies, apps, and services. 5G, or fifth generation mobile wireless, is expected to do even more, adding three [million jobs](#) and \$1.2 trillion in the coming decade by connecting the “[other 70 percent](#)” of the US economy.

Although the US led the world in 4G, it's in heated race with China to deploy 5G. In China, the Communist Party decides which state-owned entity gets to use the spectrum and for what use. The US, on the other hand, uses market-based auctions and secondary transactions to assign commercial spectrum. Once a license has been granted, it can be sold on the secondary market (subject to FCC approval). In general the market [make more efficient allocations](#) than government.

Although the C-Band is occupied almost entirely by satellite providers delivering radio and TV broadcast, C-Band spectrum has been identified for terrestrial wireless because its ideal mix of physical properties allows high data throughput across long distances. An FCC

rulemaking is underway to repurpose sixty percent of the band for mobile wireless while retaining some spectrum for the satellite providers to maintain uninterrupted service for the nearly 120 million American households that currently rely on the C-Band. Indeed, secondary market transactions would already be underway if it were not for an atavistic license design from the 1970s that makes it difficult to translate nationwide rights into smaller geographic areas. Competing proposals differ on whether market actors should design the auction or the government. While the proposals have many common elements, the private auction has already been designed and can be conducted nearly immediately upon FCC approval while a government auction could take the better part of decade in design and scheduling—the length of time until the next mobile generation.

Today In: [Innovation](#)



Making C-Band spectrum available as soon as possible is critical, and if the US waits for the government's auction, it will likely miss the opportunity to deploy C-band spectrum for 5G. Recent FCC spectrum auctions suggest that it takes several years from an FCC rulemaking inquiry for the FCC to even conduct an auction. For example, the FCC's most recently completed spectrum auction, Auction 102, began with a notice of inquiry released more than 5 years ago. Assuming the FCC could clear the spectrum in the same timeframe as the C-Band Alliance (which it likely can't), that will take at least another 3 years after the FCC auction. Taken together, an FCC auction likely would not deliver the benefits of this valuable spectrum until mid-2026—at the earliest.

Any person saving for college or retirement understands the [time value of money](#): a dollar invested is worth more today than tomorrow because of earned interest and compounding. As such, any amount of money is worth more the sooner it is received. The concept also applies to a company making a capital investment. Spectrum is like a non-depletable resource such as the wind or sunlight. A windmill or solar panel can only capture value once it is deployed. If deployment is delayed, there is no ability to capture the lost time value of the resource. The time value concept is expressed mathematically as net present value (NPV), the difference between cash flow from an investment today and over time. A mobile operator would prefer to deploy spectrum today and earn revenue

than wait ten years. And the U.S. Treasury surely would be better off with auction proceeds today instead of in the distant future.

Similarly, the longer a beneficial reallocation is delayed, the less it is worth. Assume the time value of money is 5 percent and the annual benefit of the reallocation is \$100 per year forever. The NPV of such a perpetuity is \$2000. At a time value of money of 5 percent, losing the first five years of the beneficial reallocation means wasting 22 percent of its value. At 10 percent time value of money, a 5 year delay wastes 38 percent of the value of the reallocation. With each year of delay, the public loses—and big. It's a loss we can ill afford with the Chinese at the gate.

The C-Band proceeding includes many complex models to predict the potential outcomes of private versus private auction models, but nothing can make up for lost time. Public auctions can take 5-10 years, and the delay reduces the value of cash flow by 22-38 percent. Policymakers would be wise to remember the time value of money and that a wait of 5 years will be too late for 5G. Speed to make the auction happen is all that matters.

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Roslyn Layton

An American in Denmark, I study evidence-based policy for the information, communications, and digital technology industries. Using empirical methods, I assess policy an... **Read More**

October 29, 2019

The Honorable Greg Walden
Ranking Member
House Committee on Energy & Commerce
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Robert E. Latta
Ranking Member
Subcommittee on Communications & Technology
2125 Rayburn House Office Building
Washington, DC 20515

Re: October 29 Hearing – Repurposing the C-Band to Benefit all Americans

Dear Rep. Walden and Rep. Latta:

To win the all-important race to 5G and maintain our status as the world's economic leader, the United States must move quickly to make more wireless spectrum available for 5G deployment. To that end, we strongly urge the Subcommittee on Communications & Technology to support the C-Band Alliance (CBA) plan to reallocate a significant amount of mid-band spectrum through private auctions in the secondary market.

Speed matters in the race to 5G and the C-Band is the most readily available mid-band spectrum. Private auctions will put that spectrum into the hands of U.S. wireless providers much more quickly than other proposed alternatives. At the same time, the CBA's plan will protect the existing C-Band video and radio services currently used by 120 million U.S. households.

We cannot afford to delay the reallocation of C-Band spectrum. A recent analysis found that a two-year delay could mean a loss of nearly \$18 billion in consumer surplus. In addition, China has already pledged to make the full 500 megahertz of mid-band spectrum available to its wireless carriers. Other

countries including France, Germany, Japan, and Australia are also making the C-Band a key element of their 5G plans.

The economic benefits of repurposing the C-Band to speed 5G deployment will be enormous. Building the network infrastructure necessary to support 5G will drive \$275 billion in private sector U.S. investment, spurring \$500 billion in economic growth. More than 3 million new jobs will be created for American workers.

In addition to the advantages they will enjoy from a stronger, more competitive U.S. economy, taxpayers will also be protected by the CBA plan; the CBA has repeatedly pledged to make a significant contribution to the U.S. Treasury from auction proceeds. Conversely, U.S. tax revenues will diminish if the C-Band is not rapidly brought to market, as the economy will lose billions of dollars every additional year we fail to make it available.

We commend the Subcommittee on Communications & Technology for holding this hearing to explore mid-band spectrum options for speeding 5G deployment. It is truly one of the most crucial technological issues facing America today. We sincerely hope that as a result of your factfinding you will conclude that the CBA private auction plan holds the most benefits for our nation and join us in giving it your full support.

Sincerely,

Steve Pociask
American Consumer
Institute

Mark Jamison
Roslyn Layton
American Enterprise
Institute*

Jessica Melugin
Competitive Enterprise
Institute

Tim Chapman
Heritage Action for
America

Zach Graves
Lincoln Network

Tom Struble
R Street Institute

* The American Enterprise Institute (AEI) does not take institutional positions on any issues. The views expressed are those of the scholars.



AMERICANS for TAX REFORM

Grover G. Norquist
President

October 16, 2019

Financial Services and General Government Subcommittee
U.S. Senate Committee on Appropriations
Room S-128, The Capitol, Washington, D.C. 20510

Dear Senators:

As the American economy demands more and faster connectivity, Americans for Tax Reform believes that the FCC should make getting spectrum into the hands of wireless carriers that will deploy 21st century networks a top priority. Though we initially opposed the plans set forward by the C-Band Alliance, we are encouraged by the changes they have made to their proposal, which is now more transparent, clears more spectrum, and acknowledges taxpayer interests.

We maintain that the best solution to spectrum scarcity is to make additional government spectrum available for commercial auction. But in working with what is currently attainable to close this gap, the Federal Communications Commission is rightly focused on the C-Band. Mid-band spectrum is a key element in bringing 5G to Americans. Currently, US Companies are operating at a deficit compared to other international competitors, especially China which is making 500 MHz of mid-band spectrum available to its carriers.

When it comes to spectrum, Americans for Tax Reform supports free markets without government set rates, and government should halt its involvement with an asset after it has been sold. To that end, two of best tools that the FCC has at its disposal are spectrum auctions and secondary market transactions. In many circumstances private spectrum sales can be appropriate, and government should make sales, trades, and swaps between willing buyers and sellers in the marketplace as frictionless as possible so that the spectrum can be put to its highest, best use.

The C-Band is not only the most readily available mid-band spectrum, it is also globally harmonized, a rare valuable benefit that would enable wireless carriers to keep costs lower through economies of scale. It is fortunate that the incumbent satellite companies have shown a willingness to work with the FCC to find a win-win solution to re-organizing the band. The revised proposal gets us closer to that goal.

Through the course of the FCC's C-Band proceeding, we have been pleased that the CBA has accepted feedback and revised its proposal. The CBA's modified proposal addresses our concerns.

First, CBA has indicated it intends to increase the amount of spectrum cleared and recognizes the FCC goal of clearing 300 MHz. By unleashing the secondary market forces that have served America so well over the last 30 years, the CBA proposal will get C-Band spectrum into the hands of wireless carriers far faster than any of the alternatives proposed to date. Under the revised CBA proposal, well over 200 MHz of the C-Band spectrum will be cleared and ready for 5G deployment within 36 months, with more than 60 megahertz cleared in 46 major markets within the first 18 months of an FCC order. We look forward to seeing a significant increase in the amount of spectrum cleared.

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Second, the CBA has now repeatedly committed to make a significant contribution to the U.S. Treasury. We have found over time that each auction or sale of spectrum is unique and has its own considerations at play. For these particular licenses and for this particular transaction, we believe that taxpayers do have a seat at the table. That does not mean that every time there is a spectrum transaction the government must extract its pound of flesh. CBA's commitment to make a contribution to the U.S. Treasury addresses our concerns as taxpayer advocates in this particular transaction.

Finally, there will be reasonable FCC of oversight over the transition of this spectrum to private market ownership and flexible licensing. While we appreciate the CBA's support for basic measures ensuring an open, transparent, fair, and competitive process, we caution that the government should ensure that transactions between willing buyers and sellers in the marketplace are truly market-based so the spectrum can be put to its highest, best use—and as quickly as possible.

In light of the significant changes the CBA has made to its proposal, and the importance for the U.S. to lead on 5G, we hope the FCC will use its existing authority to quickly pursue this viable solution.

If you should have any questions or comments, please contact me, or Katie McAuliffe by phone, 202-785-0266, or email, kmcauliffe@atr.org.

Onward,

Grover Norquist



Insight

Analyzing Plans To Reallocate C-Band for 5G Deployment

WILL RINEHART | OCTOBER 7, 2019

Executive Summary

The ubiquity of smartphones and the advent of the Internet of Things has propelled the importance and value of the transmission infrastructure for mobile data. Rising demand for radio spectrum has driven a conversation over how the Federal Communications Commission (FCC) should use its power to allocate spectrum, but recently this discussion has taken a unique turn with a proposal by the C-Band Alliance (CBA) to repurpose 180 megahertz (MHz) of spectrum between 3.7 gigahertz (GHz) and 4.2 GHz through an auction. What follows is an overview of the current proposals for the space known as the C-Band. For policymakers, it is important to understand that:

- The C-Band spectrum is valuable, but its value is highly dependent on the underlying costs required to put this new spectrum to use;
- While many have decried the CBA plan as a private sale, its plan would likely mirror previous FCC auctions and it has strong incentives to create a competitive and efficient process;
- Whatever method is pursued to repurpose the band, the transition needs to be orderly and conducted in a timely manner since a two-year delay could mean a loss of nearly \$18 billion in consumer surplus; and
- Assuming the FCC secures a portion of the spectrum sale proceeds for the public and ensures an open and transparent auction process, moving forward with such a plan appears to be the most economically efficient option available.

History of the C-Band

The history of data transmission in the C-Band begins during World War II. Toward the end of 1943, AT&T secured the ability from the Federal Communications Commission (FCC) to test a series of microwave relays in the 3.7 gigahertz (GHz) to 4.2 GHz space for sending telephone calls between stations in New Jersey. This project developed [into the Long Lines](#), a relay network that supplied long-distance services to AT&T and AT&T's customers in the television industry. Although the telephone company began to phase out the Long Lines system in the 1970s, shifting to fiber, coaxial cable, and other means of transmitting data, this band of spectrum has been continuously used since to transmit data via point-to-point microwave links. Today, these licenses are called Fixed Services, or FS.

Even during the height of FS transmission, another use for the same spectrum range began. In 1965, the American Broadcasting Company (ABC) [petitioned](#) the FCC to be able to use a satellite to transmit its television feed. It wasn't until 1972 that the FCC finally [ruled on the matter](#), but the resulting system created the unique pattern of spectrum use that we have today. After asking everyone in the industry to apply for a license in a 1970 order (*Domsat I*), the FCC in a second order (*Domsat II*) implemented the [Open Skies policy](#), which encouraged the development of the nascent Fixed Satellite Services (FSS) sector.

In allowing open development of the 3.7 GHz to 4.2 GHz band, the FCC rejected the comparative bidding system that was prevalent at the time. These dressed-up beauty contests often gave away licenses due to political connections. Most notably, [Lady Bird Johnson made millions](#) from buying KTBC, as her husband, then-Senator and later President Lyndon Johnson, was able to pressure the FCC to secure a license for the station.

Domsat II took a different tack. Instead of allocating unique slices of spectrum to particular applicants, *Domsat II* gave the applicants access to the full range of C-Band spectrum. As a result, the different users were forced to cooperate. In the FCC's words:

Our decision in favor of multiple entry does not mean that we have opted for a policy of “unlimited or unrestricted open entry.” Our aim, as outlined above, is to afford qualified applicants a reasonable opportunity to demonstrate the public advantages in use of the satellite technology as a means of communications. But such entry cannot be “open” in the sense that it is without any restrictions or limitations.

Spurred on by this relative hands-off approach, the satellite players coordinated to mitigate interference. By the late 1980s [there were tens of thousands](#) of earth stations sharing over 39,000 channel assignments.

Current C-Band operators developed from this Open Skies policy. Registered or licensed earth stations operating in the C-Band coordinate with each other and are authorized to use the entire C-Band across the full geostationary arc (i.e. the area of earth covered by the satellite). This policy is known as full-band, full-arc licensing. Currently, FSS uses the 3.7 GHz to 4.2 GHz band for space-to-earth, or downlink communication, while the 5.925 GHz to 6.425 GHz band is used for earth-to-space or uplink communication. Combined, these two bands are considered the traditional C-Band. Four satellite operators provide the vast majority of services in the C-Band and include Intelsat, SES, Telesat, and Eutelsat. Today, the C-Band is currently being used by satellite providers to distribute video and radio programming to nearly 120 million U.S. households.

C-Band's Unique Benefits

Because few uncharted regions remain on the spectrum map, spectrum policy has increasingly focused on repositioning incumbents and making bands more efficient. The AWS-3 auction, to name one recent example, came from spectrum [previously granted](#) to the Department of Defense. Today, several prime bands, including the C-Band, are being eyed for repurposing.

Why has the C-Band become a topic of interest? First, the C-Band resides in what is known as the mid-band. Lower bands are best suited to broad coverage and can penetrate buildings. Most of the low-band space, which is considered anything below 1 GHz, has already been dedicated to specific uses, so businesses are increasingly looking to the next-best options to deploy new tech. Because the lower band is spoken for, the mid-band is having a renaissance. The Citizens Band Radio Service (CBRS), which runs from [3.5 GHz to 3.7 GHz](#), will be auctioned in June 2020, while [the 5.925 GHz to 7.125 GHz band](#) is being targeted for potential unlicensed use as well.

Second, the C-Band spans 500 MHz, making it one of the largest contiguous bands in spectrum. Contiguous spectrum allows operators to use larger blocks of spectrum. While having prime spectrum is important, there are clear benefits to using [larger blocks of spectrum](#). Increasing the width of the channel in which an operator deploys can increase its traffic carrying capability, which reduces its costs.

Moreover, interest in the C-Band has been picking up because other countries are likely to use this space as well

for the deployment of next generation 5G wireless services. The European Conference of Postal and Telecommunications Administrations mandated that the 3.4 GHz to 3.8 GHz band will be the first primary band for 5G, pushing Austria, France, and Germany to take steps to secure it for use by carriers. Japan and Australia are also putting this band at the front of their 5G spectrum plans. In many of these countries, the spectrum has already been auctioned to mobile broadband operators.

To top it all off, the band is being used by satellite providers to distribute video programming, and as in the rest of the industry, newer tech has given these providers other options. For one, the [transmissions are more efficient](#) than they were years ago, so less total spectrum space is needed to send better transmission. The arrival of fiber has also given companies the ability to send traffic through another route. Both have eased the need to occupy the full 500 MHz space fully.

Given all of these changes, the current allocation could be significantly reduced and still be adequate for the incumbents. The CBA [estimates](#) that, of the total 500 MHz band, around 200 MHz could be repurposed for new uses, including a 20 MHz guard band, for a total of 180 MHz brought to market. [According to the CBA](#), anything larger than 200 MHz might force companies to move to the Ku-Band, which is much higher in spectrum and doesn't have the same kind of propagation qualities, leading to degradation in their services. In contrast, a study commissioned by ACA Connects, formerly the American Cable Association, posits that that 130 MHz is more than enough spectrum for the current companies, which would leave around 370 MHz free to reallocate for 5G in a comparable time period. This proposal has been met with concerns about its complexity, delay, and lack of reliability by existing video customers such as Disney, Fox, and CBS. AT&T and Verizon also opposed it as premature. Nonetheless, most agree that there is an opportunity with the C-Band, but with all opportunities come a cost.

C-Band's Opportunity Cost of Transition

The full-band, full-arc licensing creates a potential conflict in the reallocation of the band. Since the current license inherently grants various actors with overlapping and non-exclusive rights the ability to use the band, any one player could hold up the process to switch to a newer and better use. This kind of license stands in contrast to the recent 600 MHz incentive auction, where individual TV stations radiating in specific regions could make independent decisions to give up their rights.

Indeed, that the industry has coalesced around a singular plan to transition the C-Band underscores the willingness to repurpose the space for a potentially more efficient use. In a free market in which each satellite operator had control and property rights over their piece of the spectrum, a trade within the C-Band would have already occurred. Yet because satellite spectrum allocations aren't full-fledged property rights and license holders must gain favor from the FCC to transition licenses, market failures like the current holdup are endemic.

Valuing the C-Band is challenging because there are no domestic sales with which to compare. In Appendix 1 of this paper, values for a sale are approximated using a maximum likelihood method. Given that the underlying data come from other countries, the estimates should be read with caution. Still, the median sales price was estimated at \$0.201 per MHz per population (MHz pop), with an upper band of \$0.597 per MHz pop and a lower band of \$0.011 per MHz pop, which is explained in Appendix 2.

Policies and Plans for Transitioning

Making the transition from the current allocation system to one where more services are supported will force

current operators to incur costs, but there are still a number of unanswered questions that the FCC will need to address.

For one, it is still unclear who will run the auction. The CBA has proposed selling the spectrum through an auction process mirroring that of the FCC. At the helm would be economist [Paul Milgrom](#), who played a key role in designing the multiple-round auction first used by the FCC in 1993 and [led the team that created the incentive auction](#).

This kind of auction, which some have decried as a private sale, will need the blessing of the FCC. Earlier this year, Citizens Against Government Waste [worried that](#) “If it is sold on the secondary market through a private sale, there is no guarantee taxpayers would see any of the revenues generated from the sale; incumbent users are not assured they will be made whole; and there would be limited FCC oversight.” In response, [the CBA modified its proposal](#) to ensure that a portion of the revenues would be directed to the Treasury.

Michael Calabrese of New America Foundation has also expressed doubts, [explaining](#), “a private FCC-like auction subject to FCC oversight proposed here clearly violates Section 309(j) of the Communications Act. Only a public auction with the lion’s share of revenue returned to the public is within the FCC’s authority to authorize.” Section 309(j) of the Communications Act grants the FCC the authority to conduct auctions, but it doesn’t limit the FCC to assigning spectrum through public auctions or prevent private sales or auctions of interference rights by other entities. Rather, section 309(j)(6)(E) requires the FCC to consider other assignment mechanisms when appropriate to protect the public interest. Although the FCC must avoid unjust enrichment in certain contexts, whether an unjust enrichment claim could apply in this matter is up for debate. Traditionally, concerns about unjust enrichment have concerned the issuance of licenses as well as the resale of spectrum within a five-year period by entities that qualified for credits in an auction. On the other hand, broadcasters were compensated by more than \$2 billion in the Incentive Auction, so it isn’t without precedent that some kind of monetary trade should occur. Thus, the question at hand is the *extent* to which current operators should be compensated for the move.

Still, it is a fundamental mistake to think that the auction mechanism that the CBA has proposed is a private sale. Unlike a private sale, an auction would allow all qualified entities to bid. Given that the FCC would likely adopt a similar plan if it ran the auction, the result should approximate what the agency would have garnered. Yet, the FCC might not be able to solve the holdout problem. Thus, in the most optimistic of scenarios, the FCC would do only as well as the CBA plan. In the worst case, the agency might not come close to transitioning as large a swath of spectrum.

A chief selling point of [the CBA plan](#) is the relatively quick timeframe that spectrum could come to the market, which it projects will be 18 months for the first 60 MHz tranche of spectrum and 36 months for the rest of the 180 MHz. Furthermore, CBA states that if the FCC were to make its decision this fall, the CBA could conclude its sales process in the first half of 2020. While it is difficult to know exactly how long an analogous process will take for the FCC, the agency is hardly a hare on these matters. According , it takes the agency on average 13 years to complete an auction fully. If the FCC were to undertake its own version of an auction, it would surely take much longer than the timeline set out by the CBA.

Already the FCC has a full plate. Auction 101 wrapped up in January, raising \$702 million. Auction 102 was completed at the tail end of May 2019. The agency plans to hold one more auction in 2019, Auction 103, which will sell off spectrum at 37 GHz, 39 GHz, and 47 GHz. However, that auction has been delayed, [pushing back other scheduled auctions as well](#). Commissioner O’Rielly put a fine point on the FCC’s relative slowness when he noted,

Most of the criticism of what is known as the CBA Proposal shows a lack of understating of how the internal Commission works. For instance, the argument has been made that the FCC should conduct a public auction for these frequencies rather than allowing the private sector to do it. Please don’t anyone try to lecture me on the Commission’s supposed efficiency and timeliness in conducting auctions, as I have experienced the latter firsthand for the past six years and twenty more from a different perch. This is not a new problem by any stretch of the imagination. Given what is already in the pipeline and how long it takes for the Commission to set up and operate an auction, we are talking years – and I mean years – before completion. We can certainly ensure transparency, accountability, fairness, and openness without having to run the auction ourselves.

Since there is a time value of money, the FCC will need to determine if the quick turnaround set out by the CBA is worth pursuing. This delay can be modeled using discounted cash flow analysis, as explained in more detail in Appendix 2. Assuming a conservative one- or two-year delay, the lost value could be between 8 percent and 25 percent of the value of the spectrum. [Empirical studies](#) in the broadband space typically find that annual consumer surplus is equal to the value of a spectrum sale.

Thus, at the low end, the total value lost given a year delay by the FCC roughly equates to:

	C-Band Low Estimate	C-Band Mean Estimate	C-Band High Estimate
100 MHz	\$29.2 million	\$516.9 million	\$1.5 billion
180 MHz	\$52.5 million	\$930.5 million	\$2.7 billion
370 MHz	\$107.6 million	\$1.9 billion	\$5.7 billion

And at the top end, if the agency were to delay for two years, the total value lost would be:

	C-Band Low Estimate	C-Band Mean Estimate	C-Band High Estimate
100 MHz	\$92.7 million	\$1.6 billion	\$4.8 billion
180 MHz	\$166.8 million	\$3 billion	\$8.7 billion
370 MHz	\$341.6 million	\$6 billion	\$17.9 billion

Inaction and delay by the FCC on this matter could be costly, especially for consumers, to the tune of nearly \$18 billion.

Conclusion

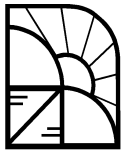
With these considerations in mind, the FCC should:

- Ensure that the transition is orderly and is conducted in a timely manner;
- Safeguard incumbents by keeping them whole;

- Establish that whatever mechanism is used is open and transparent; and finally
- Secure a portion of the spectrum-sale proceeds for the public.

Regardless of the path that is taken, the proposals by the CBA have reinvigorated the conversation around this important band. The [C-Band is undergoing a transition](#), and operators in the band have come forward with a market-driven approach. For the FCC, the most important question is how to transition this part of the spectrum to its highest and best use at the lowest cost as quickly as possible.

Appendices can be found [here](#).



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PHOENIX CENTER POLICY BULLETIN NO. 47

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September 2019

INNOVATION IN SPECTRUM REPURPOSING: THE C-BAND AS A PRINCIPAL-AGENT PROBLEM

Abstract: A consortium of satellite service providers have proposed to repurpose by private sale a large portion of a 500 MHz swath of mid-band spectrum known as the C-Band. As is common, the plan faces some resistance, with much of the opposition preferring a public auction rather than a private sale. In this BULLETIN, we evaluate the competing methods for repurposing the band by appealing to principal-agent theory where the government is the principal and the consortium of satellite incumbents is the agent. Our analysis demonstrates the following: First, given the private information available to the satellite industry, it makes sense for the government to allow the consortium to serve as an agent in conducting the sale, thereby ensuring the rapid and efficacious repurposing of the band. Second, compensation to the agent for its private information is efficient and not “unjust enrichment.” Third, considering the possibility that the principal may demand compensation from the agent, any such compensation (i.e., a regulatory payment) should take the form of a fixed payment rather than a share of auction proceeds. Fourth, while a public auction may be used to increase the government’s proceeds from repurposing the band, such enrichment is more than matched by a reduction in total economic welfare. Finally, our use of the C-Band as a case study in this paper does not restrict our analysis to the C-Band. If the CBA implements a private sale to repurpose large blocks of mid-band spectrum, then the Commission may use other incumbents as agents to efficiently repurpose other spectrum bands. Just as spectrum auctions were an important innovation in U.S. spectrum policy, conducting auctions or other similar transactions through private agents may be a sensible next step in the efficient allocation and assignment of spectrum rights.

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I. Introduction

In 2018, data transmissions over mobile wireless networks increased by more than 80% from the year before, an impressive growth rate consistent with the year-over-year average growth rate over the past decade.¹ Satisfying this rapid demand growth presents challenges not only to mobile wireless providers but also to the Federal Communications Commission (“FCC” or “Commission”), the agency responsible for repurposing the significant amounts of the radio spectrum essential to the production of mobile data services. While the Commission has conducted numerous spectrum auctions in recent years, it lacks a ready source for the much-needed spectrum in the low- and mid-bands.²

By far, the largest, most promising source of mid-band spectrum suitable for repurposing to mobile wireless use is the C-Band, a 500 MHz swath of mid-band spectrum (3.7-4.2 GHz band) presently allocated for the provision of satellite communications. Satellite service providers, operating through the C-Band Alliance (“CBA”) consortium, have indicated that a large portion of this band could be quickly repurposed through a private sale.³ The Commission is presently considering the proposal.⁴

¹ CTIA, *2019 Annual Survey Highlights* (June 20, 2019) (available at: <https://www.ctia.org/news/2019-annual-survey-highlights>).

² See, e.g., the FCC’s 5G FAST Plan (<https://www.fcc.gov/5G>); Auction 202 (24 GHz) in 2019 included seven 100 MHz blocks (<https://www.fcc.gov/auction/102/factsheet>); Auction 101 (28 GHz) in 2019 included two 425 MHz blocks (<https://www.fcc.gov/auction/101/factsheet>); Auction 97 (1700 MHz) in 2015 included 65 MHz of spectrum (<https://www.fcc.gov/auction/97/factsheet>); Auction 96 (H Block, 1900 MHz) in 2014 included a 10 MHz block (<https://www.fcc.gov/auction/96/factsheet>); Auction 92 (700 MHz) in 2011 included 24 MHz of spectrum (<https://www.fcc.gov/auction/92/factsheet>).

³ See, e.g., Comments of the C-Band Alliance, *In the Matter of Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, GN Docket No. 18-122 (August 7, 2019) at p. 2 (available at: <https://c-bandalliance.com/wp-content/uploads/2019/08/CBA-Comments-to-Other-Proposals-PN.pdf>); C-Band Alliance Filing on Proposed Commercial Auction Process, C-Band Alliance (June 10, 2019) (available at: https://c-bandalliance.com/wp-content/uploads/2019/06/FINAL-CBA-Auction-Fact-Sheet_06-10-19-1.pdf); C-Band Joint-Use Proposal Fact Sheet, Intelsat, Intel, SES (June 2018) (available at: <http://www.intelsat.com/wp-content/uploads/2018/06/C-band-Fact-Sheet-Intelsat-Intel-SES.pdf>); J. Eggerton, *CBA Outlines C-Band Auction Proposal*, MULTICHANNEL NEWS (June 12, 2019) (available at: <https://www.multichannel.com/news/cba-outlines-c-band-auction-proposal>); *Fact Sheet: C-Band Alliance Filing on Proposed Commercial Auction Process*, C-Band Alliance (June 10, 2019) (available at: <https://c-bandalliance.com/documents/c-band-auction-process-fact-sheet>); *Intelsat, SES, Eutelsat and Telesat Establish the C-Band Alliance (CBA), a Consortium to Facilitate Clearing of U.S. Mid-band Spectrum for 5G While Protecting U.S. Content Distribution and Data Networks*, SES Press Release (September 27, 2018) (available at: <https://www.ses.com/press-release/intelsat-ses-eutelsat-and-telesat-establish-c-band-alliance-cba-consortium-facilitate>).

⁴ *In the Matter of Expanding Flexible Use of the 3.7 to 4.2 GHz Band Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz; Petition for Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission’s Rules to*

(Footnote Continued....)

The CBA's plan is not without challenge and opposition. First, satellite providers must make significant investments in new satellites and thousands of earth station filters in order to accommodate existing users and uses, including the transmission of video programming to cable operators and broadcasters. The industry, however, confirms that it is willing and able to accomplish the task and do so swiftly, perhaps repurposing large portions of the band in as little as eighteen months.⁵ Second, some parties resist the idea of a private sale altogether and call on the Commission to conduct instead a government-run auction. Without dispute, the satellite providers have far more information than other parties about the requirements for repurposing the C-Band, including how much spectrum may be repurposed, how much investment by the providers is required to do so, how to arrange the band to minimize interference, and so forth. The incumbents are properly incented since they internalize the benefits and costs of their actions. The Commission, alternately, is largely uninformed on these details and its incentives are unclear. Moreover, public auctions can take a decade or more from start to finish, a delay that may cost society billions in economic welfare.⁶ Finally, as we detail here, a public auction enriches the government above the level available from the private auction only by reducing total economic welfare.

The aim of this BULLETIN is to offer an economic framework for the repurposing of the C-Band. We do so by appealing to the *principal-agent theory* studied extensively by economists, an approach ideally suited for, though not at all limited to, the C-Band.⁷ Our analysis demonstrates the following: First, given the private information available to the satellite industry, it makes sense for the Commission to allow the CBA to serve as an agent of the federal government in conducting the auction, thereby ensuring the rapid and efficacious repurposing of the band. Second, compensation to an agent for its private information is efficient, weakening substantially the existence of so-called "unjust enrichment." Third, considering the

Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3.7-4.2 GHz Band; Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Band Shared Between the Fixed Service and the Fixed Satellite Service, FCC 18-91, ORDER AND NOTICE OF PROPOSED RULEMAKING, __ FCC Rcd __ (rel. July 13, 2018), 83 Fed. Reg. 44128-01 (hereinafter "C-Band NPRM") (available at: <https://docs.fcc.gov/public/attachments/FCC-18-91A1.pdf>);

⁵ C-Band Joint Use Proposal Fact Sheet, *supra* n. 3.

⁶ A lengthy delay in the C-Band may occur because it is unclear whether the Commission has the statutory authority to conduct such an auction in the C-Band.

⁷ See, e.g., S.A. Ross, *The Economic Theory of Agency: The Principal's Problem*, 62 AMERICAN ECONOMIC REVIEW 134-139 (1973); J. Laffont and D. Martimort, *THE THEORY OF INCENTIVES: THE PRINCIPAL-AGENT MODEL* (2002); J. Laffont, *THE PRINCIPAL AGENT MODEL: THE ECONOMIC THEORY OF INCENTIVES* (2003); C. Jäger, *THE PRINCIPAL-AGENT-THEORY WITHIN THE CONTEXT OF ECONOMIC SCIENCES* (2008); D.F. Spulber and D. Besanko, *Delegation, Commitment, and the Regulatory Mandate*, 8 JOURNAL OF LAW, ECONOMICS, AND ORGANIZATION 126-154 (1992); O.E. Williamson, *THE ECONOMICS OF DISCRETIONARY BEHAVIOR: MANAGERIAL OBJECTIVES IN A THEORY OF THE FIRM* (1964).

possibility that the principal may demand compensation from the agent, we offer insights on the best form of the compensation agreement between the relevant parties, which we presume will take the form of a “regulatory payment” to the U.S. Treasury.⁸ Economic theory indicates that such compensation should take the form of a fixed payment rather than a share of auction proceeds. Taking a share of the proceeds reduces the government’s potential earnings by distorting the incumbent users’ marginal decisions, thereby making the quantity of repurposed spectrum inefficiently low. Fourth, while a public auction may be used to increase the government’s proceeds, such enrichment is more than matched by a reduction in total economic welfare.

II. Background

The C-Band (or Lower C-Band) spans 500 MHz between 3.7 GHz to 4.2 GHz and is principally used for Fixed Satellite Service (primarily satellites in geostationary orbit transmitting to fixed earth stations).⁹ In the United States, these satellites predominately transmit video programming (accounting for nearly 90% of transmissions), often to cable systems and broadcasters.¹⁰ With some excess capacity and falling demand, the industry believes it can satisfy the demand for its services with much less spectrum than is presently allocated. Satellite providers, operating through the CBA, have proposed to relinquish spectrum through secondary market transactions. Major mobile wireless carriers, with strong demand for mid-band spectrum, support the repurposing of the band as quickly as possible.

While buying and selling spectrum in the secondary market is commonplace, there is some disagreement about the protection of existing customers and whether the spectrum should be sold in a private or public auction.¹¹ The cable television industry, while not opposed to the repurposing, has sought to ensure that its use of the spectrum to receive television signals is

⁸ *Our Wireless Future: Building a Comprehensive Approach to Spectrum Policy*, Testimony of Peter Pitsch, C-Band Alliance, Before the U.S. House of Representatives Committee on Energy and Commerce Subcommittee on Communications and Technology (July 16, 2019) at p. 11 (available at: <https://docs.house.gov/meetings/IF/IF16/20190716/109797/HHRG-116-IF16-Wstate-PitschP-20190716.pdf>).

⁹ Transmissions to these satellites use the 5.925 GHz to 6.425 GHz band.

¹⁰ See, e.g., Ex Parte Filing of Ericsson, GN Docket No. 17-183 (March 29, 2018) (available at: <https://ecfsapi.fcc.gov/file/10329453530188/Ericsson%20Mid%20Band%20Ex%20Parte%20GN%2017-183%20COMBINED%20TO%20BE%20FILED.pdf>).

¹¹ See, e.g., Comments of Verizon, GN Docket No. 18-122 (filed October 29, 2018) (supporting a private auction); and c.f., Comments of T-Mobile GN Docket No. 18-122 (filed October 29, 2018) (supporting a public auction).

protected, and has received support from the mobile wireless industry for its concerns.¹² The Commission can be expected to take the issue seriously.

The limited opposition to a private auction is based largely on the concepts of “unjust enrichment” and the “return to the Treasury.”¹³ Put simply, the argument is that it is the federal government—and not the satellite industry—who should benefit most from the repurposing of the C-Band, especially since the satellite providers do not have exclusive licenses acquired via auction or other market transaction.¹⁴ Such arguments are often little more than boilerplate in spectrum transactions, serving as a means to exploit the regulatory process for private or political advantage.¹⁵

¹² See, e.g., Comments of Comcast Corporation and NBCUniversal Media, LLC, GN Docket No. 18-122 (filed May 31, 2018); Comments of CTIA, GN Docket No. 18-122 (filed October 29, 2018) at pp. 10-11 (“the Commission should ... balance the needs of existing earth station users while ‘limiting uses that would hamper new intensive terrestrial use.’”).

¹³ See, e.g., Comments of The Open Technology Institute at New America, GN Docket No. 18-122 (filed July 3, 2019) (“[A] private auction would do this in exchange for all of the (net) proceeds, with no return to the Treasury (at p. 9)”; “Only a public incentive auction run by the Commission can ensure a monetary return to the public and avoid unjust enrichment (at p. 7)”; Comments of T-Mobile at p. 2, *supra* n. 11 (“The satellite operators’ proposal, by contrast, caps spectrum for broadband at 180 megahertz and directs all spectrum revenue to satellite investors and none to taxpayers.”); see also, M. Allevan, *Spectrum Groups Urge Lawmakers to Prevent “Private Auction” of C-Band*, FIERCEWIRELESS (July 9, 2019) (available at: <https://www.fiercewireless.com/wireless/spectrum-groups-urge-lawmakers-to-prevent-private-auction-c-band>); K. Hill, *Debating the Fate of the C-Band*, RCR WIRELESS (June 6, 2019) (available at: <https://www.rcrwireless.com/20190606/policy/c-band>); M. Allevan, *T-Mobile Counters C-Band Alliance Proposal with Auction-Based Approach for 3.7-4.2 GHz*, FIERCEWIRELESS (October 30, 2018) (available at: <https://www.fiercewireless.com/wireless/t-mobile-counters-c-band-alliance-proposal-auction-based-approach-for-3-7-4-2-ghz>).

¹⁴ See, e.g., G. Morgan, *14 Free Market Groups Applaud FCC for C-Band Efforts*, Taxpayer Protection Alliance (April 10, 2019) (“the CBA’s scheme [would] deny billions—perhaps tens of billions of dollars—in proceeds owed to the U.S. Treasury...” (available at: <https://www.protectingtaxpayers.org/telecommunications/14-free-market-groups-applaud-fcc-for-c-band-efforts>); D. Collier and T. Schatz, *The Race to 5G: Protecting Taxpayers through Spectrum Auctions*, Citizens Against Government Waste (April 2019) (“If this mid-band spectrum is sold through the normal FCC auction process with strong oversight, the proceeds would go to the taxpayers; incumbent users of the spectrum would be protected; and the spectrum would be used for 5G development and deployment. If it is sold on the secondary market through a private sale, there is no guarantee taxpayers would see any of the revenues generated from the sale; incumbent users are not assured they will be made whole; and there would be limited FCC oversight.”) (available at: <https://www.cagw.org/sites/default/files/pdf/The%20Race%20to%205G-Protecting%20Taxpayers%20Through%20Spectrum%20Auctions.pdf>).

¹⁵ Such efforts act as a “tax” on spectrum repurposing, reducing the migration of spectrum from low to high-valued uses. T.R. Beard, G.S. Ford, L.J. Spiwak and M. Stern, *Taxation by Condition: Spectrum Repurposing at the FCC and the Prolonging of Spectrum Exhaust*, 8 HASTINGS SCIENCE AND TECHNOLOGY LAW JOURNAL 183-209 (2016) (available at: <http://phoenix-center.org/papers/HastingsSTLJ-TaxationbyCondition.pdf>).

Rent-seeking aside, the “public option” suffers from a number of shortcomings. First, it is impossible to say, *ex ante*, that the proceeds from the auction will exceed by any material amount the financial burden on the satellite industry caused by the repurposing. Second, as we detail here, compensation to the satellite incumbents for their private information is economically efficient and thus just compensation. Third, there appears to be no restriction on the Commission obtaining some portion of the proceeds from the private auction, so there may in fact be a benefit to the U.S. Treasury in the form of a regulatory payment. Fourth, the C-Band is non-exclusively shared among many users, so a reverse auction where some users sell while others do not is infeasible.¹⁶

But perhaps the most compelling argument for a private transaction is the CBA’s proposed timeline. Assuming the FCC adopts, largely, the CBA proposal by year-end 2019, the Alliance claims it can conduct a private sale in the first-half of 2020 and clear at least 60 MHz for terrestrial operations in as little as eighteen months.¹⁷ In contrast, public spectrum auctions conducted by the Commission can take a decade or so and are rich with special-interest lagniappe.¹⁸ One estimate suggests that repurposing this spectrum sooner rather than (much) later may be worth billions in economic welfare.¹⁹ In addition, though often ignored, satellite

¹⁶ *C-Band NPRM*, *supra* n. 4 at ¶¶ 59-61 (“because all FSS licensees have equal, nonexclusive rights to the entire band under Part 25 of our rules, they cannot compete in the same way that broadcast television licensees did in the broadcast incentive auction (¶ 59).”) (available at: <https://docs.fcc.gov/public/attachments/FCC-18-91A1.pdf>); see also Letter from Paul Milgrom, GN Docket No. 18-122 (filed March 6, 2019) <https://ecfsapi.fcc.gov/file/10307139020493/C-Band%20Alliance%20ex%20parte%203-7-19.pdf>.

¹⁷ J. Engebretson, *C-Band Alliance: You Want an Auction for Valuable Spectrum, We’ll Give You One*, TELECOMPETITOR (June 12, 2019) (available at: <https://www.telecompetitor.com/c-band-alliance-you-want-an-auction-for-valuable-spectrum-we-will-give-you-one>) (“The idea of current license holders sharing auction proceeds with the government is not a new one. That approach was used in a previous auction of TV broadcast spectrum. What would be unprecedented is having a private entity, rather than the FCC, in charge of the auction. According to the C-Band Alliance, the advantage of this approach is that spectrum could be made available for 5G deployments more quickly, helping the U.S. to remain on the vanguard of 5G technology.”)

¹⁸ *Taxation by Condition*, *supra* n. 15; T.R. Beard, G.S. Ford, L.J. Spiwak, and M.L. Stern, *Regulating, Joint Bargaining, and the Demise of Precedent*, 39 MANAGERIAL AND DECISION ECONOMICS 638-651 (2018) (available at: <https://onlinelibrary.wiley.com/doi/abs/10.1002/mde.2934>); T.K. Sawanobori and R. Roche, *From Proposal to Deployment: The History of Spectrum Allocation Timelines*, CTIA (July 2015) at p. 2 (available at: <https://api.ctia.org/docs/defaultsource/default-document-library/072015-spectrum-timelines-white-paper.pdf>) (“The data show that the process of reallocating spectrum for wireless has taken between six and 18 years—on average 13 years—from FCC Order to first deployment.”)

¹⁹ C. Bazelon, *Maximizing the Value of the C-Band: Comments on the FCC’s NPRM to Transition C-Band Spectrum to Terrestrial Uses*, The Brattle Group (commissioned by Intel, Intelsat, and SES) (October 29, 2018) at p. 27 (available at: [https://ecfsapi.fcc.gov/file/102980223165/Intel Intelsat SES Joint NPRM Comments%20Final%2010-29.pdf](https://ecfsapi.fcc.gov/file/102980223165/Intel%20Intelsat%20SES%20Joint%20NPRM%20Comments%20Final%2010-29.pdf)) (“The impact of delay can be significant. The specific magnitude of delay depends on a number of assumptions about which discount rate to use and the path of cash flows. Under reasonable assumptions, I find that one year of

(Footnote Continued....)

carriers possess a significant information advantage over federal regulators with respect to how much spectrum can be repurposed, how much investment is required to accommodate the change, how to avoid interference problems, among other important considerations. This private information and the rapid pace of re-deployment are both valuable and warrant compensation. Payment for information and efficiency is not “unjust.” Moreover, most satellite operators are “on board” with the repurposing by private auction, whereas the regulator’s less-informed and often politically-motivated choices may spur resistance, delay, and error.

III. Economic Framework

Our modeling approach uses standard economic theory to examine the best way to structure the spectrum repurposing mechanism, informed by the facts of the C-Band issue. Accordingly, our theoretical evaluation makes several assumptions which apply to this policy challenge. First, we assume that repurposing of some portion of this spectrum is in the public interest. Although this is universally believed in the communications industry and by the FCC, this assumption is actually a bit more nuanced than is first apparent. In particular, no one is likely to argue that any and every arbitrary repurposing is equally socially desirable. Rather, some repurposings are better than others, and flexible use licenses ensure that spectrum is put to its highest-valued use (assuming interference concerns are adequately addressed).²⁰

Second, we assume repurposing is costly. This is clearly the case given the current and expected use of these frequencies. Specifically, satellite providers and earth station operators, which rely on the C-Band for certain satellite-based communications, would need to make fairly significant changes to their operations, including investments in new satellites and earth station technologies, in order to free substantial bandwidth for flexible use services. There may also be issues regarding interference, requiring accommodation in the band plan. Existing users presumably know how to best address interference problems as they will act to maximize the value of the band.

Third, and importantly, information on the value of repurposing is *incomplete* in the game-theoretic sense: although it is assumed to be clear to everyone that some repurposing is socially

delay would reduce value by between 7% and 11%. The economic value of spectrum is only a fraction of its total social value. For example, every \$1 billion in delay costs would create total social costs of \$10 billion to \$20 billion. Consequently, any of the other proposals, which could easily be expected to add years of delay relative to the Market-Based Approach, would significantly decrease the value of repurposing any C-Band frequencies.” (Footnotes omitted).

²⁰ See, e.g., T.R. Beard, G.S. Ford and M. Stern, *Skin in the Game: Interference, Sunk Investment, and the Repurposing of Radio Spectrum*, PHOENIX CENTER POLICY BULLETIN No. 40 (March 2017) (available at: <http://phoenix-center.org/PolicyBulletin/PCPB40Final.pdf>).

desirable, the extent and nature of the optimal level of repurposing depends on characteristics of the current use of the spectrum, including proprietary information regarding the incumbents' business. Thus, we assume that the incumbent user knows more about its operations than anyone else, and is best positioned to know how, and to what extent, spectrum could be freed up for alternative uses at minimal costs.²¹ As a corollary, we assume the regulator (FCC) knows this is the case, and both regulator and regulated share common priors over the parameter characterizing the "state of the market."

Given these assumptions, we ask: what is the socially best form of contract (i.e., regulatory policy) for the regulator to impose on the incumbent firm? Since the incumbent holder has useful, private information, and the regulator knows this, the optimal way to motivate the firm will generally seek to gain for society those benefits obtainable through proper use of this private information. But the incumbent, of course, can be expected to act in its own best interests, and those interests may be different from the regulatory authority.

The description above motivates us to model the spectrum reallocation regulation problem as one of *principal and agent*. The Commission, as principal, has the (legal) power to impose a contract (regulation) on the agent (the incumbent satellite providers). Further, we assume the principal can directly and perfectly observe the agent's actions, so no problem of moral hazard arises. Rather, the challenge stems from the socially-valuable private information of the incumbent.

A. A Principal-Agent Model

Formally, suppose there is a principal (the FCC) that licenses a block of spectrum to an agent firm (the incumbent, in this case the CBA). The firm has specialized knowledge about how to engage in privately costly, yet socially beneficial, innovations that will increase the value of the block of licensed spectrum. The amount of value added to the spectrum will depend on the amount of costly effort put forth by the agent firm, which we assume the Commission can directly observe, and a variety of technical factors that are not precisely known to the Commission, but are known to the agent firm given their specialized knowledge. As mentioned above, this specialized knowledge arises, *inter alia*, from proprietary information on incumbent operations, capabilities, and plans.

²¹ See, e.g., *C-Band NPRM*, *supra* n. 4 at ¶ 67 ("A secondary market approach might make spectrum available more quickly than other available mechanisms, such as an FCC auction, and thus could facilitate rapid deployment of next generation wireless broadband networks. In addition, such an approach could leverage the technical and operational knowledge of satellite space station operators while relying on market incentives to promote economic efficiency.")

Let e represent the variable effort of the agent undertaken to free up spectrum for valuable new uses and let θ represent the technical factors that will influence the return to this effort. The firm knows θ , while the principal only knows the probability distribution from which θ is drawn. All of this is common knowledge. Let $V(e, \theta)$ denote the value created for society given e and θ . We will conventionally assume that V is strictly increasing in both e and θ : in other words, if the incumbent takes greater effort (that is, frees up more spectrum), more value is created, while the effect of θ on V is an uninformative assumption. Further, we assume that V is strictly concave in e (diminishing returns to effort), and the marginal return to effort is increasing in e and θ (in other words, $\partial^2 V / \partial e \partial \theta > 0$). This latter condition reflects the fact that a dollar's more effort at repurposing creates more value when repurposing itself is more valuable.

We turn now to the basic principal-agent problem of regulating the repurposing of the spectrum. Since our message is relatively simple, a simplified presentation will do. Following Macho-Stadler and Pérez-Castrillo (1997), we restrict our analysis to linear contracts.²² In such a contract, the agent is “sold” a portion of the gains realized by the repurposing (via private auction), in exchange for a fixed payment. This abstraction roughly corresponds to several extant suggestions from interested parties regarding how the reallocation of the C-Band should be managed.²³

1. *The Agent's Problem*

Formally, the government principal can offer the agent firm a contract granting rights to any value added from their costly efforts in exchange for a price P . We consider prices that are a combination of a fixed fee (F) and a fixed fraction $0 \leq \delta < 1$ of the value added. Hence,

$$P = F + \delta V . \quad (1)$$

If we normalize for convenience the marginal cost of effort to one, then the agent's profit function under this form of contract will be:

$$\pi(e, \theta) = V(e, \theta) - e - P = (1 + \delta)V(e, \theta) - e - F . \quad (2)$$

The agent then chooses her effort e to maximize this profit:

²² I. Macho-Stadler and J.D. Pérez-Castrillo, *AN INTRODUCTION TO THE ECONOMICS OF INFORMATION* (1997) at Ch. 2.

²³ Comments of T-Mobile, *supra* n. 11.

$$\max_e \{(1 + \delta)V(e, \theta) - e - F\} \quad (3)$$

The first-order condition for this optimization problem implicitly defines the agent's optimal effort as a function of θ and δ :

$$\frac{\partial V}{\partial e}(e^*, \theta) = \frac{1}{1 - \delta} \geq 1 \quad (4)$$

Since $\partial V / \partial e$ is a decreasing function of effort (recall that V is concave in e) and an increasing function of θ , it immediately follows that the incumbent's optimal effort is a decreasing function of the principal's fractional cut (δ), and an increasing function of the private information technical factors θ :

$$\frac{\partial e^*}{\partial \delta} < 0 \quad \text{and} \quad \frac{\partial e^*}{\partial \theta} > 0$$

While the agent firm has precise knowledge of θ , we assume the government principal lacks precise information and merely knows its distribution. Again, at no loss to our purpose, we adopt the simplest assumption regarding this distribution: θ takes on a low value θ_L with probability α , or a higher value θ_H with probability $(1 - \alpha)$. It is socially desirable to have greater repurposing (i.e., greater investment e) when repurposing is more valuable in general, which corresponds to $\theta = \theta_H$.

2. The Government's Problem

Having established the optimal (privately profit-maximizing) reaction of the agent to a given contract (F, δ) , we can turn to analysis of the regulator's problem. Optimal behavior by the regulator is a matter of some debate: although it is sometimes assumed the regulator acts to maximize social welfare, the mandate of the FCC is complex and multi-faceted.²⁴ Alternately,

²⁴ See, e.g., L.J. Spiwak, *How the AWS Auction Provides a Teachable Moment on the Nature of Regulation*, BLOOMBERG BNA (April 28, 2015) (available at: <http://www.phoenix-center.org/BloombergBNADesignatedEntities28April2015.pdf>); T.R. Beard, G.S. Ford, Lawrence J. Spiwak, and Michael Stern, *Market Mechanisms and the Efficient Use and Management of Scarce Spectrum Resources*, PHOENIX CENTER POLICY PAPER NO. 46 (December 2013) (available at: <http://www.phoenix-center.org/pcpp/PCPP46Final.pdf>); G.S. Ford and L.J. Spiwak, *Equalizing Competition Among Competitors: A Review of the DOJ's Spectrum Screen Ex Parte Filing*, PHOENIX CENTER POLICY BULLETIN NO. 33 (May 2013) (available at: <http://www.phoenix-center.org/PolicyBulletin/PCPB33Final.pdf>); G.S. Ford, *The Economics of Bidder Exclusion Rules: A Response to Dr.*

(Footnote Continued....)

the extremely cynical view that the FCC merely tries to maximize its own budget seems too simple.²⁵ In the interest of realism (and the federal government's need for revenues and arguments about the U.S. Treasury's take from the repurposing), we adopt the view that both self-interest and social interest motivate the FCC in this matter. In particular, we imagine that the principal desires to maximize their price received (P) subject to the condition that the spectrum is repurposed which, by assumption, is socially desirable. Thus, the FCC wants to earn the greatest revenue for the repurposing that they can, subject to guaranteeing that such repurposing proceeds. As such, the principal will choose F and δ to maximize P subject to the agent's profit being non-negative for *both* potential levels of the technical factor:

$$\max_{F, \delta} \{F + \delta V(e^*, \theta)\} \text{ such that } \pi(e^*, \theta_L) \geq 0 \text{ and } \pi(e^*, \theta_H) \geq 0. \quad (5)$$

Since profit is increasing in θ , $\pi(e^*, \theta_H) > \pi(e^*, \theta_L)$, and the first constraint will bind while the second will be slack. Hence, we have that $\pi(e^*, \theta_L) = 0$ which implies $P = \pi(e^*, \theta_L) - e^*$. The maximization problem thus reduces to:

$$\max_{\delta} \{V(e^*, \theta_L) - e^*\} \quad (6)$$

The first-order condition is given by:

$$\frac{\partial V}{\partial e}(e^*, \theta_L) \frac{\partial e^*}{\partial \delta} - \frac{\partial e^*}{\partial \delta} = \left[\frac{\partial V}{\partial e}(e^*, \theta_L) - 1 \right] \frac{\partial e^*}{\partial \delta} = 0 \quad (7)$$

We previously showed that $\partial e^* / \partial \delta < 0$, so we are left with the condition:

$$\frac{\partial V}{\partial e}(e^*, \theta_L) - 1 = 0 \quad (8)$$

Applying the first-order condition from the agent's profit maximizing choice of effort implies:

Baker, PHOENIX CENTER POLICY PERSPECTIVE NO. 13-04 (July 18, 2013) (available at: <http://www.phoenix-center.org/perspectives/Perspective13-04Final.pdf>).

²⁵ W.A. Niskanen, *Nonmarket Decision Making: The Peculiar Economics of Bureaucracy*, 58 AMERICAN ECONOMIC REVIEW 293-305 (1968).

$$\frac{1}{1-\delta} - 1 = 0 \quad (9)$$

Thus, we conclude that the optimal contract for the government principal has a fractional cut of zero ($\delta^* = 0$). This will cause the agent firm to choose the profit maximizing level of effort without any marginal distortion, as must arise with a sharing rule. This generates the largest regulator profit and the socially optimal level of effort. The government principal then sets a fixed fee to extract the profit corresponding to that associated with the lower technical parameter, θ_L . In other words,

$$\delta^* = 0; \quad (10)$$

$$F^* = V(e^*, \theta_L) - e^*. \quad (11)$$

This result may first seem surprising, but it is actually just basic economic theory, akin to the preference of lump-sum over marginal taxes. If the assumptions of the model are accepted, then the qualitative nature of the conclusion naturally follows. To briefly restate: (1) the repurposing should occur, regardless of the precise private information possessed by the agent; (2) the agent has valuable private information which, if utilized, will increase the revenues received by the regulator; (3) the agent's costly private efforts towards affecting repurposing are increasing in her share of value created, and in the profitability of repurposing; and (4) the optimal contract involves "selling" the gains from repurposing to the incumbent, thus assuring the most efficient level and type of repurposing, in exchange for a fixed payment (likely in the form of a regulatory payment), which assures incumbent participation when spectrum reallocation is relatively less productive.²⁶ We stress, however, that the fixed payment has no effect on economic welfare as long as the private sale occurs; that is, the payment is a transfer.

In practical terms, this analysis suggests, at least in a qualitative sense, that the incumbent should be allowed to sell as much spectrum as it selects and retain the proceeds in exchange for a fixed payment, if any, to the regulator-principal. By "fixed payment" we mean that the payment does not depend on auction proceeds or on the costs incurred by the incumbent to repurpose the frequencies. If the principal insists on taking a share of the proceeds, then the principal reduces its potential earnings because in that case the incumbent's marginal decision is distorted and, thus, its efforts to repurpose spectrum inefficiently low. That is, taking a share of proceeds is akin to levying an excise tax on the repurposing, thereby reducing the quantity of spectrum repurposed; a fixed payment does not affect the marginal decision.

²⁶ Testimony of P. Pitsch, *supra* n. 8.

IV. A Public Auction

The analysis above demonstrates that the optimal contract between the regulator (as principal) and the incumbent (as agent) involves a fixed payment from the latter to the former, rather than a proceeds-sharing rule. However, some observers have proposed mechanisms that omit any use of a private transaction in favor of a public auction.²⁷ Although the details of such proposals vary significantly, the basic outline of most such policies envision the regulator taking some portion of the C-Band spectrum from the incumbent(s) and then selling it in the usual way. Compensation, if any, for the incumbent users could be obtained through a sharing of proceeds with them, as the Commission has done in prior repurposings including the voluntary Broadcast Incentive Auction.²⁸

If one accepts the basic assumptions of our analysis, however, it is apparent that such proposals suffer from the basic incentive problem our recommendations mitigate. The incumbents are *uniquely* situated to make appropriate efforts to free up spectrum for alternative uses in the best way, and at the lowest costs, since the incumbents internalize the benefits and costs of the repurposing. The only way a regulator could duplicate this would be to get the incumbents to reveal this information. Whenever any disclosure by the incumbent affects their proceeds, however, we have precisely the same problem as arises with a positive share in the contract—too little spectrum is repurposed.

If the regulator proceeds with an auction on its own, without recourse to the private information held by the current user, then the government is, at best, in the position of an incumbent who does not know θ , incurs the costs e (arguably, with little incentive to minimize it), and retains all (or most) of the value arising in the auction. However, inspection of Equation (5) shows the constraint under which the regulator is assumed to operate: the regulator maximizes its proceeds *subject to the socially optimal outcome*. It is certainly true that the regulator can enrich itself beyond what our optimal contract allows, but such enrichment is feasible only when society is harmed. The regulator cannot obtain more revenue than in the optimal contract subject to social welfare being highest in each state of the world. Equations (10) and (11) give this solution.

²⁷ *Se. g., supra* nn. 11 & 12.

²⁸ *C-Band NPRM, supra* n. 4 at ¶ 103 (“Incentive auctions are a voluntary, market-based means of repurposing spectrum by encouraging licensees to compete to voluntarily relinquish spectrum usage rights in exchange for a share of the proceeds from an auction of new licenses to use the repurposed spectrum.”); New America Comments, *supra* n. 13 at p. 10 (“[T]he most straightforward option consistent with the Commission’s statutory authority is a traditional forward auction that consolidates FSS incumbents into the upper portion of the band and requires that auction winners reimburse incumbents for any eligible and reasonable costs.”).

Practically, recourse to such a public auction option is difficult for several reasons, as the long schedules for repurposing-by-auction demonstrates. First, what spectrum would the regulator seize, and how would it identify those portions that should be sold? Because the spectrum is being used now, disruption is inevitable. The regulator could commit to making the incumbent users whole, but unless the “right” spectrum is repurposed (the amount, specific frequencies, and the band plan), there is no reason to expect these costs would be minimal or that the regulator has the information to make efficient decisions. Absent detailed operational experience and proper incentives, it will be difficult for the government to make the “right” spectrum choices, especially when the parties to the proceeding have made materially different proposals.²⁹ Second, what measures, including compensation for incurred costs, are required to satisfy the incumbent(s) in the band? Third, regulatory history suggests that aligning the incentives of the regulated firms to compliance is highly desirable and the failure to do so often leads to poor outcomes. Fourth, if one accepts that any public auction will be cumbersome compared to a private sale, then the delay in achieving repurposing implies lost social benefits of indeterminate size (though estimated to be in the billions of dollars).

V. Conclusion

Few opportunities exist for the repurposing of large swaths of mid-band spectrum needed to provide advanced mobile wireless services. Incumbent users of the C-Band have proposed to conduct a private auction for portions of its 500 MHz of mid-band spectrum. Wireless carriers are hopeful, but there remain questions about whether a public auction is the preferred approach to repurposing the band. In this BULLETIN, we address this question in using principal-agent theory, where the C-Band incumbents, operating through a consortium, serve as an agent of the federal government (the principal).

We conclude that the Commission should allow the incumbent users of the band to auction the amount of spectrum the incumbents’ select. The incumbents’ financial reward is not an unjust enrichment, but efficient compensation for the information advantage and own-costs of repurposing. We show that—for many reasons—a public auction is a less desirable approach including the inevitable delays (costing potentially billions of dollars) and the special-interest lagniappe accompanying this alternative. While the government may increase its revenue through a public auction, it does so only at the cost of an outsized reduction in total economic welfare.

²⁹ T-Mobile Comments, *supra* n. 11 at pp. 5-6 (“The first phase of the T-Mobile market plan would be a forward auction for licenses for all 500 megahertz of spectrum in each geographic area. *** The second phase of the T-Mobile plan would permit the satellite consortium to sell the entire 500 megahertz of spectrum in each area at the price established in the initial phase for that area.”)

As for revenues for the U.S. Treasury from the private transaction, if any, we also show that the federal government's attempt to share in the proceeds of such a transaction should take the form of a fixed payment rather than a share of sale proceeds. That is, the government's cut should not depend on auction proceeds or on the costs incurred by the incumbents to repurpose the frequencies. By insisting on sharing sale proceeds, the principal (the Commission in this case) reduces its potential earnings by distorting the incumbent users' marginal decision, making the quantity of repurposed spectrum inefficiently low.

Satisfying the ever-increasing demand for mobile wireless services will require innovation, but not solely by private parties. The government also must innovate. Chairman Ajit Pai once said, and disapprovingly so, that "it's sometimes hard for government to be on the side of innovation."³⁰ Privatizing a spectrum auction is an innovation—a new, efficient, and faster way to repurpose spectrum. It seems reasonable that when repurposing spectrum, the Commission should embrace the most efficient methods. The Commission now faces an opportunity to encourage an innovative approach to spectrum allocation and assignment; perhaps it should embrace it.

Finally, our use of the C-Band as a case study does not restrict our analysis to the C-Band. If the CBA implements a private sale to repurpose large blocks of mid-band spectrum, then the Commission may use other incumbents as agents to efficiently repurpose spectrum. Just as spectrum auctions were an important innovation in U.S. spectrum policy, conducting auctions or other similar transactions through private agents may be a sensible next step in the efficient allocation and assignment of spectrum rights.

³⁰ Remarks of FCC Chairman Ajit Pai at The Resurgent Conference in Austin, TX (August 3, 2018) (available at: <https://docs.fcc.gov/public/attachments/DOC-353259A1.pdf>).



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July 17, 2019
Vol. 14, No. 17

A Free Market Approach Should Be Used to Reallocate C-Band Spectrum

by

Randolph J. May and Gregory J. Vogt *

I. Introduction and Summary

There is widespread agreement within the Trump Administration, Congress, and the Federal Communications Commission (FCC) regarding the importance to the United States of maintaining its leadership in next-generation wireless communications. This agreement specifically includes the importance of the U.S. maintaining leadership, as the FCC put it in its July 2018 *C-Band NPRM*, of "fifth-generation (5G) wireless, Internet of Things (IoT), and other advanced spectrum-based services."¹ And there is a consensus, that having already made significant strides under the leadership of FCC Chairman Ajit Pai and his colleagues in allocating low- and high-band spectrum, further efforts are necessary to allocate additional mid-band spectrum for 5G use.

That's why the FCC's proceeding examining the 3.7 - 4.2 GHz spectrum band, commonly referred to the C-Band, is, rightly, of such intense interest. The FCC has sought public comment, among other procedural options, on the use of some form of innovative market-based mechanism, employing voluntary, secondary market negotiated transactions, as a means of clearing some or all of the 3.7 - 4.2 GHz band for terrestrial mobile broadband use. The purpose of this *Perspectives* is to support the adoption of some form of free market-oriented approach that allows incumbent Fixed Satellite Service (FSS) operators to clear part or all of the C-Band

spectrum using negotiated secondary market transactions that would, in effect, result in the flexible use of the spectrum by terrestrial mobile service providers in exchange for compensation.²

Most importantly, we believe that, at the end of the day, the trade-offs involved in such a free market-oriented approach will enhance overall consumer welfare and reduce overall societal costs by maximizing the efficient use of this valuable mid-band spectrum. It most likely will put the spectrum to use more speedily than could be accomplished by employment of traditional spectrum allocation approaches. We recognize such a market-based approach involves various non-trivial issues that must be addressed before the Commission reaches final determinations. But by maximizing overall consumer welfare and reducing overall societal costs, it comports with the public interest. Consistent with compliance with applicable legal requirements, from a policy perspective, this should be the Commission's objective.³

The FCC's market-based procedural option was crafted from comments in the record. The C-Band Alliance (CBA or Alliance) eventually championed a market-based option. CBA is made up of the four largest FSS licensees that operate approximately 90 percent of the authorized satellites in the C-Band. The CBA proposes to conduct some form of private auction transaction, subject to Commission oversight, that, in exchange for compensation by new mobile licensees, would relocate existing FSS users to only a portion of the existing 500 MHz band. Filters to existing earth stations would be provided to reduce interference potential.

There is no question that adding more mid-band spectrum to existing allocations, such as has already been accomplished in the 3.5 and 2.5 GHz bands, is critical to achieving U.S. leadership in 5G. The economic benefits to U.S. consumers are enormous. CBA estimates that, under its proposal, spectrum could be moved to terrestrial 5G use in 18 to 36 months, faster than by an incentive auction conducted by the FCC. The Analysis Group estimated that 400 MHz of mid-band spectrum 5G could spur \$274 billion in GDP growth, adding 1.3 million new jobs.⁴ The Brattle Group has estimated that for every year of delay in reallocating a portion of the C-Band could create total social costs of \$10 to \$20 billion per year.⁵ And NERA estimates that rapidly reallocating C-Band spectrum to 5G could add approximately \$540 billion of annual tax revenues.⁶

As stated above, we acknowledge there are a number of important issues that must be resolved, such as the amount of spectrum in the C-Band to be reallocated, the legal basis for the market-based approach, and whether a portion of the sale proceeds should be contributed to the federal government. Nevertheless, a market-based approach entails important public policy benefits, including substantial consumer welfare gains from earlier rather than later deployment of next-generation 5G services. The innovative nature of the free market approach is particularly justified in the C-Band given that each of the current FSS licensees is legally entitled to use the full 500 MHz of spectrum. Absent incentives for the incumbent operators to reach a voluntary agreement, the likelihood of "holdouts" is significantly increased. And earth station owners rely on C-Band transmissions to provide video and other services to their subscribers, and those services contribute billions of dollars to the U.S. economy. Booming demand for mobile broadband use clearly justifies actions that promote the most efficient use of spectrum, while adopting reasonable measures necessary to fairly accommodate legitimate affected interests.

The Commission has long looked to various types of voluntary secondary market transactions as a means of accomplishing more efficient use of the spectrum without the need for any heavy Commission involvement in the market process.⁷ To assure that the various interests affected are treated in a manner that, ultimately, comports with the public interest, in this instance, there is no doubt that meaningful Commission oversight of the process will be required. Nevertheless, if the process is successful, it may provide a model – even if not an exact one – for carrying out similar market-based transactions in other bands that lead to similar public interest benefits in maximizing efficient use of the spectrum resource.

II. The Market-Based Approach to Reallocating C-Band Spectrum

C-Band spectrum currently is allocated to FSS on a co-primary basis with fixed service. The rules provide that licenses in the C-Band are non-exclusive and entitle the licensee to operate throughout the 500 MHz band.⁸ Four FSS licensees, Intelsat, SES, Telesat, and Eutelsat, operate approximately 90 percent of the authorized satellites in the band and serve nearly 120 million American households that receive programming content over the C-Band.⁹ The 3.7 - 4.2 MHz band is reserved for downlink transmissions paired with 5.9 - 6.4 GHz uplink portion, collectively referred to as the C-Band. Only spectrum from the downlink portion of the C-Band would be reallocated.

The *C-Band NPRM*¹⁰ proposes as one option a market-based approach to clear some or all of the 500 MHz that comprises the 3.7 - 4.2 MHz C-Band and make the cleared spectrum available for flexible mobile use, including 5G. Existing FSS operators would use secondary market transactions to repurpose the spectrum in exchange for compensation. The FCC's proposal would rely on a Transition Facilitator, a private cooperative entity created by FSS operators "to coordinate negotiations, clearing, and repacking the band."¹¹ The Transition Facilitator would deal with what is known as the "holdout problem," i.e., satellite operators unwilling voluntarily to relinquish spectrum. FSS operators would be required to notify incumbent earth station operators who receive signals in the C-Band to take steps to change their earth station facilities to reduce potential interference from new mobile licensees in the band. FCC Commissioner Michael O'Rielly frequently has advocated for a market-based approach for the C-Band precisely because of the benefit of quicker reallocation of the spectrum.¹²

The C-Band Alliance, formed by the four major FSS licensees, has urged the FCC to adopt the market-based approach in reallocating a portion the band.¹³ The CBA proposes clearing 200 MHz of the C-Band, including a 20 MHz guard band, by repacking existing users to a smaller portion of the C-Band and making it available for terrestrial mobile use, including 5G services. It proposes to utilize a transition facilitator to effectuate the transition. Alliance members would launch eight new satellites to ensure that the same FSS capacity was available both before and after the repacking. At the same time, the CBA committed to protect earth station operators in their receipt of primarily video service transmission in the band.

The CBA would use secondary market transactions by establishing some form of private auction procedures conducted by the CBA and overseen by the FCC. Once the private auction is complete, winning mobile users would file FCC license applications. The mobile licenses would

include conditions agreed upon by the mobile operators as the winning bidders. Compensation distributed to CBA members would cover repacking costs and ensure uninterrupted service.

Since filing its original proposal, CBA has provided a number of additional details concerning its proposal.¹⁴ As contemplated by the *C-Band NPRM*, a final order in the docket would establish the rules of the road to govern such a market-based approach.

III. Speedier Reallocation of C-Band Spectrum Produces Significant Consumer Benefits

There is little question that a delay in reallocating a portion of the C-Band will risk incurrence of societal costs because the record consensus appears to conclude that the current band licensing structure is not the highest and best use for the C-Band. Therefore, the spectrum repurposing goal for the C-Band is consistent with the FCC's long-held policy to allow spectrum to be put to its highest and best use.

First and foremost, additional mid-band spectrum is required in order to permit U.S.-based 5G providers to ensure the United States maintains a leading role in the development of 5G.¹⁵ A number of econometric studies have demonstrated the huge enhanced consumer welfare value associated with wireless services like 5G. For example, in February 2019 the Analysis Group estimated that 400 MHz of mid-band spectrum 5G could spur \$274 billion in GDP growth, adding 1.3 million new jobs.¹⁶

U.S. leadership in 5G will produce enormous benefits not only to the world economy, but more specifically to U.S. companies and consumers. Some have argued that U.S. leadership in 4G drove a \$100 billion increase to the U.S. economy.¹⁷ A major economic spur similarly is expected in the 5G arena as well.

More specifically, with respect to the C-Band, the Brattle Group estimated that for every year of delay in reallocating a portion of the band, the value of the spectrum subject to the delay decreases from 7 to 11 percent per year. This decrease in value for every year of delay in reallocating spectrum would impose total social costs of \$10 to \$20 billion.¹⁸ In addition, NERA estimates that rapidly reallocating C-Band spectrum to 5G could add approximately \$540 billion of annual tax revenues.¹⁹

The major alternative procedural proposal to reallocate spectrum in the C-Band is an FCC-run incentive auction, such as the one repurposing over-the-air television broadcasting spectrum to flexible mobile use. That auction is taking over six years to complete from the time the FCC decision²⁰ establishing the auction was released to the date the entire transition process is expected to take place.²¹ This is some three years longer than the suggested timetable for the free market approach. Of course, because the TV incentive auction was the first, another incentive auction might not take quite as long to formulate and complete because some of the initial issues have already been addressed and tested.

But a C-Band auction would be complicated because, among other things, transponder capacity and signal strengths are not consistent within the same band, legal issues regarding compensation to existing users and government proceeds would continue, and the difficulty of dealing with

holdouts would persist. And replacing lost capacity will require new satellite launches, which can be more complicated and time-consuming than changing out tower-based transmitters. The anticipated three additional years to complete a government-run auction means a significant delay in the 5G deployment race, one that will entail significant societal costs as indicated previously. On July 7, Chairman Pai indicated that FCC staff believe that an incentive auction in the 2.5 GHz band would have added several years to the process.²²

While we understand that the projections regarding completion of the repurposing are necessarily estimates – and we don't purport to vouch for their precision – we do think it is likely that a process employing market-based voluntary exchange along the lines proposed by CBA can be completed more quickly than can the Commission's traditional auction process. And although economic estimates of future value are reasonably debatable, the general thrust of the economic benefits realized by early reallocation of C-Band spectrum for 5G service cannot be seriously challenged.

IV. Private Market-Based Transactions Can Be Expected to Achieve Maximum Value for both Current and New Licensees

The traditional methodology for reallocating spectrum – identify a spectrum band, evaluate existing uses, conduct a rulemaking to reallocate spectrum, conduct an auction, and then manage the transition to new uses – takes a lot of time. Historically, the government has been agonizingly slow assigning spectrum to a licensee or other authorized user, taking an average of roughly 13 years from identification to reassignment. A July 2015 study commissioned by CTIA demonstrates this stark fact.²³ Even scheduling an FCC-run auction has been slow for other spectrum, with the 3.5 GHz auction to be held at some unspecified time in 2020. It is just a fact that government-run processes historically are considerably drawn out, which is a downside to an FCC incentive auction procedure.

When they are permitted, voluntary, private market-based transactions achieve the highest and best use for spectrum, as opposed to government fiat. Private transactions can reduce overall costs, particularly regulatory and litigation costs, and they can achieve results more swiftly than government decisionmaking. Prompt preservation of existing C-Band content delivery licensees and customers in a smaller amount of existing spectrum, while adding significant new mid-band spectrum for 5G use, is a win-win situation, the value of which is hard to underestimate.

The time estimated by CBA to reallocate spectrum from the Commission's final decision to issuance of new user licenses is lowered to 18 to 36 months. This relatively efficient time-to-market is important with regard to the race for world leadership in 5G. This is all the more so for the coveted C-Band spectrum, which, due to its propagation characteristics, is needed for wide 5G deployment, at least in initial stages. The C-Band is also adjacent to other 5G bands that have already been allocated, such as the Citizens Band Radio Service band at 3.5 GHz and the 2.5 GHz band. And it is consistent with international allocations for 5G use.

The traditional spectrum reallocation methodology becomes even more complicated in the C-Band given its unique licensing scheme where each FSS licensee has the right to transmit over the entire 500 MHz band for the duration of their license terms. Compounding this problem are

the thousands of receive-only earth stations (the exact number is not known) owned by independent entities that rely on such transmissions for the delivery of their primarily video and audio content that must be accommodated in the repacking process in the C-Band. All of these operating entities have legal rights to the use of the spectrum, and the government would face serious legal challenges to modify those rights on an involuntary basis. While the FCC can take steps to modify licensee rights, compliance with the statutory method for such modifications is often a lengthy process, and, upon completion, there may be court appeals.

Even setting aside such legal rights, the business expectations of the operating entities should not be lightly compromised in the process of changing spectrum usage. Because the operating entities will continue to use a portion of the C-Band, interference concerns must be carefully addressed to ensure continued operations on the repacked portion of the band. The FCC, of course, recognizes the importance of such business expectations and is careful to protect incumbent users when transitioning to new licensing schemes.

Given these difficulties, a market-based proposal along the lines of the CBA proposal, which incorporates voluntary exchange and compensation in a market context, should go a long way towards eliminating potential legal challenges, as well as eliminating additional detailed time-consuming processes at the Commission that otherwise would be required in managing the transition to terrestrial mobile use. As long as the private auction and repacking procedures are reasonably transparent and fair to all existing and potential new licensees, with an appropriate degree of Commission oversight, achieving prompt reallocation and repacking is likely to produce overall consumer welfare benefits and reduced costs consistent with the public interest.

V. Conclusion

We are encouraged that FCC Chairman Ajit Pai has announced publicly that he expects to ask the Commission to vote on a final C-Band rulemaking order in the fall of 2019. Time is of the essence if the United States wishes to maintain its wireless leadership as the world transitions to 5G. Locating and reallocating low-, mid-, and high-band spectrum is a critical step to maintain that leadership. In sum, in light of the trade-offs and complexities involved, from a public policy perspective, a market-based proposal along the lines of the CBA proposal, relying substantially on a process of secondary market voluntary exchange, is attractive because of the likely overall increase in consumer welfare benefits.

* Randolph J. May is President and Gregory J. Vogt is a Visiting Fellow of the Free State Foundation, an independent, nonpartisan free market-oriented think tank located in Rockville, Maryland.

Further Reading

Gregory J. Vogt, ["Getting to 'Yes' on Allocating Mid-band Spectrum,"](#) *Perspectives from FSF Scholars*, Vol. 14, No. 13 (May 15, 2019).

Gregory J. Vogt, ["The Race for Global 5G Leadership: Where Are We Now?"](#) *Perspectives from FSF Scholars*, Vol. 14, No. 7 (March 5, 2019).

Gregory J. Vogt, “[STREAMLINE 5G Processes to Match the Speed of Business](#),” *FSF Blog*, (July 9, 2018).

Gregory J. Vogt, “[RAY BAUM Would be Proud](#),” *FSF Blog* (March 23, 2018).

Gregory J. Vogt, “[Now Is the Time for MOBILE NOW](#),” *Perspectives from FSF Scholars*, Vol. 12, No. 15 (April 28, 2017).

Randolph J. May & Gregory J. Vogt, “[Focusing on Communications Infrastructure Development: Completing the Incomplete Obama Administration Spectrum Report Card](#),” *Perspectives from FSF Scholars*, Vol. 11, No. 44 (December 13, 2016).

¹ *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order & Notice of Proposed Rulemaking, GN Docket No. 18-122, FCC 18-91, 2 (rel. Jul. 13, 2018) (*C-Band NPRM*).

² We may well address other issues, of course, in future papers.

³ We note that the CBA has said that it will make a significant voluntary contribution to the Treasury if the FCC approves its auction proposal. As taxpayers, we surely might welcome such a contribution. But our support for a market-based approach along the lines of the CBA proposal is based on an assessment of the overall consumer welfare gains and reduction in societal costs relating to the proposal, not on representations regarding a contribution to the Treasury.

⁴ See David W. Sosa & Greg Rafert, Analysis Group, *The Economic Impacts of Reallocating Mid-Band Spectrum to 5G in the United States* 1, 4-5 (Feb. 2019), <https://api.ctia.org/wp-content/uploads/2019/02/The-Economic-Impacts-of-Reallocating-Mid-Band-Spectrum-to-5G-1.pdf> (Analysis Group White Paper).

⁵ Joint Comments of Intel Corporation, Intelsat, License, LLC, & SES Americom, Inc., Appendix A, C. Bazelon, The Brattle Group, Maximizing the Value of the C-Band, GN Docket No. 18-122, 27 & note 72 (Oct. 29, 2018) (Brattle Group White Paper).

⁶ Reply Comments of The C-Band Alliance, GN Docket No. 18-122, Reply Declaration of Jeffrey A. Eisenach, NERA Economic Consulting, ¶ 30 (Dec. 7, 2018) (NERA White Paper).

⁷ See, e.g., *Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, Report and Order and Order of Proposed Modification, 27 FCC Rcd 16102, ¶¶ 244-53 (2012) (AWS-4). The FCC more recently sought comment on whether its secondary market transaction rules needed updating to promote reader availability of more spectrum. *Partitioning, Disaggregation, and Leasing Spectrum*, Notice of Proposed Rulemaking, WT Docket No. 19-38, FCC 19-22 (rel. Mar. 15, 2019).

⁸ There are a relatively small and declining number of fixed service licensees in the C-Band, which do not present the same challenges as allowing terrestrial mobile use adjacent to satellite downlink transmissions.

⁹ Comments of the C-Band Alliance, GN Docket No. 18-122, 2 (dated Jul. 3, 2019).

¹⁰ *C-Band NPRM*.

¹¹ *Id.*, ¶ 70.

¹² See, e.g., *C-Band NPRM*, Statement of Commissioner Michael O’Rielly.

¹³ Comments of the C-Band Alliance, GN Docket No. 18-122 (dated Oct. 29, 2018).

¹⁴ See, e.g., Letter from Jennifer D. Hindin, Counsel for C-Band Alliance, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (Mar. 4, 2019) (technical statement on protection of earth stations); Letter from Jennifer D. Hindin, Counsel, C-Band Alliance, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (dated Apr. 9, 2019) (transition implementation process); Letter from Bill Tolpegin, CEO, C-Band Alliance, to Marlene H. Dortch, Secretary, FCC, Docket No. 18-122 (dated Jun. 12, 2019) (private auction design).

¹⁵ D. Absecassis, C. Nickerson, J. Stewart, Analysys Mason, *Global Race to 5G – Spectrum and Infrastructure Plans and Priorities* (Apr. 2018), available at <https://www.ctia.org/news/global-race-to-5g-spectrum-and-infrastructure-plans-and-priorities>.

¹⁶ See Analysis Group White Paper, at 1, 4-5.

¹⁷ M. Baker, The Wireless Race the United States Must Win, Morning Consult (Apr. 17, 2018), available at <https://morningconsult.com/opinions/the-wireless-race-the-united-states-must-win/>.

¹⁸ Brattle Group White Paper, at 27 & note 72.

¹⁹ NERA White Paper, ¶ 30.

²⁰ *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report & Order, Docket No. 12-268, 29 FCC Rcd. 6567 (2014).

²¹ Public Notice, Incentive Auction Closing and Channel Reassignment, 32 FCC Rcd. 2786 (2017) (July 2020 is the expected completion timeframe for the final phase of repacking).

²² Chairman Ajit Pai, Press Conference (Jul. 10, 2019), available at <https://www.fcc.gov/news-events/events/2019/07/july-2019-open-commission-meeting>.

²³ T. Sawanobori, R. Roche, CTIA, From Proposal to Deployment: The History of Spectrum Allocation Timelines (Mar. 2015), available at <https://ecfsapi.fcc.gov/file/60001121340.pdf>.

How Government Can Get Brave About Spectrum

Ignore the groups that gripe about a taxpayer rip-off. The public benefits when airwaves trade freely.



By Holman W. Jenkins, Jr.
June 14, 2019 6:41 p.m. ET

Decades ago the U.S. government doled out free rights to the “public” airwaves to various broadcasters and other businesses. Since then, investors have paid billions for these embedded rights when buying companies that originally acquired their licenses at no cost. Hence the snarl we see now in trying to reallocate these valuable rights to more-worthwhile uses.

The current license holders have no incentive to vacate the airwaves unless paid to do so. But then various mau-mau groups intervene and argue that the taxpayer should get the money instead, even if this effectively means the reallocation won’t take place.

Because the scrum becomes a political powerplay, other groups that have no claim to the spectrum threaten to gum up the political works unless they get paid too. Yuck.



PHOTO: ISTOCK/GETTY IMAGES

This template was enacted several years ago, you may remember, in a partly successful auction of spectrum used by local TV broadcasters. Now the template is being re-enacted in the case of “C-band” operators, satellite companies that distribute large batches of video privately for cable and broadcast networks.

These companies, such as Intelsat and its competitors SES, Eutelsat and Telesat, acknowledge they are making inefficient use of a resource. By launching new satellites, they could shrink their footprint, thereby freeing up spectrum especially well-suited for 5G mobile broadband. Remember, though, their shareholders spent billions to control these spectrum rights. Their CEOs would be failing in a fiduciary duty if they gave them up without market compensation.

But now “public interest” groups like Citizens Against Government Waste and the Taxpayers Protection Alliance naturally have inserted themselves, shrieking about a taxpayer rip-off. Small satellite companies that never used the relevant spectrum want to be compensated for what they claim is their right to use it. TV stations led by Trinity Broadcasting want to be paid above and beyond any cost or inconvenience they may incur from the reallocation because, well, they like money.

So we come to a question of the public interest. Should the Federal Communications Commission, which is considering the matter, acquiesce in the satellite industry's proposal to auction off some of its rights to the highest bidder?

Hell, yes. Here's what we learned from the TV auction: The government should always be gratefully receptive whenever a license holder wants to sell its rights. The mere fact of the FCC being open to such reallocations would lead to a downward repricing of all spectrum. Washington should not be in the business of creating artificial scarcity and inflating the value of a useful asset.

To this end, it was the opposite of sad that TV stations were disappointed in the proceeds from 2016's "incentive" auction. Partly this was because other spectrum came to the market during the laboriously drawn-out negotiations. Partly it was because an unexpected Wi-Fi boom relieved the strain on wireless carriers.

Hooray. The sums the U.S. Treasury and private parties forgo from not being able to extract an inflated price is dwarfed by the benefits to the public of a more efficient spectrum market. These benefits include the creation of new industries and new wealth seeded by faster, cheaper broadband.

This week the C-Band Alliance (as the satellite operators call their ad hoc group) submitted an auction proposal. They would vacate more than a third of their spectrum while compensating their TV clients for any adjustment costs. The FCC should grab the proposal with both hands, expeditiously implement any necessary changes, and then shout from the rooftops that the same eager, friendly treatment will be accorded to any other existing licensee who wishes to sell part or all of his current allocation. Not least among them: the U.S. military and other federal agencies, which surely could make more efficient use of their airwave holdings if given a financial incentive to do so.

Filial piety at this point requires invoking the name of the late Nobel Prize-winning economist Ronald Coase. He not only brilliantly described the general benefits of negotiated exchanges to untangle messes of every kind, he also wrote a famous 1959

paper criticizing the government's then-practice of allocating spectrum rights by administrative fiat.

There would certainly be unhappiness among current spectrum owners, including the big wireless companies such as Verizon and AT&T as well as speculators like Dish Network's Charlie Ergen, who has been squirreling away large amounts of unused spectrum. Opening the door to efficient reallocations would likely cause the value of their holdings to plummet.

Then again, that's likely to happen anyway as new spectrum-sharing technologies increasingly make the airwaves seem less scarce than once thought. The benefits to the public will be huge.

Mid Band Spectrum Is the Next Critical Piece to Timely 5G Deployment

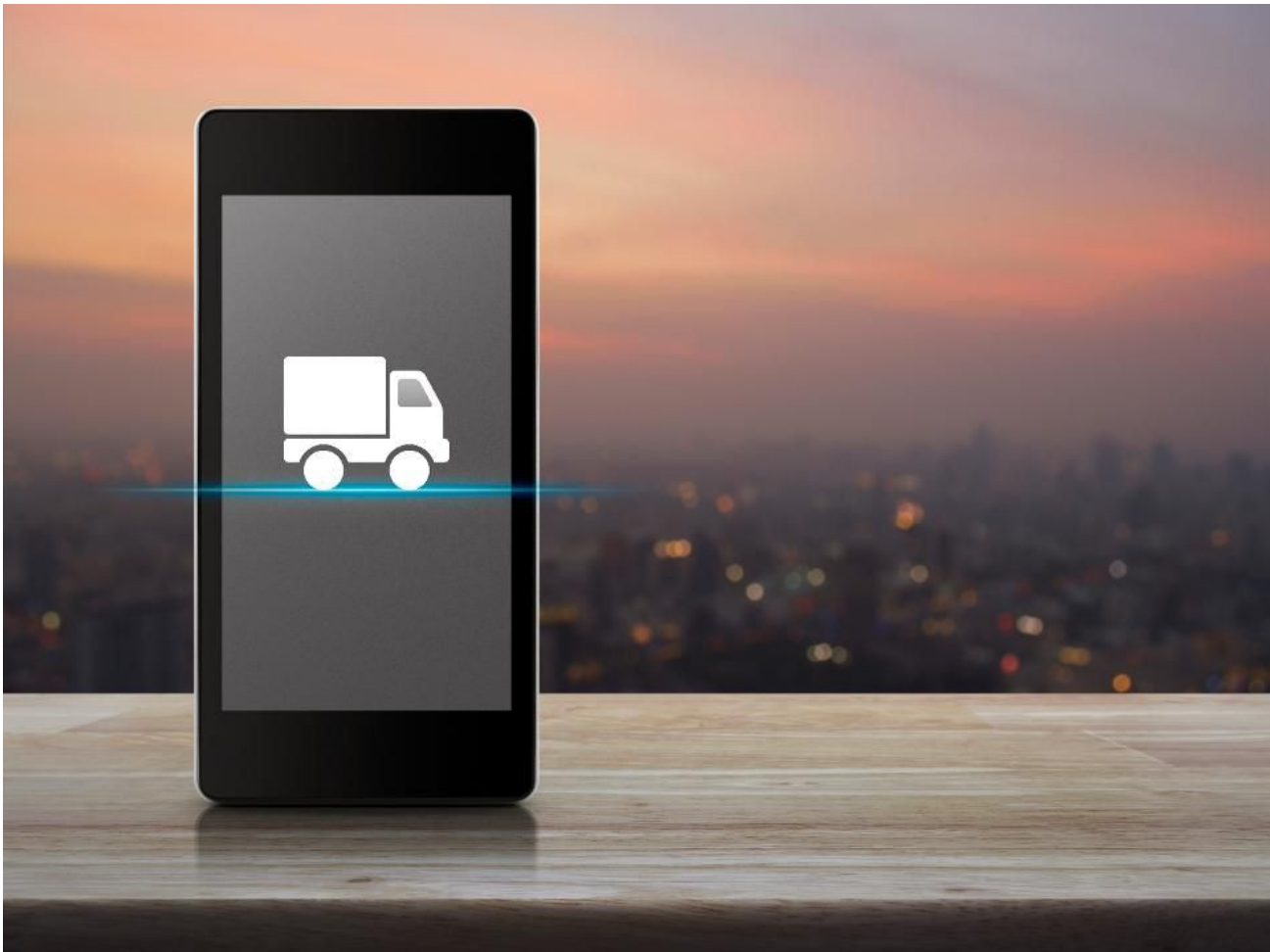


Roslyn Layton Contributor

[Enterprise & Cloud](#)

Evidence-based tech policy

For the past two years the Federal Communications Commission (FCC) has [worked double time](#) on policy helping mobile operators [close the gap with China](#) on 5G, and while it should be applauded for its efforts, important work remains. The prior FCC focused on inventing new things to regulate, like the [Internet](#), [set-top boxes](#), [online privacy](#) (after it unilaterally removed the Federal Trade Commission's privacy protections from consumers), and [state level broadband choices](#); the priority of the current FCC Chairman Pai is to maximize the availability of next generation broadband to all Americans. The FCC has promoted a [5G Fast Plan](#) – a three part strategy to bring more spectrum to market, update infrastructure policy to increase private investment, and [modernize outdated regulations](#) which inhibit Americans from accessing broadband.



GETTY

The FCC has moved to make both high and low band spectrum available. Now the focus is on mid-band frequencies, the so-called Goldilocks band for its ideal mix of technical properties. The FCC [proposes](#) to expand the flexible use of the 3.7 GHz to 4.2 GHz frequencies, part of a robust, diversified spectrum strategy to maximize the availability of high, mid, low, and unlicensed spectrum.

Technological innovation has enabled frequencies earlier used for television to be repurposed for mobile video and other services increasingly demanded by consumers; the challenge now is for regulators to keep up with spectrum management.

Under normal circumstances, getting spectrum into commercial use can take a decade or more. Fortunately, a group of incumbent users made up of satellite companies, the C-Band Alliance (CBA), [offers](#) to expedite the entire process in 18-36 months, speeding the rollout of 5G while protecting other license holders in the band. While the institutional design of the FCC can overcomplicate spectrum

allocation and attract rent-seeking parties, secondary markets can solve the problem.

The Virtues of Secondary Markets

Spectrum transactions are a market success story. Secondary markets, the reallocation of spectrum rights, allows spectrum to flow away from inefficient uses to more highly valued ones. This has made possible the explosive growth of mobile broadband, creating enormous benefits for consumers, innovators, the economy, and jobs. Secondary markets have proved important tool to reduce minimize interference, as actors invest in the tools and information to make more efficient trades. In this proceeding, the CBA, in exchange for selling their rights to willing buyers (notably mobile carriers offering 5G), proposes to cover the upgrade costs (launch of additional satellites, repointing of antennas and the use of hardware filters) and compensate other users for their hassle.

Some counter that the CBA companies should not be able to participate in these markets given that they never purchased the spectrum in the first place, but the CBA companies have honored the government's contract and obeyed the public interest obligations. If a new standard now applies, it must be imposed on the many other spectrum holders which also got their spectrum "for free." Moreover, such a standard would eliminate proposals for unlicensed spectrum.

It is true that spectrum management is sub-optimal today in part because of inferior non-market allocation in the past. We don't have the option to go back to 1959 and heed the advice of Coase and [Levin](#), but that does not mean we should restrict a valuable trade. While an incentive auction is a great market-based instrument, it is not appropriate in every situation. In this case, it does not remedy the set-up of this band. Unlike other spectrum, which is assigned uniquely to a single operator, all 500 MHz of this spectrum is licensed to, and used simultaneously by multiple users including the government, the four CBA companies, and others. As such, selling the rights must be coordinated as a bloc to avoid a [holdout problem](#).

The C Band had limited worth 40 years ago. Because CBA satellite operators invested billions of dollars and created value for American consumers, this spectrum has increased value today. Indeed the CBA's desire to vacate the band speaks to a larger renaissance in the satellite industry. Just as mobile operators must [reinvent themselves](#) for 5G, the satellite industry is doing the same for the next technological evolution. Satellite networks are integral to 4G and 5G by distributing data streams at the source and via backhaul. Plus, new satellites are offering 100 Mbps download broadband, positioning to compete head on with mobile, cable, and fiber networks in high speed broadband and closing the digital divide once and for all.

The US is entering a golden age of broadband with many networks competing to offer better and faster service to customers. The FCC should not second guess the desires of millions of consumers driving these companies to evolve. It should speed the C Band rulemaking process and let secondary markets work their magic.

An American abroad, Roslyn Layton studies evidence-based policy for the information, communications, and digital technology industries with the goal to maximize welfare for consumers and taxpayers.



Roslyn Layton Contributor



Filling the mid-band spectrum gap to sustain 5G momentum

Bret Swanson

April 24, 2019 6:00 am | *AEIdeas*

The United States has jumped to an [early lead](https://api.ctia.org/wp-content/uploads/2019/04/A-National-Spectrum-Strategy-to-Lead-in-5G.pdf) (<https://api.ctia.org/wp-content/uploads/2019/04/A-National-Spectrum-Strategy-to-Lead-in-5G.pdf>) in the deployment of [fifth generation wireless networks](http://bit.ly/EE-5G-1116) (<http://bit.ly/EE-5G-1116>). But there is one hole that needs to be filled if that momentum is to be sustained.



A 5G sign at the Mobile World Congress in Barcelona, Spain, February 26, 2018 – via REUTERS

The availability of wireless spectrum is the defining constraint for data delivery, and one of 5G's big advantages is that it will utilize a far wider range of spectrum than ever before. Over the past few years the US has moved quickly to open up more "high band" airwaves, which will allow for new super-high capacity links over short distances. The Federal Communications Commission has already moved the 24 and 28 gigahertz bands to the commercial market, and later this year will hold an auction for the 37 and 39 GHz bands as well.

Low band airwaves in the range between 400 and 2,400 megahertz are already in use for today's existing 4G networks and will continue to be a foundation of tomorrow's 5G networks. The airwaves in the middle, however — what we call "mid-band" — will be a key component of 5G and need to be unshackled. In fact, a delay here could sidetrack the whole 5G endeavor.

A juicy portion of this mid-band spectrum is currently occupied by satellite firms, who use much of it to transmit broadcast and cable TV signals to cable TV ground stations, which then deliver the signals to subscribers via wire.

This architecture, however, is something of a relic of the early cable TV architecture. Today, most of these TV signals are, like internet data, delivered via fiber optics. So this important wireless spectrum, which sits between 3.7 and 4.2 gigahertz, is increasingly underutilized, and the satellite firms want to sell it.

That's fortunate, because it is perfectly situated to fill a hole in the coming 5G small cell architectures. The existing low bands will continue to provide broad coverage, while the new high bands will provide extremely high capacity links, often in densely populated areas. Mid-band spectrum will fill the gap in between. It can deliver higher data rates than today's low band mobile networks and transmit signals much further than the coming high bands. It will thus powerfully leverage the new 5G networks of small cells, hundreds of thousands of which will sit on lampposts, utility poles, and building roofs.

One can already preview this potent architecture in some cities. For example, in Indianapolis, where I live, an early variant of this network, utilizing *unlicensed* 5 GHz mid-band spectrum, which is also used for Wi-Fi, is delivering peak data rates of 800 megabits per second. Adding up to 200 MHz of *licensed* spectrum to this architecture will only make it more powerful. Remember that all of today's mobile networks in the US operate with a grand total of only around 600 MHz of spectrum. So an additional 200 MHz of prime airwaves would be a big deal.

The trick is finding the fastest and most economical path to repurpose the 3.7–4.2 GHz “C band,” as it's known. The satellite companies want to sell it, and the mobile firms would like to buy it. But clearing the spectrum bands in the right way and making sure the new owners can deploy it without interference can be complicated. A group known as the C-band Alliance has proposed a secondary market solution, which could avoid a time-consuming FCC re-auction. As my colleague Dan Lyons [recently described](https://www.aei.org/publication/secondary-markets-can-pave-the-way-for-rapid-5g-deployment/) (<https://www.aei.org/publication/secondary-markets-can-pave-the-way-for-rapid-5g-deployment/>), the proposal:

would authorize mobile service as a co-primary use in the C-band. Existing owners would then negotiate secondary market agreements with mobile operators for the clearing and repacking of C-band spectrum. These agreements would then be reviewed by the FCC, and upon approval of the new license, the sellers would clear and repack their operations, and buyers could commence operations.

There's another proposal that asks the FCC to repurpose the spectrum using a more complicated incentive auction, just as it did with the 600 MHz broadcast TV airwaves. But the C-band Alliance method seems much simpler and quicker.

Learn more: [Secondary markets can pave the way for rapid 5G deployment](https://www.aei.org/publication/secondary-markets-can-pave-the-way-for-rapid-5g-deployment/) (<https://www.aei.org/publication/secondary-markets-can-pave-the-way-for-rapid-5g-deployment/>) | [In the 5G race, competition policy now vies with industrial and security policy](https://www.aei.org/publication/in-the-5g-race-competition-policy-now-vies-with-industrial-and-security-policy/) (<https://www.aei.org/publication/in-the-5g-race-competition-policy-now-vies-with-industrial-and-security-policy/>)

This article was found online at:

<https://www.aei.org/publication/filling-the-mid-band-spectrum-gap-to-sustain-5g-momentum/>



Secondary markets can pave the way for rapid 5G deployment

Daniel Lyons

March 21, 2019 6:00 am | *AEIdeas*

The Federal Communications Commission (FCC) is exploring avenues to meet its congressionally mandated goal of making more spectrum available for wireless broadband. The agency is currently considering a proposal by leading satellite communications companies to repurpose up to 200 megahertz (MHz) of mid-band spectrum through secondary market transactions. By leveraging market forces, this creative proposal can quickly provide a much-needed boost to help build America's 5G networks.



via REUTERS

The C-Band Alliance proposal

The C-band represents 500 MHz of spectrum between 3.7 and 4.2 gigahertz (GHz). It is currently used primarily by satellite operators for fixed satellite downlink services, such as delivering

programming content to broadcasters or cable providers for delivery to customers. But this mid-band spectrum has excellent propagation characteristics and significant data capacity, which fits well into the small-cell, dense network model that is emerging for 5G wireless networks. Indeed, other countries are already experimenting with 5G networks in this space. In 2018 the FCC, under orders from Congress to free up 255 MHz of spectrum for next-generation networks, sought proposals to free up some C-band spectrum for mobile use.

The [C-Band Alliance](https://c-bandalliance.com/) (<https://c-bandalliance.com/>) (CBA), a consortium representing the four largest holders of C-band spectrum, has proposed to solve the problem through secondary markets. Under this proposal, the FCC would authorize mobile service as a co-primary use in the C-band. Existing owners would then negotiate secondary market agreements with mobile operators for the clearing and repacking of C-band spectrum. These agreements would then be reviewed by the FCC, and upon approval of the new license, the sellers would clear and repack their operations, and buyers could commence operations.

These transactions are complicated somewhat by the nature of the C-band spectrum licenses. Unlike broadcast licenses, which grant the exclusive right to use a band within a limited geographic area, C-band spectrum licenses grant the holders a nonexclusive right to use the band nationwide. This means that multiple providers can transmit within overlapping geographic boundaries. Thus, clearing a band requires more than simply purchasing a license on the open market. For example, it would be useless for Verizon to pay Intelsat to use a portion of the C-band if SES and other satellite providers continued to use that portion for satellite operations in ways that inhibit 5G service. For a portion of the band to be useful to a buyer, it would need some coordination among existing licensees to make sure that the band is sufficiently clear. This coordination problem raises the risk that one seller would strategically hold out for a larger payday.

To address these challenges, the CBA proposes negotiating on behalf of its members, which together control virtually all American C-band spectrum. The consortium can coordinate repacking efforts among the sellers, to identify and clear the most spectrum in the most efficient fashion. And coordination eliminates the holdout problem. While this competitor coordination raises antitrust concerns, the CBA argues that the procompetitive effects of the CBA offering are significant and that the Alliance has been constructed according to the Federal Trade Commission (FTC)/Department of Justice Collaboration Guidelines to minimize the risk of anticompetitive effects.

Opposition and alternatives

Not everyone is enamored with the secondary markets proposal. The primary competing proposal is from T-Mobile, which suggested a FCC-run auction similar to the recently completed broadcast incentive auction. Stage 1 would solicit bids from existing owners to clear the spectrum, and then Stage 2 would auction the cleared spectrum to bidders. The process would then repeat until sufficient spectrum would clear. The FCC would play the coordinator role, which T-Mobile suggests would allow for more total spectrum to be made available.

The advantage of the market-based approach is speed. The CBA estimates that it can make 200 MHz available within 18 to 36 months, which is much faster than it would take to run an incentive

auction. Moreover, a market-based approach is more likely to clear an efficient amount of spectrum, as buyers and sellers are directly negotiating to move spectrum to its highest and best use. An FCC-mandated minimum clearance could create inefficiency and delay.

Of course, the other objection is who would reap the benefits of the sale. Incentive auctions would result in a surplus to the treasury, while a market-based approach would transfer proceeds directly from sellers to buyers. Some argue this would result in a windfall to existing satellite providers, but this objection is somewhat overblown. For one thing, sellers will bear the costs of repacking, [which may include building and launching eight new satellites](https://spacenews.com/c-band-alliance-plan-would-require-5g-networks-to-pay-for-eight-new-satellites/) (https://spacenews.com/c-band-alliance-plan-would-require-5g-networks-to-pay-for-eight-new-satellites/) to assure seamless provision go to existing services. Moreover, [as my AEI colleague Jeff Eisenach](http://www.intelsat.com/wp-content/uploads/2018/12/C-band-Reply-J-Eisenach-Reply-Declaration-20181207.pdf) (http://www.intelsat.com/wp-content/uploads/2018/12/C-band-Reply-J-Eisenach-Reply-Declaration-20181207.pdf) has noted, the FCC has often approved license transfers even when sellers have yielded significant financial gains: The promised financial gain provides incentive to risk repacking and making more spectrum available, resulting in greater gains to consumers.

The CBA's market-based proposal reflects the FCC's two decade long project to harness the power of market forces to improve American spectrum policy. The agency should approve the proposal and help America regain its edge in the battle for the next generation of wireless networks.

Learn more: [The toll-free auction: Breathing new life into legacy systems](http://www.aei.org/publication/the-toll-free-auction-breathing-new-life-into-legacy-systems/) (http://www.aei.org/publication/the-toll-free-auction-breathing-new-life-into-legacy-systems/).
| [Testimony: The impact of broadband investments in rural America](http://www.aei.org/publication/testimony-the-impact-of-broadband-investments-in-rural-america/) (http://www.aei.org/publication/testimony-the-impact-of-broadband-investments-in-rural-america/)

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