

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

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services)	GN Docket No. 14-177
)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band)	RM-11664
)	

COMMENTS OF VIASAT, INC.

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SUMMARY

ViaSat, Inc. (“ViaSat”) is a leading provider of communications solutions across many technologies and operates a fleet of spacecraft that provides advanced satellite broadband services to U.S. businesses and consumers. ViaSat’s cutting-edge satellite broadband technology has enabled service speeds, price points and levels of reliability that previously were not possible, as well as services that are winning customers from competitive terrestrial alternatives. The development of this advanced satellite broadband service, and its rapid adoption by consumers, has been made possible by reducing the “cost per bit” delivered to the customer. These revolutionary advances in satellite broadband services have required shared access to certain spectrum that is designated primarily for other technologies, combined with sophisticated spectrum sharing techniques.

Today’s advanced satellite broadband networks are well-suited to advance the Commission’s goals in this proceeding to ensure support for 5G wireless services. Those networks today already offload significant amounts of traffic from mobile wireless devices onto a Wi-Fi access point that connects to the Internet. Thus, today’s advanced satellite broadband networks actually increase the amount of bandwidth effectively available for terrestrial wireless broadband communications over terrestrial frequencies.

Access to additional spectrum for advanced satellite broadband services, including the bands subject to this *Notice of Inquiry* (such specific bands, the “High-Band Spectrum”), is critically important to enable advanced satellite broadband services to continue to meet consumers’ ever-increasing demands for greater capacity and service speeds, and correspondingly, to satisfy the Commission’s evolving requirements for broadband services. Notably, the need for additional spectrum to support satellite-delivered broadband is greatest in populated areas—where the greatest density of satellite broadband subscribers actually exists.

To meet these consumer needs throughout the United States, satellite systems will need continued access to “dedicated” spectrum bands—a base of “core” spectrum where they can operate on an unimpeded basis. Equally important, however, is also having access to spectrum for “opportunistic” uses in bands that may be used for other purposes, such as terrestrial services, including the lower portion of the LMDS spectrum band (27.5-28.35 GHz).

For these reasons, ViaSat urges the Commission to recognize the critical need to maintain and add designations for satellite services in various spectrum bands in order to achieve the goals in the *Notice of Inquiry*. ViaSat recommends that any consideration of the proposals for new mobile wireless services in the High-Band Spectrum take into account the continued development and future growth of satellite broadband services in those bands.

ViaSat believes that innovative sharing techniques, such as cognitive sharing, can facilitate an even more efficient use of spectrum by satellite networks in certain band segments in a manner that was not possible when current band plans were established. These types of recent developments should lead to a thorough reexamination of the decades-old perception that broad use of shared spectrum by satellite networks necessarily would impede use of the same band by terrestrial users. In sum, ViaSat urges the Commission to ensure continued access to spectrum for satellite broadband operations in High-Band Spectrum, including the possibility of enabling new and opportunistic satellite uses in band segments available to terrestrial services.

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ViaSat, Inc. (“ViaSat”) submits these comments in response to the Commission’s *Notice of Inquiry* examining the possible use of frequency bands above 24 GHz for advanced terrestrial mobile radio services.¹ ViaSat welcomes the opportunity to comment on the issues presented in the *Notice of Inquiry* about the potential deployment of advanced terrestrial mobile networks in frequency bands above 24 GHz, and how proposals for those services can and should take into account existing and future uses of those same bands by satellite services.

I. BACKGROUND

ViaSat is a leading provider of communications solutions across a wide variety of technologies, both terrestrial- and satellite-based. ViaSat has a long record of developing innovative technologies for consumer, business and government users alike that rely on the shared use of spectrum. In particular, and through the use of innovative sharing technologies, ViaSat has developed and deployed satellite communications technologies that improve network

¹ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band*, GN Docket No. 14-177, RM-11664, Notice of Inquiry, FCC 14-154 (rel. Oct. 17, 2014) (“*Notice of Inquiry*”).

performance and bandwidth efficiency in order to provide competitive new broadband services to the American consumer.

Most significantly to this proceeding, ViaSat operates a fleet of spacecraft that provides advanced satellite broadband services to U.S. businesses and consumers at speeds, price points and levels of reliability that previously were not possible, and that also can satisfy the Commission’s “reasonable comparability” standards.² Specifically, ViaSat now offers a broadband service throughout the United States called Exede® that is fully competitive with many terrestrial alternatives. The attractiveness of this offering to consumers is reflected in the large numbers of customers who have switched to satellite broadband from terrestrial alternatives, as well as the results of the Commission’s own analysis of customer satisfaction with this service.³ In fact, ViaSat is one of the fastest growing Internet service providers in the United States.

Today’s advanced satellite broadband services provide another invaluable function: by offloading traffic from mobile wireless devices onto a Wi-Fi access point that connects to the Internet through a satellite broadband service, satellite broadband networks actually increase the amount of bandwidth effectively available for terrestrial wireless broadband communications over terrestrial wireless frequencies. Thus, satellite broadband networks are well-suited to advance the goal of the *Notice of Inquiry* to ensure support for 5G wireless services.⁴

² See, e.g., *Connect America Fund*, Report and Order, DA 14-1569 (rel. Oct. 29, 2014) (reasonable comparability benchmarks for fixed broadband services using data from the annual urban rate survey).

³ The Commission has found that “during peak periods 90 percent of ViaSat consumers received 140 percent or better of the advertised speed of 12 Mbps” and that “both peak and non-peak performance was significantly higher than advertised rates.” See *2013 Measuring Broadband America: February Report*, at 8 (2013).

⁴ See *Notice of Inquiry* ¶ 7.

The development of this advanced satellite broadband service, and its rapid adoption by consumers, has been made possible by reducing the “cost per bit” delivered to the customer, which in turn has been enabled by both access to sufficient radio spectrum, and the development of sophisticated spectrum sharing techniques. These revolutionary advances in satellite broadband services have been made possible by the willingness of Commission staff to apply the Ka-band band plan in a flexible manner, and to embrace new approaches to efficient spectrum use.⁵ In particular, ViaSat’s broadband offering is based on reliable access to a core segment of Ka-band spectrum that has been designated for widely-deployed satellite terminals and thus is available “everywhere and anywhere,” as well as “opportunistic” access to other portions of the Ka band (originally designated for other technologies) that ViaSat also is able to use on a “workaround” basis—at times and locations where other spectrum users are not actively using that spectrum.⁶

Access to additional spectrum for advanced satellite broadband services, including the bands subject to this *Notice of Inquiry* (the “High-Band Spectrum”),⁷ is critically important to enable the continued provision of competitive broadband service at speeds and levels of throughput that are needed to meet consumers’ ever-increasing demands. Correspondingly, the

⁵ These approaches are manifested in the grant of authority for two of ViaSat’s most advanced spacecraft designs. *See* ViaSat-1 Authorization, IBFS File Nos. SAT-LOI-20080107-00006, SAT-AMD-20080623-00131, SAT-AMD-20090213-00023, Call Sign S2747 (granted Aug. 18, 2009); IBFS File Nos. SAT-LOA-20110722-00132, SAT-AMD-20110728-00140 (granted Oct. 14, 2011); ViaSat-2 Authorization, IBFS File No. SAT-LOI-20121226-00225, Call Sign S2891 (granted Dec. 12, 2013).

⁶ For example, ViaSat operates user terminals on a non-interfering basis in portions of the Ka band where non-geostationary (“NGSO”) systems are primary.

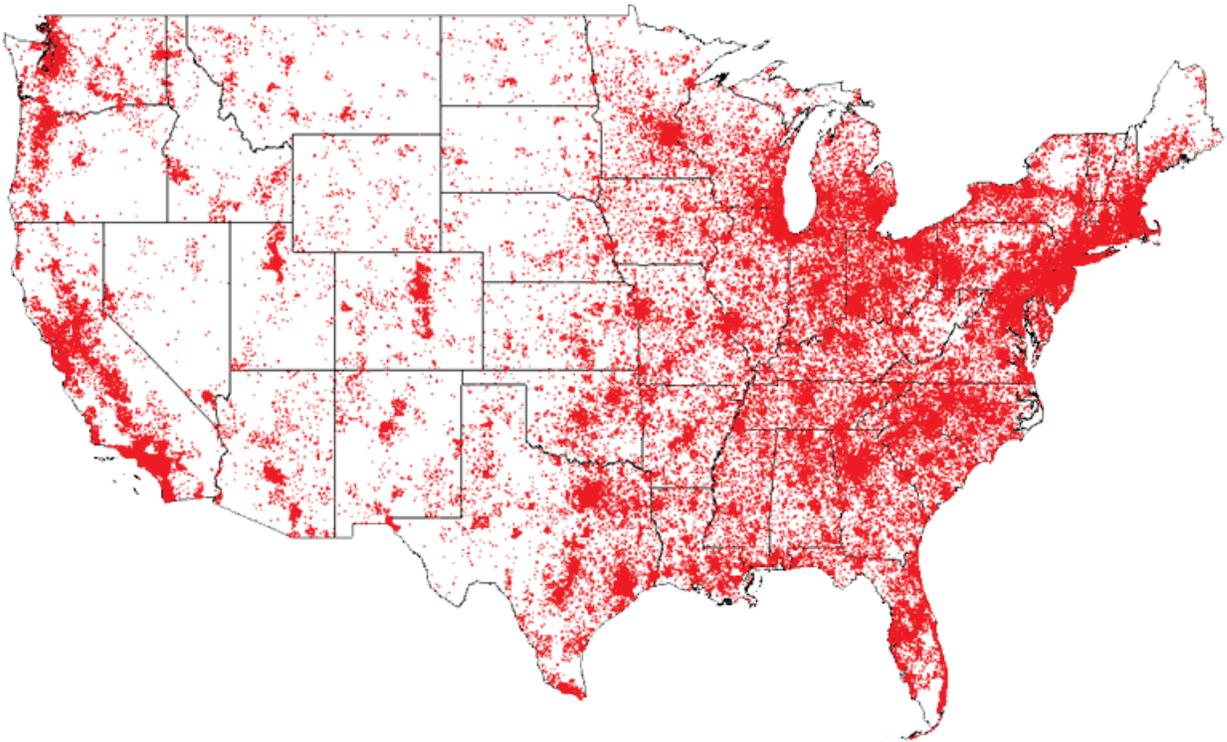
⁷ Specifically, the reference to “High-Band Spectrum” in this case includes the 27.5-28.35 GHz, 29.1-29.25 GHz and 31.0-31.3 GHz portions of the Ka band; the 38.6-40 GHz, 37.0-38.6 GHz and 42.0-42.5 GHz portions of the V band; the 24.25-24.45 GHz and 25.05-25.25 GHz portions of the 24 GHz band; and the 57-64 GHz, 64-71 GHz, 71-76 GHz, and 81-86 GHz portions of the 60/70/80 GHz bands.

Commission has encouraged all broadband providers to respond to these rapidly evolving consumer demands.⁸ The launch of the ViaSat-1 Ka band satellite in 2011 has enabled ViaSat to offer broadband speeds of 12/3 Mbit/s and higher to residential and business consumers. ViaSat's next Ka-band satellite, ViaSat-2, will introduce even faster speeds, higher capacity and seven times the current geographic coverage of ViaSat-1. ViaSat-2 will double the bandwidth economics of ViaSat-1 and provide coverage of the U.S., Central America, the Caribbean, and the main aeronautical and maritime route over the Atlantic Ocean.

Access to additional spectrum is imperative to allow consumer expectations for higher performance broadband services to be met, and even more customers to be served. Significantly, continued access to additional spectrum *in populated areas* is critically important. As depicted in Figure 1, below, these are the areas where the greatest density of satellite broadband subscribers exists, and where the greatest potential for subscriber growth exists.

⁸ See, e.g., *FCC's Wheeler says 25/3 Mbps Should Define Broadband*, FierceTelecom (Jan. 9, 2015), available at <http://www.fiercetelecom.com/story/fccs-wheeler-says-253-mbps-should-define-broadband/2015-01-09> (last visited Jan. 15, 2015).

Figure 1. ViaSat Broadband Subscriber Density



To maintain and expand capacity to meet growing demand in these areas and throughout the United States, satellite broadband systems will need continued access to “dedicated” spectrum bands—a base of “core” spectrum where they can operate on an unimpeded basis. This is true for existing and future satellite operations across the High-Band Spectrum. Equally important, however, is having access to spectrum available for “opportunistic” use in bands that may be used for other purposes, such as terrestrial services. This type of opportunistic use by satellite networks occurs today in the Ka band and it likely will be needed in parts of the High-Band Spectrum in the near future as well.

For these reasons, ViaSat urges the Commission to recognize the critical need to maintain and add designations for satellite services in various spectrum bands in order to achieve the goals in the *Notice of Inquiry*. ViaSat recommends that any consideration of proposals for new mobile

wireless services in the High-Band Spectrum take into account the continued development and future growth of satellite broadband services in those bands.

ViaSat believes that innovative sharing techniques can facilitate even more efficient use of spectrum by satellite networks. In this respect, ViaSat urges the Commission not to assume that the circumstances that led to previous approaches to spectrum management still apply. For instance, a variety of cognitive and other sharing technologies exist and are being developed that can facilitate satellite uses of spectrum without impeding terrestrial uses in the same bands. These recent developments should negate the decades-old perception that broad use of spectrum by satellite operators somehow would constrain use of the same band by terrestrial users. It thus is important to ensure that continued access to spectrum for satellite broadband operations is possible in many portions of the High-Band Spectrum that are available for terrestrial use.

II. SATELLITE TECHNOLOGIES PLAY A CRITICAL ROLE IN THE MOBILE WIRELESS ECOSYSTEM TODAY

In the *Notice of Inquiry*, the Commission looks to the High-Band Spectrum as a possible source of additional capacity to support mobile services and as a pathway to Fifth Generation (“5G”) mobile services. The Commission seeks to explore ways to use High-Band Spectrum to expand capacity and relieve congestion on mobile wireless networks and acknowledges that High-Band Spectrum is “typically considered not for stand-alone mobile services but as supplementary channels to deliver ultra-high data rates in specific places, as one component of service packages that will likely include continued use of lower bands to ensure ubiquitous coverage and continuous system-wide coordination.”⁹ Thus, the Commission envisions that such spectrum will be used in large part to offload wireless traffic from congested lower-band

⁹ *Notice of Inquiry* ¶ 7.

networks.¹⁰ Through this proceeding, the Commission aims “to develop a framework that will accommodate as wide a variety of services and uses as possible, and that will promote coexistence between different services in these bands.”¹¹

Satellite broadband technology in the High-Band Spectrum has already proven to support mobile services in the manner the Commission contemplates for High-Band Spectrum. Thus, as an initial matter, ensuring the continued availability and growth of satellite broadband services would serve a number of the goals the Commission is trying to achieve in this proceeding. Today, an estimated 65 percent of content carrier over mobile wireless devices is transmitted via a Wi-Fi connection.¹² Wi-Fi access points connected to satellite broadband networks, like ViaSat’s Ka-band network, divert traffic from congested wireless networks in much the same way as Wi-Fi connected to fiber or cable networks. The role of satellite technologies in this scenario addresses precisely the need envisioned by the Commission for these types of “supplementary channels” to support and expand wireless networks by offloading traffic from lower wireless service bands.¹³ And as satellite broadband access expands, the existing Ka-band model for carrying such traffic can be expanded and replicated over other frequencies in the High-Band Spectrum to further support mobile wireless services.

Furthermore, allowing flexibility for satellite operations in the High-Band Spectrum considered in this proceeding would promote the Commission’s goals of efficient use of

¹⁰ *Id.* (delivery of service through multiple, widely-spaced frequency bands and diverse types of radio access technologies, in which bands above 24 GHz are typically considered for backhaul-type services and not for stand-alone mobile services); *see also id.* ¶ 27.

¹¹ *Id.* ¶ 15.

¹² *See* Wireless 20/20, LLC, Case Study: ROI Analysis of WiFi Offloading, at 4, available at <http://www.wireless2020.com/wifioffloading/> (last visited Jan. 15, 2015).

¹³ *See Notice of Inquiry* ¶ 7.

spectrum and maximizing its utility.¹⁴ As the Commission is well aware, the dozens of GSO networks currently operating in part of the High-Band Spectrum, and spaced two degrees apart, share and reuse the spectrum multiple times over broad geographic areas. Similarly, GSO and NGSO networks currently operating in part of the High-Band Spectrum also share and efficiently reuse spectrum through coordination.

III. SATELLITE NETWORKS REQUIRE CONTINUED ACCESS TO BOTH “CORE SPECTRUM” AS WELL AS SPECTRUM FOR “OPPORTUNISTIC” USE

In order to meet the growing consumer demand for satellite broadband services, satellite networks need access to additional spectrum to expand the capacity of existing networks. Additional spectrum available for satellite use is needed in “core” bands in which the ability to operate unimpeded by the operation of terrestrial services is critical (including, without limitation, 28.35-28.6 GHz and 29.25-30.0 GHz), as well as for “opportunistic” uses that may be able to operate on a secondary basis to some of the terrestrial uses contemplated in this proceeding in certain portions of the High-Band Spectrum (including, in particular, the 27.5-28.35 GHz band segment). The services that satellite broadband operators currently provide to customers can be substantially enhanced by access to additional spectrum that may not be available everywhere—spectrum that such broadband networks can use in certain locations and at certain times—even if access is limited in time, geography, or some other use dimension, and even where satellite operators need to work around terrestrial uses.

A. Opportunistic Uses in High-Band Spectrum Should Be Broader than Those Reflected in the Commission’s Historical Designations

When considering spectrum for such opportunistic use by satellite, ViaSat urges the Commission to refrain from defaulting to outdated paradigms for sharing between satellite and

¹⁴ See, e.g., *id.* ¶ 46.

terrestrial services that may have been appropriate 10 or 20 years ago, when the current band plans were originally developed. For instance, limiting use of shared bands to satellite “gateway-type” operations will not be sufficient going forward,¹⁵ given the amount of spectrum needed for satellite networks to keep pace with consumer demands and Commission requirements. Moreover, satellite network architecture is changing fundamentally, with many satellite terminals being directly tied into the public Internet, thus eviscerating the traditional concept of “gateways” as being limited numbers of large terminals located in remote regions.

Moreover, it is no longer necessary to impose such limitations in light of the sharing technologies and techniques that have been proven to facilitate successful non-interfering operations. Notably, many scenarios contemplated in the *Notice of Inquiry* for mobile wireless services in High-Band Spectrum are conducive to opportunistic uses by small satellite terminals through cognitive sharing techniques (including dynamic spectrum databases) and sophisticated radio terminal technologies (including dynamic beam forming). As the Commission tentatively concludes, terrestrial base stations that could operate in High-Band Spectrum likely would have small coverage areas and limited aggregate coverage.¹⁶ If this is the case, there likely will be

¹⁵ In the LMDS portion of the Ka band, the 1996 band plan was intended to accommodate “earth stations which are limited in number, and are generally larger and easier to coordinate than widely-deployed user terminals.” *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, First Report and Order, 11 FCC Rcd 19005 ¶ 10 n.13 (1996). See also *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations*, Second Report and Order, 18 FCC Rcd 25428 ¶ 33 (2003) (limiting FSS operations to gateway terminals in portions of the V band for shared use with fixed services).

¹⁶ *Notice of Inquiry* ¶ 89.

ways that satellite operators can make opportunistic use of the same spectrum in nearby areas based on information regarding the locations and frequencies of these stations. The Commission recognizes that such technologies could facilitate co-existence among terrestrial wireless operations, and these technologies can also be employed to enable coordination with satellite earth stations in those terrestrial bands.¹⁷ In addition, beam nulling technologies that enable coordination in cellular and wireless networks likewise can be used to facilitate the co-existence of satellite and terrestrial wireless operations. ViaSat urges the Commission to explore all such possibilities to maximize the use of the spectrum resources, and to better enable satellite broadband operators to serve the growing needs of consumers.

B. Spectrum Planning Should Recognize the Need for “Core” Bands and Also Accommodate “Opportunistic” Uses by Satellite Networks in the High-Band Spectrum

Twenty years ago, 1,000 MHz of Ka-band spectrum in each direction was designated for what is now a “core” band used by satellite broadband operators for service to ubiquitously-deployed small terminals. That spectrum is intensively used today by a variety of satellite networks that serve the United States. As the Commission recognizes in the *Notice of Inquiry*,¹⁸ satellite broadband operators also have invested heavily in other portions of the Ka band, including the 27.5-28.35 MHz portion, for both current generation spacecraft and next-generation spacecraft that are under construction.

ViaSat anticipates that the continually growing demand for satellite broadband services will require access to the full 2.5 GHz of the Ka band (in one form or another) to meet such demands. As to the 27.5-28.35 GHz portion of the Ka band (currently designated on a primary basis for LMDS), ViaSat notes that the Commission already has determined that certain types of

¹⁷ See *id.* ¶ 97.

¹⁸ *Id.* ¶ 55.

satellite earth stations can be individually licensed in this segment of the Ka band, because such operations can be coordinated with terrestrial licensees in the band. Today, these earth stations provide essential support to Ka-band satellite networks. Indeed, because the locations and operating parameters of these types of individually licensed terminals are readily known to terrestrial licensees, continued mutually acceptable co-existence with terrestrial licensees has been facilitated.

ViaSat urges that any proposals developed in this proceeding for mobile services in the 27.5-28.35 GHz band recognize the existence of these types of essential satellite operations, and provide a regulatory means to ensure that these types of operations can continue in this band on a “protected” basis, unimpeded by the deployment of any terrestrial services in that band. In addition, ViaSat recommends that the Commission consider the prospect of additional satellite uses in this band on a blanket-licensed basis, which ViaSat believes is very feasible on an opportunistic and secondary basis, in locations and/or at times when there would not be any adverse impact on terrestrial use of this band.

As the Ka band reaches capacity, the V band will be an important expansion band for satellite networks. ViaSat recommends that the Commission explore opportunities for satellite operators to make greater use of this spectrum as well. Advancements in antenna technology and sharing techniques that have developed since the Commission originally adopted its “soft segmentation” approach in this band fundamentally change the assumptions and conditions underlying the sharing criteria contemplated in that approach. Similarly, in the 24 GHz band, ViaSat believes that a number of ways exist to allow the band to be used to support other FSS services besides BSS feeder links, in a manner that is compatible with existing and future use of the band for BSS feeder links and terrestrial services. As to the 60/70/80 GHz frequencies

identified in the *Notice of Inquiry*, ViaSat similarly urges that the Commission ensure that opportunities for satellite deployment are not curtailed or foreclosed by proposals for mobile wireless operations in these bands.

C. Any Proposals for Mobile Wireless Services in the High-Band Spectrum Should Facilitate Shared Uses

As the Commission proceeds with this *Notice of Inquiry*, ViaSat encourages the Commission to consider a regulatory framework that would facilitate flexibility for the type of spectrum sharing opportunities discussed above. While specific licensing proposals would be premature at this preliminary stage where the type of possible terrestrial uses still remains to be determined, ViaSat can say that it would support approaches to licensing terrestrial uses in suitable band segments allocated for terrestrial use that promote sharing with satellite services and thus, maximize the use of spectrum. In such bands allocated for terrestrial service, ViaSat agrees that the Commission's suggestion that non-exclusive licensing of terrestrial services with automated frequency coordination, coupled with suitable power limits, could lend itself well to spectrum sharing with satellite uplinks.¹⁹ Likewise, in such bands allocated for terrestrial service, unlicensed use by mobile wireless services under Part 15 operating at suitable power levels also could be compatible with satellite uplink operations.²⁰

In contrast, and as the *Notice of Inquiry* recognizes, ViaSat recommends that the Commission not auction exclusive rights to terrestrial mobile users in large geographic service areas, because doing so could leave areas where spectrum would go unused for terrestrial purposes for significant periods.²¹ Particularly in light of the limited coverage of wireless radio

¹⁹ *Notice of Inquiry* ¶ 97.

²⁰ *Id.* ¶ 100.

²¹ *See Id.* ¶ 93.

