Federal Register Notice: 89 FR 12871, https://www.federalregister.gov/documents/2024/02/20/2024-03400/request-for-information-on-the-national-spectrum-research-and-development-plan, February 20, 2023.

# Request for Information on the National Spectrum Research and Development Plan

**Viasat, Inc.**

**Before the**
**NATIONAL SCIENCE FOUNDATION**
**Alexandria, VA 22314**

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| National Spectrum Research and Development Plan | ) | 89 FR 12871 |
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**COMMENTS OF VIASAT, INC.**[1]

Viasat, Inc. ("Viasat") submits these comments in response to the Request for Information ("RFI") published by the National Science Foundation ("NSF") on February 20, 2024.[2] In the RFI, the NSF seeks public input to facilitate the development of a National Spectrum Research and Development Plan ("R&D Plan"). The R&D Plan is intended to organize and guide government investments in spectrum-related research and development ("R&D")—including by identifying recommended priority R&D areas.

Viasat is a global communications company that connects homes, businesses, governments, and militaries with high-speed broadband services and secure networking systems. Spectrum plays a critical role in allowing Viasat to offer these services to the public, and spectrum-related R&D likewise plays a critical role in allowing Viasat to improve these offerings and their underlying economics over time. Notably, Viasat's R&D investments have made it possible to exponentially increase the total throughput achievable over Viasat's satellite networks without a concomitant increase in required spectrum inputs. This has allowed Viasat to

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[2] *See National Spectrum Research and Development Plan*, Request for Information, 89 FR 12871 (2024).

offer higher speeds, dramatically increased capacity, and smaller end-user terminals—all at a much lower cost per bit than other technologies. As Viasat's experience demonstrates, a carefully crafted R&D strategy can drive substantial improvements in spectral efficiency and make possible the provision of innovative service offerings available to the public.

In short, Viasat understands the significant value that can be derived from spectrum-related R&D activities—provided they are appropriately targeted. Viasat therefore applauds the NSF's efforts to develop the R&D Plan, which should help to solidify U.S. leadership with respect to the management and use of spectrum resources. As it develops the R&D Plan, Viasat recommends that the NSF prioritize R&D efforts that will allow spectrum to be used more efficiently and effectively to support satellite use cases. As explained below, such efforts have the potential to significantly improve spectral efficiency while advancing other critical public policy objectives—including by facilitating greater competition and innovation, as well as more equitable access to spectrum resources.

## I. THE R&D PLAN SHOULD PRIORITIZE R&D WITH THE POTENTIAL TO ENHANCE SPECTRUM USE BY SATELLITE NETWORKS

The RFI specifically solicits recommendations with respect to potential R&D related to spectrum efficiency and the shared use of spectrum resources. Viasat agrees that these are areas that should be explored, particularly as there are significant *in*efficiencies in how spectrum resources are currently being used to support satellite use cases. Indeed, substantial gains can be realized by exploring the technical bases for more efficient coexistence between satellite operators, as well as between satellite operators and terrestrial operators. Viasat more specifically recommends that the R&D Plan incorporate and prioritize work in the following areas of inquiry:

### A. Default Criteria for GSO-NGSO Coexistence

Virtually all spectrum used by satellite operators is shared with other spectrum users. For example, the same spectrum is increasingly used by geostationary satellite orbit ("GSO") and nongeostationary satellite orbit ("NGSO") operators. In many bands, this sharing is facilitated by technical rules—including equivalent power-flux density ("EPFD") limits—which establish the "lanes of the highway" that allow GSO and NGSO operators to coexist and make productive use of spectrum resources.

However, not all bands are subject to EPFD limits or similar mechanisms. Rather, some bands are subject only to coordination requirements, which are often underspecified and subject to delay and abuse. Thus, in the absence of any default sharing criteria, there is a significant risk that the parties will not converge on a negotiated coexistence solution quickly, even where they enter into coordination negotiations in good faith. Furthermore, in the absence of default criteria, parties may have the ability and incentive to refuse to coordinate in good faith, and thus effectively block the other party from making *any* use of the relevant spectrum (creating significant hold-up risk). In both cases, spectrum is left underutilized and the public is denied the benefits that would otherwise flow from additional service offerings.

Viasat recommends that the R&D Plan prioritize the development of default GSO-NGSO sharing criteria in bands that currently lack such criteria, such as the 18.8-19.3 GHz and 28.6-29.1 GHz band segments. These default criteria would apply in the absence of a coordination agreement and would ensure that both GSO and NGSO operators have the spectrum access needed to offer a range of innovative, high-quality satellite communications services to consumers. This approach would also prevent any operator from blocking others from using shared spectrum by refusing to enter into meaningful, good-faith coordination. At the same time,

it would preserve incentives to realize a coordinated outcome where possible, as one could be expected to provide the parties with additional flexibility and other benefits.

Critically, such default criteria would be beneficial regardless of which party is afforded "priority" in a given band—*e.g.,* by defining technical parameters within which parties without such priority would be permitted to operate, and specifying minimum standards that would need to be met by parties with such priority to facilitate shared spectrum use. Notably, this is how things work today in bands subject to EPFD limits; NGSO operators are able to deploy as long as they meet applicable EPFD limits, and GSO operators are required to design networks that tolerate interference levels consistent with those limits. In the 18.8-19.3 GHz and 28.6-29.1 GHz band segments (in which NGSO systems have priority), default sharing criteria could incorporate suitable default power density limits, and a simple requirement that NGSO systems employ satellite or earth station diversity to avoid signal transmissions that would intersect the GSO arc (NGSO operators generally take this approach anyway to facilitate coordination, without adversely impacting their systems given their system diversity).

### B. Enabling GSO Use of Modern Antenna Technologies

The RFI appropriately recognizes the role that hardware can play in enabling efficient use of available spectrum resources. Viasat agrees that providing greater flexibility with respect to the deployment of additional hardware solutions can help to improve spectrum efficiency, including with respect to the operation of GSO networks. For example, applicable regulations currently require GSO operators to meet restrictive technical requirements that were developed decades ago based on the assumption that GSO networks would employ antenna technologies that are now outdated. These standards are not sufficiently flexible to allow GSO operators to take advantage of cutting-edge technologies (*e.g.,* flat-panel, phased-array antenna technologies)

that would allow them to provide even more innovative, quality services to consumers at low cost.

In stark contrast, NGSO operators are *not* subject to these legacy antenna performance requirements. This does not reflect any reasoned evaluation of the respective risk posed by GSO and NGSO operations, or their respective ability to harness modern antenna technologies. Rather, this distinction reflects the historical fact that GSO networks were introduced decades earlier—at a time when far different assumptions were made about what was technically possible—and thus saddled with legacy regulations. But that historical fact hardly justifies the differential treatment of GSO networks and NGSO systems today, particularly when it limits the ability of GSO operators to make the most efficient and productive possible use of spectrum resources.

Viasat recommends that the R&D Plan correct this imbalance by prioritizing the development of liberalized antenna performance standards that allow both GSO and NGSO operators to utilize the most advanced technologies on a technology-neutral basis, and thereby enable the United States to increase spectrum utilization.

### C. Refining Methodologies for Evaluating NGSO Interference Potential

The RFI identifies "modeling for coexistence analysis" as an area of interest for future R&D. Viasat agrees that there would be significant benefit in refining existing methodologies for modeling and evaluating interference potential—including in the satellite context. Of particular concern are widely acknowledged deficiencies in existing methodologies used to evaluate the interference potential into GSO satellite networks associated with proposed NGSO systems. Among other things, these methodologies do not adequately account for all relevant sources of interference (*e.g.,* sidelobe interference) and do not evaluate interference at even a potential representative sample of physical locations—and thus do not evaluate whether a given

NGSO system is reasonably likely to be able to comply with applicable limits *everywhere* as required by existing rules. In addition, these methodologies do not adequately account for the aggregate interference potential (or "joint effect") generated by multiple NGSO "systems"—whether deployed by the same or different NGSO operators.

Viasat recommends that the R&D Plan prioritize the development of higher-fidelity methodologies, which would help to understand and cabin interference risk and thus facilitate more effective shared use of spectrum resources by satellite operators.

### D. Facilitating the Equitable Coexistence of Multiple NGSO Operators

The RFI notes that potential topics for R&D efforts include "economic-, market-, social-, and human-centric concerns" related to spectrum efficiency. Viasat agrees that spectrum efficiency is a multidimensional concept and should be treated as such. In Viasat's view, spectrum R&D that aims to improve efficiency should not blindly focus on maximizing throughput or some other technical metric alone, but rather should ensure that spectrum resources are most effectively harnessed to serve public policy objectives—including by making them available to multiple operators in an equitable fashion. Among other things, this approach would help to advance important policy objectives—including by promoting competition, innovation, and diversity in system architecture and offered services.

Viasat also recommends that the R&D Plan prioritize research into linkages between the physical use of space and the ability of multiple operators to access and use spectrum resources efficiently and equitably. These linkages are particularly pronounced in the NGSO-NGSO sharing context, as the geometric configuration of NGSO system architecture, the relative locations of satellites and earth stations in different systems, and the performance of NGSO antennas (*e.g.,* use of small antennas with wide beams) all can dictate whether and to what extent shared use of spectrum is feasible. These linkages also dictate the extent to which operators may

reasonably be expected to design and deploy smaller systems that would provide greater spectral efficiency but for the fact that they cannot operate effectively in the face of larger, less spectrally efficient NGSO systems.

This unfortunate dynamic is produced by the existing regulatory framework in the United States, which (by default) requires NGSO operators to "split" available spectrum resources in the event of an in-line interference event between their systems. Within this framework, large NGSO systems are able to "blanket the sky," causing multiple in-line interference events that effectively prevent smaller systems from accessing shared spectrum resources on an efficient or equitable basis. Indeed, analysis has shown that the use of "band-splitting" can reduce the capacity available to smaller systems by 50-100% in some cases. Critically, though, larger systems are not similarly impacted by the use of "band-splitting," as they simply reroute affected communications through a different satellite.

Viasat recommends that the R&D Plan prioritize research into alternatives that ensure that spectrum is shared on an equitable basis, regardless of the respective sizes of the relevant NGSO systems. Such R&D could include evaluation of approaches based on the use of "angle-splitting" during in-line interference events in lieu of "band-splitting," and suitable NGSO antenna performance requirements. Under an "angle-splitting" approach, each system involved in an in-line event would be allowed to use available spectrum to communicate to and from satellites within a portion of space visible from a given area on Earth (*e.g.,* one system might operate with satellites to the East of a given point, and the other system might operate with satellites to the West of a given point). Available resources (and look angles) would be divided equally among relevant systems, without regard to the number of satellites in each such system.

Consequently, this approach would not subject smaller operators to a competitive disadvantage simply because they deploy fewer satellites.

### E. Enabling Satellite-Based Direct-to-Device Services

The RFI suggests that R&D with respect to spectrum efficiency might productively focus on "[b]usiness and economic models." Viasat agrees that spectrum efficiency can be improved through the exploration of additional applications and use cases that can be supported by spectrum that is already available to operators—including satellite operators. For example, Viasat and other satellite operators are exploring innovative approaches to using mobile-satellite service ("MSS") spectrum to support direct-to-device ("D2D") offerings. The ability to provide D2D in MSS spectrum is among the most substantial growth opportunities for the satellite industry, and one of the most effective paths for realizing gains in spectral efficiency. The introduction of D2D offerings promises not only to make the use of MSS spectrum by satellite operators more efficient, but also to harness MSS spectrum to provide a level of capabilities to mobile handsets not otherwise possible today.

Viasat recommends that the R&D Plan prioritize efforts to facilitate the introduction of D2D services—*e.g.,* by supporting ongoing standards development, as well as the development of effective approaches that allow existing MSS service providers to support emerging D2D applications. Notably, Viasat is already working with other major players in the industry (directly and through the Mobile Satellite Services Association) to ensure that emerging D2D technologies are reflected in 3GPP standards. It is critical that the R&D Plan *not* undermine that important work that is already underway by and between industry participants.

### F. Facilitating More Efficient Satellite Use of Certain Bands

In the United States, satellite operators are able to access and use certain band segments only on a heavily restricted basis due to the perception that those restrictions are necessary to

protect wireless operations. For example, satellite operators wishing to access the 27.5-28.35 GHz portion of the Ka band are subject to extensive regulations limiting their deployment to certain rural and remote counties, and further limiting the number, nature, and location of the earth-station facilities that can be deployed in those counties. Recent experience under this framework confirms that these restrictions are unduly conservative; they *over*protect terrestrial systems (particularly given their limited deployments in the band segment) and prevent satellite operators from using this spectrum in ways that would not pose any interference risk to terrestrial operators. Consequently, the framework undermines spectral efficiency objectives.

Viasat recommends that the R&D Plan prioritize the exploration of alternative sharing approaches that would enable expanded use of that part of the Ka band by satellite networks. The R&D Plan should also explore whether additional spectrum bands (particularly in millimeter wave bands and above) could be made available for satellite use, subject to appropriate restrictions to protect terrestrial use. For example, there may be opportunities for satellite services to use additional spectrum bands in the Earth-to-space direction without posing any interference risk to terrestrial networks.

## II. THE NSF SHOULD ESTABLISH A PROCESS FOR REGULARLY UPDATING THE R&D PLAN

The RFI seeks comment with respect to the creation of "a process to refine and enhance the R&D plan on an ongoing basis." Viasat believes that such a process is essential to account for the results of ongoing R&D efforts, as well as the evolution of national priorities over time. Viasat recommends that the NSF establish a process through which the R&D Plan would be periodically updated (*e.g.,* every two years) following a public consultation process. As part of this process, the NSF could solicit input from a wide variety of stakeholders, including industry,

government, and academia, providing transparency and allowing the R&D Plan to benefit from the knowledge and expertise of stakeholders actively involved in spectrum use and research.

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The R&D Plan provides an opportunity for the United States to prioritize spectrum policy goals for the next decade and beyond. Satellite operators continue to play an essential role in providing critical connectivity to the public, and targeted R&D would enable satellite networks to be even more effective in this respect. Viasat therefore recommends that the NSF develop an R&D Plan that prioritizes spectrum-related R&D in support of satellite applications and use cases, so as to allow satellite operators to meet customer demands and continue to innovate.

Respectfully submitted,

/s/

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March 21, 2024