555 Eleventh Street, N.W., Suite 1000
Washington, D.C. 20004-1304
Tel: +1.202.637.2200 Fax: +1.202.637.2201
www.lw.com

LATHAM & WATKINS LLP

November 9, 2017

VIA ELECTRONIC FILING

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

Re: ViaSat, Inc., *Ex Parte* Submission Responding to T-Mobile,
GN Docket No. 14-177; IB Docket Nos. 15-256 & 97-95; RM-11664;
and WT Docket No. 10-12

Dear Ms. Dortch:

ViaSat, Inc. submits this response to T-Mobile's written *ex parte* submission filed on October 25, 2017, in which T-Mobile claims there is no need for the Commission to make additional spectrum available for satellite broadband networks,[1] to which T-Mobile attached a paper from Gregory L. Rosston and Andrzej Skrzypacz entitled "Using Auctions and Flexible-Use Licenses to Maximize the Social Benefits from Spectrum."

Enclosed is a paper from Jonathan Orszag and Maya Meidan of Compass Lexecon that responds to Messrs. Rosston and Skrzypacz, and explains why making spectrum available for satellite broadband helps address longstanding market failures, and why terrestrial wireless operators do not have an economic incentive to engage in the types of coordination that T-Mobile asserts would naturally occur in the marketplace.

Please contact us if you have any questions regarding this submission.

Respectfully submitted,

/s/

John P. Janka
Elizabeth R. Park

[1] T-Mobile USA, Written *Ex Parte* Presentation, GN Docket No. 14-177, *et al.*, at 1-2 (filed Oct. 25, 2017).

LATHAM & WATKINS LLP

Enclosure

cc:

Rachael Bender
Louis Peraertz
Erin McGrath
Kevin Holmes
Umair Javed
Jose Albuquerque
Bahman Badipour
Simon Banyai
Paul Blais
Brian Butler
Stephen Duall
Chip Fleming
Diane Garfield
Jennifer Gilsenan
Michael Ha
Karl Kensinger
Kal Krautkramer
Michael Mullinix
Kerry Murray
Robert Nelson
Charles Oliver
Nicholas Oros
Matthew Pearl
Ronald Repasi
Alyssa Roberts
John Schauble
Catherine Schroeder
Blaise Scinto
Thomas Sullivan
Joel Taubenblatt
Jeff Tignor
Nancy Zaczek

A RESPONSE TO THE ECONOMIC REPORT OF GREGORY ROSSTON AND ANDRZEJ SKRZYPACZ, "USING AUCTIONS AND FLEXIBLE-USE LICENSES TO MAXIMIZE THE SOCIAL BENEFITS FROM SPECTRUM"

Jonathan Orszag and Maya Meidan[1]

November 9, 2017

[1] Jonathan Orszag is a Senior Managing Director and co-founder of Compass Lexecon, LLC, an economic consulting firm. Maya Meidan is a Vice President at Compass Lexecon. For more complete biographies, please see http://www.compasslexecon.com/professionals/bio?id=117 and http://www.compasslexecon.com/professionals/bio?id=230, respectively.

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I. Introduction

We have been asked by ViaSat to respond to the study prepared by Gregory L. Rosston and Andrzej Skrzypacz, "Using Auctions and Flexible-Use Licenses to Maximize the Social Benefits from Spectrum".[2] In particular, we were asked to consider the claims regarding the ability of auctions to accommodate different business plans and technologies, and the feasibility of expecting that terrestrial providers would agree to share use of spectrum with satellite operators.

II. The FCC's Mission Is to Encourage Deployment of Broadband Capability to All Americans

The Telecommunications Act of 1996 states that "Consumers in all regions of the Nation, including low-income consumers and those in rural, insular, and high cost areas, should have access to telecommunications and information services, including interexchange services and advanced telecommunications and information services, that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas."[3] It is further stated that the FCC "shall encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms) by utilizing, in a manner consistent with the public interest, […] measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment."[4]

Rosston and Skrzypacz claim that the FCC should not set aside additional spectrum for satellite broadband providers because "the FCC should consider the incremental social value of restricting spectrum to satellite uses, which may be low or even negative because of the opportunity cost of precluding other potentially more valuable uses."[5] One must evaluate the Rosston and Skrzypacz claim against the backdrop of the overall policy goal promulgated by both Congress and the FCC to promote the deployment of advanced broadband services for *all*

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[2] T-Mobile *Ex Parte*, GN Docket No. 14-177, Rosston, Gregory L. and Skrzypacz, Andrzej, "Using Auctions and Flexible Use Licenses to Maximize the Social Benefit from Spectrum," (filed October 25, 2017), ("Rosston and Skrzypacz" henceforth).

[3] Telecommunications Act of 1996, Section 254(b)(3).

[4] Id., Section 706(a).

[5] Rosston and Skrzypacz, p. 2.

Americans.[6] Measured against that policy goal, and in light of additional considerations discussed below, the Rosston and Skrzypacz approach risks leaving significant parts of America without access to broadband services, in contravention of the promulgated policy goals.

The underlying economics of how an approach that seeks to promote *average* value may result in significant parts of the nation remaining underserved is quite simple. Terrestrial and mobile service providers can provide high-quality broadband Internet service to densely populated areas, but as profit-maximizing organizations, they are unable or unwilling to offer comparable services to many rural, less populated areas. Specifically, when wireless technology is used for the final broadband delivery ("last-mile"), terrestrial providers typically link their wireless towers to the Internet core with fiber in order to offer the high upload and download speeds of advanced broadband. Fiber unit construction costs are per mile (not per site), and thus economies of scale imply that the higher the number of consumers who can connect to a given mile of fiber, the lower the per-site cost of the network. Thus, terrestrial providers deploy fiber only to areas where it is cost effective and choose not to deploy fiber in most rural areas. Moreover, wireless providers need to incur the cost of installing and maintaining wireless towers. In general, those costs are also lower on a per-subscriber basis in more densely populated areas.[7]

Consumers place significant value on high-speed Internet services and thus terrestrial service providers are willing to place high bids on spectrum auction licenses that cover densely populated areas, where they can expect high revenue. However, consumers in rural areas, which are either unserved or underserved by the same terrestrial providers, gain very little from these terrestrial services in densely populated areas. Consequently, the FCC's goal of providing equal access cannot be attained by terrestrial services, since many rural Americans do not have access to a terrestrial service that is comparable to that of urban Americans. To achieve the FCC's goal of facilitating access to advanced broadband services to all Americans, the Commission can either try to subsidize providers of rural services, or encourage alternative technologies that can reach rural areas at lower costs, such as high capacity and ultrahigh capacity satellite.

[6] See e.g. FCC Chairman Ajit Pai, "A Digital Empowerment Agenda," Remarks at the Brandery, Cincinnati, Ohio (September 13, 2016) ("Pai Speech"), available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-341210A1.pdf.

[7] It is possible in certain cities that the cost of renting the space for a wireless tower is so high that the per-subscriber costs are lower in less densely populated areas.

While Rosston and Skrzypacz claim that “there is no evidence of a market failure that requires correction by setting aside spectrum for satellite service to increase social surplus,”[8] there is plenty of evidence that many rural Americans do not have access to the same Internet services as urban Americans. The FCC’s 2016 Broadband Progress Report examines the number of Americans that have access to high-speed Internet services and finds that when satellite Internet services are excluded from the analysis, 39 percent of rural Americans (23 million people) lack access to 25 Mbps/3 Mbps, while only four percent of urban Americans lack access to 25 Mbps/3 Mbps broadband.[9] In fact, 19 percent of rural Americans lack access to service at just 4 Mbps/1 Mbps.[10] Fundamentally, rural Americans need satellite broadband services to have some form of higher-speed Internet service. For example, once recently-deployed high capacity satellite services are included in the FCC’s analysis, the total number of Americans without access to 4 Mbps/1Mbps falls from 16.1 million (5%) to 1.37 million; almost 10 million households in rural areas have access to satellite services to connect to broadband Internet.[11,12]

Clearly, while terrestrial service may not have found it economical to reach certain parts of the United States, satellite services, which can provide service effectively anywhere, play a vital role in bringing higher-speed Internet to rural America, especially with new high capacity and

[8] Rosston and Skrzypacz, p. 2.

[9] “2016 Broadband Progress Report,” FCC (released January 29, 2016), para. 79, 121, available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf.

[10] “2016 Broadband Progress Report,” FCC (released January 29, 2016), n. 242.

[11] Rosston and Skrzypacz claim that “more than 90% of U.S. households live in census tracts that have terrestrial broadband service of at least 25 Mbps.” (Rosston and Skrzypacz, pp. 2-3). However, the national average masks the disparity between urban and rural areas: According to the FCC’s fixed broadband deployment data as of June 2016, 28% of households in rural areas had no access to broadband services with at least 25Mbps/3Mbps speeds. (Data from the FCC form 477, available at https://www.fcc.gov/maps/fixed-broadband-deployment-data/#lat=38.82&lon=-94.96&zoom=4).

[12] Rosston and Skrzypacz also claim that “Wireless providers offered 4G LTE service to more than 99% of census blocks as of two years ago.” (Rosston and Skrzypacz, p. 3). These figures are based on the “Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services,” Eighteenth Report, 30 FCC Rcd. 14515, Chart III.A.3 Estimated LTE Coverage in the U.S. by Census Block: Mosaik, July 2015 (2015). However, the notes to the chart warn that “[c]overage calculations based on Mosaik data, […] have certain limitations that likely result in an overstatement of the extent of mobile coverage.” According to the FCC’s 2016 Broadband Progress Report, 171.5 million (53 percent) of Americans do not have access to a mobile LTE service provider with a minimum advertised speed of 10 Mbps/1 Mbps. In rural areas, 52.2 million (87 percent) of Americans are without access to such LTE services (“2016 Broadband Progress Report,” FCC (released January 29, 2016), para. 83, available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf). The disparity between urban/suburban and rural access to 4G services is also highlighted in Open Signal’s State of the Mobile Network: USA (February 2017) report: “We see speeds on the increase at operators like AT&T and Verizon thanks to new upgrades and new 4G spectrum, and in individual cities operators are pushing well beyond 20 Mbps in our download tests. But in our nationwide tests, all four operators fell short of the global LTE download average of 17.4 Mbps.” The report also notes that while availability of LTE service, measured as the proportion of time users have access to an LTE network, was more than 90% at some U.S. cities, the U.S. as a whole had an overall 4G availability of only 81.3%, indicating disparity between the availability of service to urban/suburban and rural areas. (See “State of Mobile Networks: USA,” OpenSignal (February 2017), available at https://opensignal.com/reports/2017/02/usa/state-of-the-mobile-network).

coming ultrahigh capacity satellites that are now being designed, built and launched.[13] While no satellite provider was yet offering advanced broadband, defined as speeds of more than 25 Mbps/3Mbps, at the time the data underlying the FCC's 2016 report was gathered (although such speeds are already being provided today),[14] the majority of those served only by satellite had access to 10Mbps/1Mbps (see the report's Table 1 below).

Table 1

Americans Without Fixed 4 Mbps/1 Mbps and 10 Mbps/1 Mbps Services

	4 Mbps/1 Mbps		10 Mbps/1 Mbps	
	Including Satellite Services[15]	Excluding Satellite Services	Including Satellite Services[16]	Excluding Satellite Services
United States	1,376,047	16,080,909	1,419,962	19,899,559
Rural Areas	732,387	11,539,608	776,295	14,749,138
Urban Areas	643,660	4,541,301	643,667	5,150,421
Tribal Lands	0	776,272	0	1,126,897
Rural Areas	0	622,623	0	924,765
Urban Areas	0	153,649	0	202,132
U.S. Territories	1,376,047	1,376,047	1,419,962	1,419,962
Rural Areas	732,387	732,387	776,295	776,295
Urban Areas	643,660	643,660	643,667	643,667

Source: FCC 2016 Broadband Progress Report, Appendix F, p. 69.

[13] Hughes Network Systems EchoStar launched its new high capacity EchoStar XIX satellite in December 2016, allowing it to offer 25 Mbps/3 Mbps ("Hughes Network Systems Is Launching High-Speed Satellite Internet For North America," Forbes (March 13, 2017), available at https://www.forbes.com/sites/alexknapp/2017/03/13/hughes-network-systems-is-launching-high-speed-satellite-internet-for-north-america/#432e77c85ace). ViaSat launched its ViaSat-2 high capacity satellite in June 2017 and anticipated the satellite will start delivering Internet service in early 2018 and will offer download speeds of at least 25 Mbps ("Status Update For ViaSat-2, Our Newest Satellite," Exede by ViaSat (August 23, 2017), available at https://www.exede.com/blog/status-update-viasat-2-newest-satellite/). EchoStar launched its EchoStar 105/SES-11 satellite on October 11, 2017, a hybrid high capacity Ku and C-Band that will enable the company to increase capacity ("EchoStar 105/SES-11 Satellite Successfully Launched," EchoStar Corporation (October 12, 2017), available at https://www.prnewswire.com/news-releases/echostar-105ses-11-satellite-successfully-launched-300535420.html). Design and construction of ultrahigh capacity satellites that will increase speeds and throughput by orders of magnitude are also underway and anticipated for launch and operation in the next several years. For example, ViaSat and Boeing are in the process of constructing two new ultrahigh capacity satellites named ViaSat-3 ("ViaSat and Boeing Proceeding with Full Construction on the First Two ViaSat-3 Satellites," ViaSat Inc. (September 25, 2017), available at https://www.viasat.com/news/viasat-and-boeing-proceeding-full-construction-first-two-viasat-3-satellites). Hughes Network signed a deal to launch an ultrahigh capacity satellite in 2021 ("Hughes Selects Space Systems Loral to Build Net-Generation Ultra High Density Satellite," EchoStar Corporation (August 9, 2017), available at https://www.echostar.com/en/Press/Newsandmedia/Hughes%20Selects%20Space%20Systems%20Loral%20To%20Build%20Next-Generation%20Ultra%20High%20Density%20Satellite.aspx).

[14] See *supra* n. 13.

[15] The numbers in this column do not take into account currently deployed satellite capacity.

[16] The numbers in this column do not take into account currently deployed satellite capacity.

As noted in the FCC's 2016 Measuring Broadband America Fixed Broadband Report, performance increases for satellite technology depend on the launch of new high capacity satellites, which add capacity, serve more customers, and can also increase available speeds.[17] The provision of these competitive high capacity satellite broadband offerings is relatively new. The introduction of new high-throughput satellites operating in the Ka-band in 2011 led to an order-of-magnitude increase in performance, and satellite operators are now offering speeds of 25 Mbps (or more) to their subscribers at competitive prices.[18] Satellite providers continue to launch additional satellites to eliminate the bandwidth constraints created by strong consumer demand for their services.[19] Thus, satellite companies are playing an important role in decreasing the number of Americans without access to what the FCC defines as advanced broadband service, particularly in rural areas with neither fixed nor mobile high-speed terrestrial broadband service. Facilitating the growth of these new service capabilities would be consistent with the overall policy goal promulgated by both Congress and the FCC to promote the deployment of advanced broadband services for *all* Americans. Indeed, as evidenced by the benefits that high capacity satellite-delivered video services have provided (i.e., DIRECTV and DISH Network), including providing a robust competitive alternative to terrestrial MVPDs (i.e., cable and telco companies), there is a sound basis to believe that high capacity satellite-delivered broadband could provide benefits to consumers if it is provided access to adequate spectrum so that it can continue to develop its service offering.

The cost of building, launching and insuring a new satellite network is in the hundreds of millions of dollars. For example, the cost of ViaSat-2 has been reported at around $625 million.[20] Unlike terrestrial providers, who can simply choose which markets to serve (through auctions or the secondary market) and what speed to offer in each market on a rolling basis, satellite providers must make a considerable investment at the outset. Because of the large sunk cost of providing satellite Internet service on the one hand, and the ability to offer the service to a wide geographic area on the other, satellite companies must be able to compete for customers in more lucrative and densely populated markets (who have broadband alternatives) and not just those in

[17] "2016 Measuring Broadband America Fixed Broadband Report, FCC (2016), ("2016 Measuring Broadband America Fixed Broadband Report" henceforth) available at http://data.fcc.gov/download/measuring-broadband-america/2016/2016-Fixed-Measuring-Broadband-America-Report.pdf.

[18] 2016 Measuring Broadband America Fixed Broadband Report, p. 9, and *supra* n. 13.

[19] 2016 Measuring Broadband America Fixed Broadband Report, p. 9.

[20] "ViaSat: Betting Big On Satellite Broadband With Upcoming Launch," The San Diego Union-Tribune (February 5, 2017), available at http://www.sandiegouniontribune.com/business/technology/sd-fi-viasat-launch-20170202-story.html.

rural and remote areas, both for their business to be economically viable and for them to be able to offer their services at prices that are comparable to those of other Internet providers, as they do now. Similarly, in order for high capacity satellite providers to offer service to rural areas, they must have access to sufficient spectrum. Without such spectrum, consumers of such services will either have a lower-quality product or have to pay more for access to limited satellite resources. Of course, one benefit of a high capacity satellite provider having access to additional spectrum is that the same satellites can generally be used to offer Internet service to more urban/suburban consumers, thus increasing competition in more urban/suburban markets and allowing satellite companies to compete for consumers all over the United States.

Rosston and Skrzypacz suggest the FCC use reverse auction subsidies or cost-adjusted vouchers for providing services to consumers in rural unserved and underserved areas,[21] instead of allowing satellite providers to preserve or extend their broadband capabilities through access to adequate spectrum so they can offer services to consumers throughout the United States. In a previous phase of the FCC's Connect America Fund, $1.5 billion were allocated to eight terrestrial operators who committed to bring broadband to an estimated 3.6 million households and businesses in rural uncovered areas in the continental United States.[22] This still left millions of rural households without a solution for advanced broadband services. The upcoming reverse auction for the next phase of the Connect America Fund aims to bring broadband services to consumers in unserved areas by disbursing another $2 billion over the course of 10 years.[23] Satellite providers are one way in which such broadband service can be provided to rural areas. However, as noted by Rosston and Skrzypacz, satellite providers are effectively excluded from participating in these auctions.[24]

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[21] Rosston and Skrzypacz, pp. 5-6

[22] Connect America Fund Phase II Funding by Carrier, State, and County, Doc-335269A5, Location Obligation and Support by State by Carrier (August 28, 2015), available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-335269A5.xlsx.

[23] "Connect America Fund Phase II Auction," FCC (updated September 13, 2017), available at https://www.fcc.gov/connect-america-fund-phase-ii-auction.

[24] Rosston and Skrzypacz, p. 5. Of course, the ability of satellite providers to effectively participate in such an auction could provide a number of important public interest benefits, including driving down the level of the subsidies otherwise required to serve a given location, and allowing the limited budget to cover more locations.

III. Terrestrial Providers May Lack the Incentives to Coordinate with Satellite Providers

The FCC R&O's draft in the Spectrum Frontiers proceeding[25] defines several frequency bands as shared between FSS earth stations and terrestrial providers.[26] The R&O requires that satellite providers coordinate with and obtain the approval of terrestrial broadband providers, who are the primary users of these frequencies, prior to building new earth stations.[27]

Rosston and Skrzypacz go even farther than the Commission and suggest that coordination between satellite and terrestrial providers, whether in the form of (1) pre-auction contracts; (2) secondary-market sales; or (3) co-operation during the auction bidding process,[28] can lead to successful sharing between the two parties, that there is no need to provide for direct access to spectrum by satellite operators, and that the concerns of satellite providers regarding lack of cooperation from terrestrial providers are unfounded.[29]

To analyze the likelihood of cooperation between satellite and terrestrial providers who share the same frequency and geographic area, it is important to acknowledge that the two have different interests. While satellite providers require a relatively small geographic area to be able to operate an earth station that transmits or receives content from the satellite, terrestrial providers typically plan full coverage of the license area. With this in mind, we look at each of the Rosston and Skrzypacz coordination suggestions and assess their economic feasibility.

Rosston and Skrzypacz suggest that satellite providers can contract with terrestrial providers prior to the auction of the relevant spectrum.[30] For terrestrial providers to agree, the satellite provider must be able to compensate the terrestrial provider for the use of the spectrum.

To show why this kind of contract is not likely, we will use the following notation: let V_{FSS} denote the value that the satellite provider assigns to having an earth station in the terrestrial provider's license area. Let V_H denote the value that the terrestrial provider assigns to having his license without the presence of the earth station, and let V_L denote the value that the terrestrial

[25] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*; *et al.*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order [*as circulated*], GN Docket No. 14-177, *et al.*; FCCCIRC1711-02 (circ. Oct. 26, 2017) ("Draft R&O").

[26] Draft R&O, para. 3, 53, 55, 112-113. See also Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016), para. 43-60, 88-93.

[27] See Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016), para. 54, 93.

[28] Rosston and Skrzypacz, pp. 10-11.

[29] Rosston and Skrzypacz, pp. 10-11.

[30] Rosston and Skrzypacz, p. 10.

provider assigns to having the license with the earth station. Denote by C the payment from the satellite provider to the terrestrial provider according to the contract. Clearly, $C \leq V_{FSS}$ because the satellite provider will not be willing to pay to terrestrial provider more than what the earth station is worth to him.

Let Pr(V) denote the probability that bid V wins the auction. Then the terrestrial provider's expected value from winning the license with a contract with the satellite operator is: $Pr(V_L+C)(V_L+C)$. The terrestrial provider's expected value from winning the license without such a contract is: $Pr(V_H)(V_H)$. The terrestrial provider will only be willing to sign the contract with the satellite provider if the expected value with the contract is higher than the expected value without the contract: $Pr(V_L+C)(V_L+C) \geq Pr(V_H)(V_H)$. A necessary condition for this to hold is: $C \geq V_H - V_L$. Since $C \leq V_{FSS}$, this implies that a necessary condition for the terrestrial provider to contract with the satellite provider is: $V_{FSS} \geq V_H - V_L$. In words: the satellite provider's value from installing the earth station in the terrestrial provider's license area needs to be higher than the added value that the terrestrial provider gains from blocking the installation of the earth station in his license area. Given the previously noted asymmetry between the satellite provider (who only needs a small area) and the terrestrial providers (who wishes to cover a wide area as cost-effectively as possible), this condition is unlikely to hold. To the extent that blocking the installation of earth stations makes the satellite provider less competitive (e.g. by decreasing the quality of the service), the added value of blocking the earth station is even higher relative to the value of the license with the earth station, increasing the compensation required from the satellite provider even further and making it unlikely that the parties will be able to reach an agreement.

In their report, Rosston and Skrzypacz include an example which they claim demonstrates that an "FSS operator" can strike a deal with one of three terrestrial providers in a market to build an earth station. However, their example seems to confuse the FSS gateway earth stations at issue in the Draft R&O with FSS consumer earth stations. In particular, they claim that the installation of an earth station will lead to "the FSS operator [taking] a total of 300 in revenues from the terrestrial providers," and as a result "at least one of the terrestrial providers who stands to lose 100 would be better off by striking a deal with the FSS provider to split the other 200."[31] Such a statement does not appear to accurately reflect the function of FSS gateway earth stations: The

[31] Rosston and Skrzypacz, p. 10.

installation of FSS gateway earth stations in the frequencies to be shared under the Draft R&O does not directly affect the number of satellite users in a given geographic area, since FSS gateway earth stations aggregate traffic and interconnect to the Internet, unlike consumer earth stations, which provide satellite Internet service to consumer homes. Thus, the assumption that the installation of an FSS gateway earth station will lead to an increase of 300 in the revenue of the satellite provider at the expense of the terrestrial provider is unwarranted.

Furthermore, if the two parties were unable to contract prior to the auction, this implies that in fact $V_{FSS} < V_H - V_L$, so that the satellite provider will be unable to unilaterally bid and win the auction, as Rosston and Skrzypacz suggest, since its valuation is clearly too low to outbid terrestrial providers.

By the same token, it is not likely that the terrestrial providers will be willing to sell earth-station licenses in the secondary market, particularly if they were unwilling to contract with satellite providers prior to the auction.

Rosston and Skrzypacz also suggest coordination between satellite and terrestrial providers through a 2-license auction mechanism: Each market included in the auction will have a general license (allowing FSS operations) and, within the same area, a so-called "FSS license," in their terminology, that would allow operations of FSS in the area.[32] They claim this auction scheme will allow satellite providers to team up with terrestrial service providers who are willing to share the license and compete with terrestrial service providers who are unwilling to do so. Using the above notation, the total bid of the terrestrial provider and the satellite provider will be V_L+V_{FSS}, while a terrestrial provider who wants a license without the presence of earth stations will be willing to pay V_H. As before, necessary condition for the terrestrial-satellite pair to win is $V_{FSS}>V_H-V_L$.

All of the above suggestions have two features in common. First, if the terrestrial and satellite service providers manage to reach an agreement, that will drive up the cost of providing satellite broadband service, since satellite service providers would have to pay terrestrial providers in order to deploy earth stations in terrestrial license areas. Second, it is unlikely that coordination will be reached since terrestrial providers have no incentive to accommodate satellite providers,

[32] Rosston and Skrzypacz, p. 11.

and these suggestions will effectively allow one technology to block or interfere with the implementation of a competing technology.

While the FCC's suggestion in the Draft R&O does not involve any payment by the satellite provider for the right to use the frequency for earth stations, it does condition the construction of new earth stations on the consent of terrestrial providers. As noted above, since the terrestrial provider likely has nothing to gain from the installation of an earth station, it has no incentive to agree to its construction. On the contrary, if the terrestrial provider believes that installing an earth station can improve the service of a competing satellite provider, then it has both the economic incentive and ability to block (or at least stall) the installation of an earth station in its license area.

IV. Conclusion

The FCC is facing complex decisions regarding how to allocate millimeter-wave spectrum between satellite and terrestrial services. This paper reaches two important conclusions that should be taken into account in that decision-making process.

First, the FCC's mission is to facilitate access to advanced broadband services for all Americans. Current high-speed terrestrial service providers favor densely populated areas, leading to a widening digital divide between urban/suburban and rural Americans. The unique nature of satellite services allows a single satellite to cover the whole of the continental United States, including markets that are currently unserved or underserved by terrestrial service providers. However, for still-nascent high capacity satellite broadband providers to realize the potential to offer services to all Americans at competitive and comparable prices, they need to have access to additional spectrum frequencies that would allow them to increase their capacity and the speed of service to consumers.

Second, when designating certain frequencies as shared between satellite and terrestrial providers the Commission must take into account the different incentives of each provider and make sure that terrestrial providers do not use their right of refusal to thwart or stall installation of FSS earth stations in their license areas.