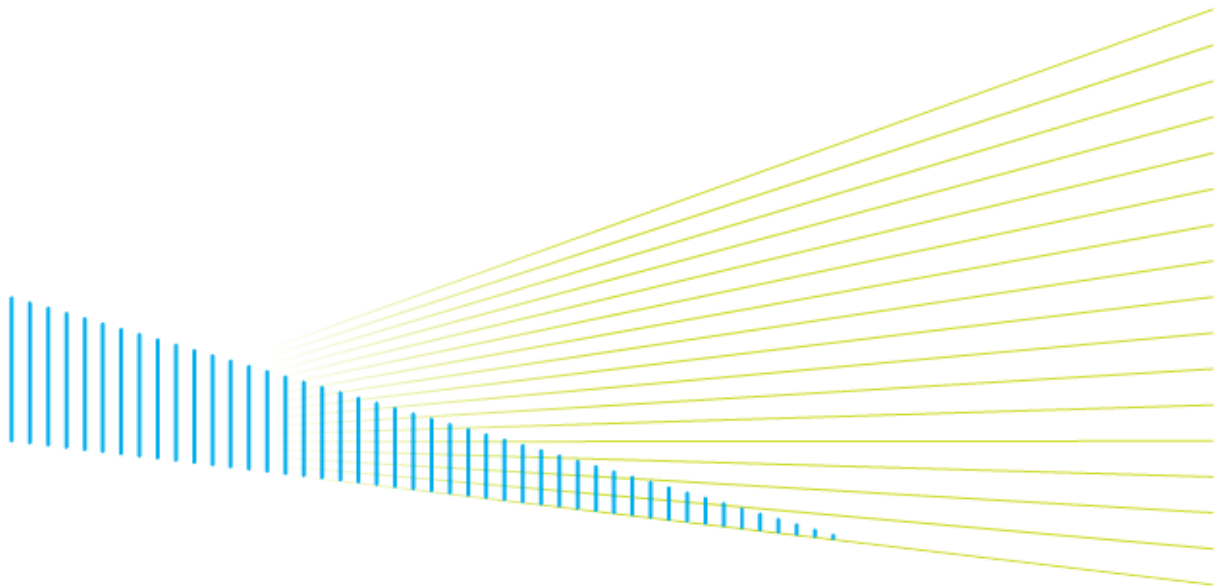


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Market Access for Satellite Services in the New Space Age



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1. Introduction

The global satellite industry is undergoing unprecedented transformation driven by reductions in the cost of accessing space. While this brings the promise of innovation and new services, it also gives rise to important policy questions related to the sustainable use of scarce spectrum and orbital resources, which must be shared equitably by all nations, and concerns about ensuring national sovereignty. These questions include how to manage the risk of interference that could degrade vital services used for communications, navigation, Earth observation, science, defense, and security purposes. **The primary source of this impact is the rapid deployment of commercial constellations consisting of many thousands of satellites in Low Earth Orbit (LEO mega-constellations), the scope and scale of which regulation has never before needed to consider.**

This paper explains how gaps in the historical approach to authorizing satellite services create unintended consequences when applied to LEO mega-constellations. It also provides constructive guidance to enable national administrations to protect and advance national policy interests by leveraging the authorization process for services proposed to be provided by LEO mega-constellations within or over their territories. Among other things, **this paper encourages national administrations to fully evaluate the national policy implications of allowing a LEO mega-constellation to access and provide service to their jurisdictions—before authorizing the LEO mega-constellation to do so—to ensure that appropriate conditions can be adopted if such an authorization is granted.** This evaluation is vital even if a nation has historically used approaches based on “open skies,” “blanket licensing” of user terminals, or deference to satellite network filings made with the International Telecommunication Union (ITU).

It is widely understood that a new approach to regulating use of space is needed to enable every nation to benefit from the innovation and economic promise offered by the New Space Age. As leading experts emphasize:

- **It is imperative that action occur at the national level** because (i) international regulatory frameworks, such as those implemented through the ITU and United Nations, *were not designed with the national policy implications of LEO mega-constellations in mind*; and (ii) *we simply will not reach international consensus in the short term on a new framework for regulating large LEO constellations.*ⁱ
- **It is critical to address the national policy issues at the “market access” stage**, because the decision to allow a satellite or satellite system to serve a nation (whether by granting landing rights, earth station authorizations, service licenses, or otherwise) presents one of the rare opportunities that a nation has to (i) review the impact of satellite operations within or over its territory; and (ii) address national policy goals by denying, limiting, or otherwise conditioning authority to conduct those operations within or over its territory.ⁱⁱ

Forward-looking responses such as the European Union Space Act, and Europe’s Digital Networks Act, recognize the need for new regulatory approaches to address this

changing environment. Moreover, the GSOA satellite trade association has issued a call for action to address the growing sustainability concerns, which involves **engaging in the development of regulations to enable the world** to maximize the beneficial use of space resources and promote their sustainable use, **including by ensuring the continued availability of spectrum and orbital resources.**ⁱⁱⁱ GSOA also recognizes: “Space provides significant benefits to people and our planet and **preserving those benefits in the face of greater utilization of orbits for valuable services requires timely action.**”^{iv}

New regulations are needed to enable satellite systems and services of all types, whether in Geostationary Orbit (GSO) or Non-Geostationary Orbit (NGSO); whether commercial, governmental, or scientific; and whether national, regional, or global in nature.

Notably, 52 countries at the 2025 World Telecommunication Development Conference (WTDC-25):

- Emphasized the need to develop **guidelines and best practices for evaluating the impact of LEO satellite services on sovereignty, security, and spectrum integrity at the national level.**
- Requested the creation of measures to:
 - Promote transparency and prior notification to affected administrations when LEO satellites intend to operate within or over sovereign territory;
 - Support mechanisms for mutual consultation and consent prior to service activation; and
 - **Encourage fair access and prevent dominance or exclusionary behavior in orbital and frequency resource allocation.**^v

That call for action to address the unique issues of national sovereignty posed by LEO mega-constellations builds on Resolution 74 of the 2023 Radiocommunication Assembly (RA-23). In Resolution 74, the international community invited nations, as a matter of urgency, to address:

[T]he prevention of harmful interference, and ensuring the rational, equitable, efficient and economical use of the radio-frequency spectrum and associated orbit resources, **with a focus on non-GSO systems . . . taking into account the special needs of the developing countries and the geographical situation of particular countries.**^{vi}

This paper attempts to fill the gap left by these unanswered calls for action. [Section 5](#) identifies constructive and tangible steps nations should take as they address requests to authorize LEO mega-constellation services within and over their territories.

National market access processes remain the only meaningful opportunity to evaluate how proposed LEO mega-constellation services could affect key policy objectives, such as the promotion of innovation, competition, economic growth, efficient spectrum use, and ensuring national safety, security, and sovereignty.

2. Historical Approaches to Authorizing Satellite Services Are Inadequate for LEO Mega-Constellations

Historically, many regulators have taken a ‘light touch’ approach to authorizing the provision of service within or over their territories by GSO networks and small NGSO systems. This approach was premised on the assumption that those satellite networks and systems would consume limited spectral and orbital resources, and that their operation would not impair the provision of service by others.

This assumption is not valid in the case of LEO mega-constellations. The historical approach does not allow national administrations to either (i) fully evaluate these effects and the other adverse impacts that LEO mega-constellation operations within or over a nation can have on vital policy goals, or (ii) take steps to mitigate those impacts.

A. National Policy Issues Presented by LEO Mega-Constellations

LEO mega-constellations create issues that are qualitatively and quantitatively different than anything that the global community and individual nations have faced previously. Never before has the world needed to manage the issues now posed by just *one* commercial LEO mega-constellation, which seeks to:^{vii}

- Operate around the world in virtually all spectrum available for satellite services below 100 GHz (51 GHz total) and for direct-to-device (D2D) service.
- Operate in spectrum already used by others to provide vital satellite services, and with no demonstration of compatibility with those existing services.
- Deploy 49,000 satellites across prime LEO orbits.
- Occupy a 444 km orbital range (240-684 km), encompassing the most valuable LEO orbits.
- Employ hundreds of steerable beams per satellite operating at elevation angles as low as 5 degrees and sweeping across the sky.
- Use very wide antenna beams associated with countless user terminals as small as 15 cm, making spectrum sharing with others even more difficult.

Operations on these terms within or over any nation could impair and even foreclose the ability of other satellite systems and networks to access the spectrum and orbits they need to provide innovative and competitive services to that nation, or to otherwise serve the sovereign defense and security needs of that nation. Among other things, operations of this type could generate material interference towards other satellites

(both NGSO and GSO) that degrades signal quality, reduces data throughput, and impairs the reliability of vital services (or prevents them from operating altogether).

Notably, this one LEO mega-constellation is not alone. Plans for another commercial LEO mega-constellation present similar issues across the world. Indeed, the second operator has gone so far as to boast that “there will be two players in LEO.”^{viii}

Moreover, the same commercial operators are now planning to launch up to **one million additional satellites a year**^{ix} as part of a plan to fill LEO with AI data centers^x—an additional initiative that inevitably would consume even more shared and scarce spectrum and orbital resources.

As one expert has explained, one LEO mega-constellation’s control over the skies could “fundamentally alter the relationship between a state and its citizens,” because:

For the first time, a private company will be able to provide global communications services that bypass national networks, government oversight and geographic boundaries.^{xi}

And as another report explains: “Many leaders want control over satellites because they worry private companies could limit access, according to space-industry executives.” **For these and other reasons, nations are increasingly investing in developing their own dedicated satellite capabilities. But those capabilities can be realized only if a nation has access to the spectrum and orbital resources needed to support its own independent operations.**^{xii}

Moreover, press reports abound about how some mega-constellations have already operated without regard for national regulatory frameworks, including by providing service to illegally imported terminals.^{xiii}

For these reasons (among others), it is critical that national market access reviews include suitable mechanisms to evaluate the impact of LEO mega-constellation operations within or over a nation’s territory in ways that could undermine the competitive landscape, the introduction of diverse and innovative satellite services by other service providers, and the realization of national sovereignty, defense, and security goals.

B. The Economic Opportunities and Strategic Capabilities at Stake

The economic opportunities in the New Space Age are vast. The size of the global space economy is expected to triple in the next ten years. This growth will yield new opportunities for a wide range of industry participants to support new and advanced capabilities, including:

- **Communications and Monitoring:** Global broadband; Internet of Things (IoT) networks; precise positioning and navigation; Earth observation capabilities for agriculture, weather, and environmental monitoring; seamless global connectivity.

- **In-Space Manufacturing:** Leveraging space's unique microgravity, vacuum, and radiation to create advanced materials, pharmaceuticals, semiconductors, and complex structures impossible to make on Earth.
- **Logistics & Supply Chain:** Space-enabled tracking, autonomous transportation, and new delivery models.
- **Data & Analytics:** Leveraging space-collected data for finance, security, and consumer purposes.
- **Defense & Security:** Enhanced national security and cybersecurity through space assets.
- **Agriculture:** Satellite data for precision farming, irrigation, and yield prediction.
- **Transportation:** Better navigation for airlines, support for autonomous vehicles, ship, and aircraft.
- **Finance:** Secure, encrypted banking and securities exchange services.

Moreover, space is the new geopolitical frontline, and the ability for a nation to act independently in space, or in coordination with its allies, is vital to national security. As thought leaders from Europe explain, “space is the foundation of modern defence readiness, enabling critical surveillance, connectivity, and security capabilities.”^{xiv}

Notably, space technology is inherently dual-use, enabling both civilian and military capabilities. **The commercial satellite systems that are at risk of increased interference from LEO mega-constellations also provide vital defense and security capabilities.**

New technologies are at hand today to allow any nation around the world to participate in the New Space Age, including by leveraging innovative solutions that serve as alternatives to relying on LEO mega-constellations.

These new technologies support:

- **Competitive offerings**
 - Operating state-of-the-art, low-cost GSO satellites that can deliver the same speeds and prices to users that mega-LEO-constellations deliver, for market segments such as direct-to-consumer, backhaul, aeronautical, maritime, land mobile, and connectivity for national defense and civil purposes.
 - Reselling, distributing, or integrating GSO or LEO services from any network or system (other than a mega-constellation).
 - Operating the same types of small user terminals that LEO mega-constellations utilize.

- **National capabilities**
 - Operating a sovereign GSO constellation (as many nations do today).
 - Operating a sovereign LEO constellation.
 - Otherwise enjoying the benefits of satellite-enabled national security services that enable a host nation to defend its national interests.
 - Utilizing dual-use satellites (GSO or NGSO) that can serve competitive commercial as well as national defense and civil service needs.

- **Multi-orbit capabilities**
 - Deploying or using configurations that deliver the benefits optimally provided by satellites in different orbits (both GSO and NGSO).

- **Downstream products and services**
 - Providing hardware, software, operational components, ground infrastructure and user terminals, launch services and support, ground infrastructure, user terminals, application development, network operations, financing, and insurance to national or regional satellite operators or distributors in support of satellites providing any of the other services described above.

Absent the application of suitable measures at the national market access stage, the operations of a LEO mega-constellation within or over a nation’s territory could preclude others from supporting these vital capabilities and prevent nations from enjoying the benefits of these economic and strategic opportunities.

These are some reasons why nations must develop effective tools for (i) evaluating the issues presented by the operation of LEO mega-constellations within or over their territories, and (ii) managing or mitigating policy concerns. As detailed below, **the development and application of appropriate regulations is essential to ensure that opportunities in the New Space Age remain available to any nation in the world, and are not precluded by the operations of any LEO mega-constellation. *The time is now to ensure that those regulations are in place.***

3. The Critical Role the National Satellite Service Authorization Process Serves in Advancing Sovereign Interests

The national “market access” process for authorizing the provision of satellite services within or over a nation’s territory provides a critical opportunity for evaluating the national impact of allowing services by a LEO mega-constellation. This includes consideration of how doing so could consume scarce and shared spectrum and orbits, and more generally affect key policy objectives (e.g., promoting innovation, competition, economic growth, and efficient spectrum use, and ensuring national safety and security, consistent with sovereign interests).

Market access for a satellite service can be granted by a nation in a variety of ways, including through:

- Landing rights for the satellite system over which service is provided.
- Licenses for the gateway stations that may be used within the nation to communicate with the satellite system.
- Authorization of user terminal operations within or over the nation's territory.^{xv}
- Service licenses.
- Equipment authorizations.

Whatever the approach used, **a grant of market access implicitly or explicitly includes permission** for a satellite system or network, or the entity providing service over those facilities, **to use a nation's vital natural resources (including radio-frequency spectrum and associated orbits).**

While historically spectrum and orbits were efficiently shared under longstanding international conventions, that situation has fundamentally changed with the introduction of LEO mega-constellations. **Nations no longer can rely on the efficacy of international conventions or assume that other service providers will be able to share spectrum and otherwise coexist with LEO mega constellations.**

In evaluating any request for market access involving a LEO mega-constellation, **nations should ensure that those mega-constellation operations can coexist with other users whose business or operations rely on equitable access to the same spectrum and orbits.** Indeed, it is essential that a review of such a request include the ability to fully consider spectrum availability, competition, national security, law enforcement, foreign policy, and trade impacts, as well as satisfaction of national eligibility and operating requirements.

Notably, mitigating the harms of granting market access may require (if access is granted at all) that **specific conditions be imposed on any grant, including to prevent (i) interference that could impair the operation of other satellite systems, and (ii) the opportunity to bypass national security and telecommunications requirements.**

These considerations are particularly important in the New Space Age, where the market dynamics described above otherwise create new opportunities for all nations to participate in the global space economy, even if the nation historically has not been a member of the small club of space-faring nations.

The continued availability of spectrum and associated orbits within and over a nation is vital for realizing these opportunities and achieving economic growth and national security, and also for maintaining national sovereignty.

4. Significant Gaps Exist in Existing Regulatory Processes

Experiences over the past few years reveal that **significant gaps exist in regulatory processes that were not developed with LEO mega-constellation operations in mind**. These gaps exist under the ITU’s rules and procedures and also at the national level, especially for nations that use licensing procedures that generally just rely on the ITU for guidance. The following examples **explain why specific actions at the national level—including developing more robust market access procedures and requirements—are necessary**:

- The ITU does not license LEO mega-constellations; it simply registers their claims to spectrum and orbits.
- While the ITU has tried to stop the provision of unauthorized LEO mega-constellation services, it is ultimately powerless to do so—the ITU lacks enforcement tools. Moreover, some claim that this problem is a matter to be addressed *only* by the affected nations.
- Neither the ITU’s Master International Frequency Register (MIFR), nor the underlying ITU filings, provide all the information required for an administration to understand fully the nature of the proposed operations of a LEO mega-constellation and assess the interference risks associated with those operations (e.g., they do not include actual radiation patterns of satellite and earth station antennas, number of co-frequency beams per satellite, etc.). Moreover, the information provided to the ITU often has internal inconsistencies.^{xvi}
- Inclusion in the MIFR does *not* reflect a conclusion about the absence of interference or other risks presented by a given satellite or system. For example, LEO mega-constellations can be entered into the MIFR even before coordination has been completed with other affected satellites (NGSO or GSO), and even if the ITU has determined that the mega-constellation has the potential to cause harmful interference to others. And the ITU does not evaluate all relevant interference scenarios in any event. For example, the ITU does not conduct a technical examination of the ability of a LEO mega-constellation to operate co-frequency with other NGSO systems without causing harmful interference.
- LEO mega-constellations are being deployed today that do not conform to the characteristics in their ITU filings, that are artificially broken up into separate ITU filings to mask their full interference impact, and that when considered together as a single constellation, exceed the interference prevention provisions of Article 22 of the ITU Radio Regulations. Those provisions, known as equivalent power flux density (EPFD) interference limits, constrain the level of interference any LEO mega-constellation may generate toward GSO satellite operators.
- The Director of the ITU’s Radiocommunication Bureau explains that the practice of splitting a LEO constellation into several ITU filings “may affect the effectiveness of single-entry [EPFD] limits contained in Article 22 to protect geostationary systems or have an impact in the implementation of Resolution 76

(Rev.WRC-15).”^{xvii} As his report to WRC-23 details, this artifice was first recognized 22 years ago, and the conclusion reached then was that the only reason to misapply single-entry EPFD limits by artificially splitting up the components of a LEO constellation would be to artificially suppress the expected EPFD levels otherwise calculated by the ITU’s paper examination of a filing.^{xviii}

- The ITU does not evaluate the ability of a LEO mega-constellation operator to actually operate in a manner consistent with the data in its ITU filings, and concerns have been raised that some inputs in the data files provided to the ITU are inconsistent with the laws of physics.
- LEO mega-constellation operators have been known to mask the true interference impact of their operations by (i) not including in their ITU filings all the elements of their networks that generate interference, and (ii) conducting interference assessments at limited locations on the Earth that are not representative service locations of the affected GSO network and that typically are not within the nations over which they propose to operate.^{xix}
- The ITU does not evaluate whether the operation of multiple NGSO systems in the same spectrum within or over a nation complies with the ITU interference prevention provisions that apply to all NGSO systems that share the same spectrum, under ITU Resolution 76.^{xx} Addressing and managing compliance with these interference criteria is essential to avoid harm to GSO services operating within and over a nation’s territory. As GSOA recognizes, the process “requires a measure of transparency, ensuring that non-GSO participants appropriately discharge their responsibility towards GSO networks.”^{xxi}
- There is no ITU mechanism to implement the mandate of Article 44 of the ITU Constitution to ensure that operators from all nations, including LEO mega-constellations, use limited spectrum and orbital resources “rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular country.”
- The **gateways** that support a LEO mega-constellation are a particular concern because they tend to use many antennas at a single gateway site called an “antenna farm.” One mega-constellation plans to deploy 32 antennas at a single gateway site and to use several antenna farms within a country. In this case, dozens of satellite beams will transmit at any time to each antenna farm, and dozens of gateway antennas will track across the sky to stay in communication with different mega-constellation satellites, further constraining the availability of “look angles” for other NGSO operators seeking to provide service within and over the same country. This interference dynamic is not addressed by the ITU, and careful interference analyses and specific conditions at the national level are required for LEO mega-constellation gateways to ensure that they do not “sterilize” a wide region around them and impair the ability of

other satellite systems to deploy gateways or user terminals within or over the nation.

- The use of blanket license or license exempt regimes for authorizing LEO mega-constellation **user terminals** within or over a nation presents significant risks that should be evaluated and mitigated through suitable national regulation. Historical blanket licensing and license exempt regimes are based on traditional uses of spectrum, and typical earth stations and coexistence scenarios that do not factor in the operation of mega-constellations.

Critically, these historical approaches rely on either (i) quantified interference criteria and an assessment of compliance with those criteria to mitigate the risk of interference between satellite systems and networks, or (ii) the assumption that a NGSO system can equitably share spectrum with other NGSO systems. In the case of LEO mega-constellation coexistence with other NGSO systems and with GSO networks, these criteria either do not exist or are not being appropriately assessed, as explained above.

Moreover, the risk of interference from LEO mega-constellation to other satellite networks and systems is significant, and even more so when the mega-constellation uses very small and mobile user terminals with wide beamwidths. Under current approaches to licensing, this impact on existing and subsequently deployed NGSO systems is not considered.

The ability of a LEO mega-constellation to employ small user terminals without creating harmful interference depends on its successful coordination with other satellite systems and all the different terminal types used on those other systems. But LEO-mega-constellation operators often have undue leverage in the coordination process.^{xii} And, as noted above, LEO mega-constellations are being entered into the MIFR without having completed that coordination, and without regard to their preclusive effects on other NGSO systems in general.

For these reasons, national licensing approaches that rely on the ITU are inadequate. Further national regulations and assessments are needed to ensure that a LEO mega-constellation does not create undue interference within or over a nation's territory.

Similarly, a nation cannot safely assume that a LEO mega-constellation licensed by another administration will not create undue interference within or over the nation's own territory. Increasingly, some administrations are authorizing LEO mega-constellations to operate globally—including over other nations—without evaluating whether the mega-constellation can coexist with other spectrum users and protect existing and planned operations within and over those other nations. This approach shifts the burden of reviewing and policing such matters onto the other nations being served. **It is critical that nations use their own market access processes to fill the gap left by this approach.**

LEO mega-constellation operators also seek to change or avoid the longstanding criteria used to prevent them from generating interference into other users of the same spectrum. That is, they seek to alter national and international regulatory frameworks in order to produce higher interference toward other satellite networks in the Fixed Satellite Service (FSS), Broadcasting-Satellite Service (BSS), and Mobile Satellite Service (MSS), which could: (i) degrade existing service quality and operational reliability; (ii) prevent other satellite operators from improving the performance of their networks in the future; and (iii) prevent others from offering the same types of service capabilities as the LEO mega-constellations. This comes in the form of proposals to change the interference limits that currently apply to them, and in the form of requests for waivers that would allow them to ignore those limits.

5. Recommended Approaches for Authorizing Service from LEO Mega-Constellations at the National Level

As discussed above, LEO mega-constellation operations present material questions about the equitable and efficient use of shared spectrum and orbital resources, interference into the operations of others, and the ability of a nation to achieve its national sovereignty, defense and security goals. These considerations must be evaluated and managed at the market access stage—**one of the only opportunities a nation has to (i) evaluate** the issues presented by the operation of a LEO mega-constellation within or over its territory, **and (ii) attempt to address any policy concerns** through appropriate limits and conditions on the provision of service and the use radio-frequency spectrum within or over its territory.

Administrations must **supplement ITU rules and procedures with their national licensing procedures and requirements to effectively protect and advance their sovereign interests.**

Notably, the commercial satellite industry already successfully navigates various national and regional regulations that differ from those of the ITU. For example, the United States Federal Communications Commission requires all non-U.S.-licensed satellite systems seeking market access to comply with U.S. requirements, even when U.S. requirements vary from (i) international conventions, or (ii) those of the licensing administration of the satellite system.^{xxiii} In doing so, the U.S. ensures compliance with its national policy goals, including the “effect on competition in the United States, as well as issues of spectrum availability, eligibility requirements and operating requirements, national security, law enforcement, foreign policy, and trade.”^{xxiv}

For these reasons, **regulators should take the actions detailed in Sections A, B and C below to strengthen their national frameworks for authorizing LEO mega-constellation satellite services within and over their territories.**

A. Establish Suitable National Regulations Governing LEO Mega-Constellations

- A national process should be established to ensure that:
 - Interested governmental ministries and authorities have an opportunity to assess the impact of a grant of market access on the nation’s policies and goals regarding matters such as spectrum availability, competition, national security, law enforcement, foreign policy, and trade, as well as compliance with national eligibility and operating requirements.
 - Interested parties have the ability to review and comment on the application in a public process.
 - Mandatory pre-authorization interference assessments occur for LEO mega-constellations vis-à-vis other NGSO and GSO capabilities that serve the needs of the nation.
- National regulations should require full compliance with Article 22 of the Radio Regulations, including the existing framework for limiting interference from a single NGSO satellite system into GSO networks in the specified spectrum bands (which are critical for broadband and broadcast services).
 - Article 22 is the principal provision relating to the coexistence of LEO mega-constellations with GSO networks in key FSS and BSS spectrum bands. Article 22 requires that a mega-constellation not cause *unacceptable Interference* to GSO networks, and is fundamental to continued GSO network operation, including the ability to deploy the types of small and phased array terminal antennas that LEO mega-constellation system operators deploy today.
 - In frequency bands not subject to Article 22, national regulations should go beyond the general ITU coordination requirements in Article 9.1 of the Radio Regulations and ensure (i) non-interference with already established satellite services and other forthcoming services, and (ii) equitable sharing with other NGSOs and with GSO operations. For example:
 - In MSS bands where a mega-constellation has not reached coordination with already authorized NGSO systems and GSO networks, *no mega-constellation authorization should be granted.*
 - In FSS bands where a mega-constellation has not reached coordination with a GSO satellite network (as required by Article 9.1), any authorization that may be granted should be *conditioned on compliance with the EPFD interference criteria that apply to adjacent frequency bands.*
- National regulations should require that a market access application include an empirical demonstration that a LEO mega-constellation complies with *all* of the

single-NGSO-system and aggregate-NGSO-system interference prevention provisions in Article 22 and ITU Resolution 76, considering:

- The LEO mega-constellation as a whole (and irrespective of the number of ITU filings under which it may seek to operate).
- All other NGSO systems serving, or seeking to serve, that same nation.
- The required Article 22 and Resolution 76 compliance demonstration should include, among other things:
 - Information about the number of satellite beams used for transmissions on the same frequency in the same, overlapping, or nearby, areas at any given time.
 - A demonstration how the LEO mega-constellation avoids interference to GSO networks created by LEO earth station and satellite antenna sidelobes, and earth station antenna backlobes, particularly when phased array antennas are employed.
 - An analysis whether the portion of the LEO mega-constellation to be used to serve the nation's territories is able to meet the interference prevention limits.
 - An examination of interference cases that are not tested by the limited examination conducted by the ITU at a single location on Earth, which is typically not within the nation's territory.
- The market access application should include a demonstration of (i) successful coordination with other satellite systems and networks in frequency bands not subject to Article 22 and Resolution 76, and (ii) equitable sharing with other NGSOs and with GSO operations.
- National regulations also should:
 - Ensure that all NGSO systems authorized to serve a nation in any given frequency band can equitably share the "look angles" to and from space that are needed to serve that nation. This can be done by dividing up the range of satellite azimuths as seen from a location on the Earth whenever the potential for NGSO/NGSO interference exists at that location.
 - Establish other enforceable interference measures to prevent LEO mega-constellation interference into other NGSO and GSO operators serving the needs of a nation, such as:
 - Limiting the frequency bands authorized to be used by a LEO mega-constellation within or over the nation.

- Establishing the minimum size of user terminals authorized to be used by a LEO mega-constellation within or over the nation.
 - Requiring that the LEO mega-constellation not cause unacceptable interference into GSO networks and not claim interference protection from GSO networks.
 - Requiring the LEO mega-constellation to have an operational feature that allows it to immediately interrupt radio frequency emissions to ensure non-interference.
 - Requiring that the LEO mega-constellation cease service to the nation if interference into a GSO network occurs, and not recommence operations until the mega-constellation resolves the cause of the interference.
- Require that all NGSO systems serving the nation, as a collective, not exceed Resolution 76 aggregate EPFD interference criteria.
- If aggregate interference to a GSO network from signals transmitted by multiple NGSO systems is detected, and it is not possible to identify the NGSO system generating the interference, require that all NGSO system operators serving the nation promptly cooperate with each other and take the technical measures necessary to eliminate the interference.
- Require that the characteristics of a LEO mega-constellation (e.g., radio frequency, avoidance angle, orbital characteristics, number of satellites, etc.) not be modified without prior consent from the national regulator with respect the authorizations it has issued.
- Require that any entity providing service via a LEO mega-constellation submit, every six months, a report showing compliance with the obligations attached to any national authorizations granted.
- Establish clear and meaningful penalties for non-compliance with national requirements and conditions.

B. Thoroughly Review Market Access Applications Involving a LEO Mega-Constellation

- Review of a market access application by the nation’s authorities should include:
 - An assessment of the impact on the nation’s policies and goals regarding matters such as spectrum availability, competition, national security, law enforcement, foreign policy, and trade.

- An assessment of the ability of the LEO mega-constellation to comply with the national security and telecom requirements of the nation, as well as its national eligibility and operating requirements.
- An independent analysis of the application, including:
 - Required compliance showing regarding interference protection provisions (EPPD).
 - Claimed coordination and other compatibility with established satellite services, and sharing with other NGSOs and with GSO operations, including whether the LEO mega-constellation has exerted undue leverage in the coordination process.^{xxv}
 - Integrity of the underlying LEO mega-constellation ITU filings and the interference analyses provided in the market access application.
 - Whether the orbits used in the interference analyses are consistent with the orbits licensed by the system's authorizing administration.
 - Whether the GSO avoidance angles proposed are consistent with the power flux density and EIRP density masks provided, and whether these masks provided for different orbital shells (*i.e.*, the particular combination of orbit altitudes and inclinations) are consistent with (i) each other and (ii) the actual antennas used on the satellites.

An independent analysis by the authorities is vital, because any inconsistency in the data provided in the application can be used to game the process to produce false results.

Similarly, relying on ITU filings alone (which typically are made *before* a constellation is deployed) may not reflect the parameters of the satellites or earth stations *actually deployed*, and as system modifications occur over time (*e.g.*, changes in iterative versions of the satellites).

C. Impose Suitable Conditions on Any Grant of Market Access Involving a LEO Mega-Constellation

- Should a nation grant market access, conditions on the grant should include requirements that the LEO mega-constellation's operations within or over the nation:
 - Fully comply with single-NGSO-system interference prevention provisions in Article 22 of the ITU Radio Regulations and all the parameters provided in the constellation's underlying ITU filings (*e.g.*, the maximum number of co-frequency beams serving a specific location, the minimum GSO arc avoidance angle, the downlink power flux density and uplink EIRP density masks).

Compliance should be (i) based on the actual characteristics of the LEO mega-constellation deployed, including the radiation patterns of its satellite antennas and all sizes and types of earth stations (gateways and user terminals), and (ii) established for the entirety of the constellation (no matter how many ITU system filings under which it may operate).

- Maintain a suitable GSO arc avoidance angle, taking into account the actual characteristics of affected GSO networks (such as satellite receiver noise temperature and antenna gain, and sizes and characteristics of user terminals).
- Have an operational feature that allows the immediate interruption of radio frequency emissions to ensure non-interference.
- Cease service to the nation if interference occurs, and not recommence operations until the LEO mega-constellation has resolved the cause of the interference.
- Not modify the characteristics of the LEO mega-constellation (e.g., radio frequency, avoidance angle, orbital characteristics, number of satellites, etc.) without prior consent from the national regulator with respect the authorizations it has issued.
- Comply with the national security and telecom requirements of the nation.
- Such other conditions as the circumstances require, including providing a staged grant of authority for certain numbers of satellites, to ensure that the mega-constellation can actually operate as represented.

6. Conclusion

Robust national authorization frameworks are critical for LEO mega-constellation services proposed to be provided within or over a nation. Such frameworks are essential to advancing national interests, including:

- Promoting competition, investment, and innovation by a wide range of satellite service providers.
- Ensuring that national policy goals can be achieved, including economic growth, universal connectivity, sovereign independence, and national defense and security.

A grant of market access to a LEO mega-constellation implicitly or explicitly **includes permission to use the nation’s vital natural resources — radio-frequency spectrum and associated orbits.**

Nations must **supplement ITU rules and coordination procedures with their own authorization procedures and requirements** to effectively protect and advance their own sovereign interests.

In the LEO mega-constellation context, **deference to authorization processes developed years ago when access to space was uncontested is no longer appropriate.** Doing so would risk leaving a nation out of the global space economy and without shared access to the space resources that are needed to secure its place in the New Space Age and otherwise secure its sovereign interests.

Endnotes

- i Romain Buchs, EPFL International Risk Governance Center, *Policy options to address collision risk from space debris*, at ii (2021), <https://infoscience.epfl.ch/server/api/core/bitstreams/d972d09f-11d8-4e7a-b8f9-b736392970eb/content> (“Given that the prospect of reaching consensus in the short term is very low, governments are advised to take unilateral but coordinated action by improving their national regulations.”).
- ii See French Le Conseil d’Etat, Decision No. 455321 (Apr. 5, 2022), <http://www.conseil-etat.fr/fr/arianeweb/CRP/conclusion/2022-04-05/455321>.
- iii See GSOA: Further Commitments on Space Sustainability 2024 (Dec. 2024), <https://gsoasatellite.com/wp-content/uploads/GSOA-Space-Sustainability-Dec-24.pdf>.
- iv See <https://gsoa.space/topics/space-sustainability/> (last visited Jan. 14, 2026).
- v See Member States of the African Telecommunications Union, Proposals for Work of the Conference, WTDC-25 (Baku), Document WTDC-25/4909-E (21 Oct. 2025), at *resolves* 1, 3.
- vi ITU-R Res. 74 (Rev. Dubai, 2023), at *resolves* 1, https://www.itu.int/dms_pub/itu-r/opb/vadm/R-VADM-RES-2023-PDF-E.pdf.
- vii SpaceX has various related licenses and applications before the U.S. Federal Communications Commission, including ICFS File Nos. SAT-MOD-20241011-00224 ([link](#)) and SAT-AMD-20241017-00228 ([link](#)); SAT-LOA-20250916-00282 ([link](#)) and SAT-AMD-20251125-00339 ([link](#)); SAT-MOD-20250805-00200 ([link](#)); *Authority to Add a Direct to Cellular System*, Order and Authorization, DA 24-1193 (rel. Nov. 26, 2024) ([link](#)); see also Letter from SpaceX to the FCC, ICFS File Nos. SAT-LOA-20200526-00055, SAT-AMD-20210818-00105, SAT-AMD-20221216-00175; SAT-MOD-20241011-00224 and SAT-AMD-20241017-00228 (Jan. 31, 2025) (available via this [link](#) under “Pleadings and Comments” tab); *Authority for Modification of the SpaceX Gen2 NGSO Satellite System*, Authorization and Order, DA 26-36 (rel. Jan. 6, 2026) ([link](#)).
- viii Rachel Jewett, *Amazon CEO on Kuiper: There Will Be 2 Players in LEO*, VIASATELLITE (Aug. 1, 2025), <https://www.satellitetoday.com/connectivity/2025/08/01/amazon-ceo-tells-investors-there-will-be-2-players-in-leo/>.
- ix *Musk Discusses Launching 1 Million Tons of AI Satellites Annually*, TIGER TRADE (Dec. 7, 2025), <https://www.itiger.com/news/1192308484>.
- x Micah Maidenberg and Becky Peterson, *Bezos and Musk Race to Bring Data Centers to Space*, WALL STREET JOURNAL (Dec. 10, 2025), <https://www.wsj.com/tech/bezos-and-musk-race-to-bring-data-centers-to-space-faa486ee>.
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- xii Micah Maidenberg, *Governments' New Must-Have: Their Own Satellites. Desire for more sovereign control over satellite services juices demand for satellite fleets across the globe*, WALL STREET JOURNAL (Jan. 26, 2026), <https://www.wsj.com/business/telecom/governments-new-must-have-their-own-satellites-e7e801a3?mod=Searchresults&pos=1&page=1>.
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- xiv Anders Fogh Rasmussen and Josef Aschbacher, *Space is now essential to European security*, EURACTIV (Dec. 17, 2025), <https://www.euractiv.com/opinion/space-is-now-essential-to-european-security/>.
- xv Different regimes for authorizing user terminals can apply to those used at fixed locations and to mobile terminals. The licensing approaches used can include individual licensing, blanket licensing, general authorizations, and exemptions from licensing.
- xvi See Viasat, Inc., *Inconsistency of non-GSO efpd input parameters and impacts related to Recommendation ITU-R S. 1503*, ITU WP4A Doc. 4A/488, (Apr. 23, 2025).
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