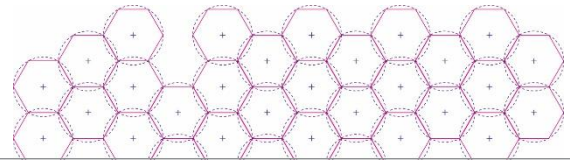


Balancing act: regulating space services

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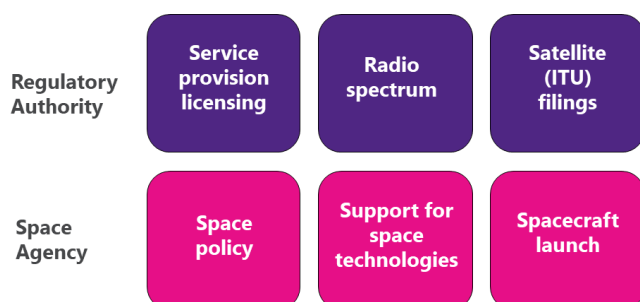
Understanding the regulations adopted by national regulators for the authorisation of space services can be a challenging task. Over the years, various authorisation schemes have evolved and been adopted in different countries. However, by its very nature, the space sector requires international cooperation, and the lack of standardisation has resulted in different requirements for the provision of space-based telecommunication services and how Earth stations and satellites access radio spectrum. With the number of satellites orbiting the Earth increasing, there is a need for countries to make clear their approaches to spectrum authorisation and satellite filings. The complexity of this issue is likely to increase with several new satellite constellations, each comprising hundreds of satellites and aiming to offer a range of new services, and by diverging regulatory requirements of space services and applications ranging from fixed and mobile satellite communication networks, to space research systems examining physical characteristics of celestial bodies. This paper outlines the approaches adopted worldwide for regulating space services and highlights key challenges mainly faced by national authorities.

Overview of space services regulatory frameworks

In general, countries have a primary regulatory instrument – a telecommunications law or act – which defines responsibilities of authorities in governing the telecommunications sector. The authorities established under this legal framework develop secondary and other instruments (regulations and guidelines) to define their rules and approaches associated with telecommunications service and spectrum authorisations.

The most common approach is for regulation of the space sector to be divided between the telecommunications regulatory authority and space agency, as shown in Figure 1.

Figure 1: Space sector regulatory responsibilities



The telecommunications regulatory authority is typically an independent organisation and responsible for the authorisation and enforcement functions related to the service provision and radio spectrum use. These, for example, include service licences, Earth station and space station spectrum authorisations, and satellite spectrum filings.

The national space agency is generally an executive agency of the relevant ministry. They are involved in high level space policy decisions and development of space technology capabilities through supporting research activities as well as issuing authorisations for the launch of spacecraft.

These two regulatory authorities may not be the only bodies involved in overseeing the space sector: due to the many uses of satellites, there are likely to be roles for military, information and transportation regulators. However, telecommunications regulators usually play the largest role due to the use of satellite networks for telecommunications services, and the need for spectrum access. In both cases, regulators must consider how rules are set to take account of the fact that the service is being provided from outside a country's borders, and there must therefore be international cooperation to ensure effective regulation.

From extensive benchmarking and subsequent analysis of the space sector, we have identified that regulators adopt a range of approaches to regulate the service provision and spectrum access for satellite networks. These approaches range from short guidelines, accompanied by regulations developed on a case-by-case basis with no overall strategy, to detailed instruments describing rules and regulations for specific services offered and frequency bands used. In the following sections, we have attempted to summarise some of the key practices.

Telecommunications service provision via satellite networks

Fixed and mobile satellite communications networks can be deployed to support a range of services. Examples include:

- Internet services;
- News gathering;
- Commercial aerospace;

- Mobile satellite phones;
- Direct-to-home broadcasting; and
- Defence and maritime applications

It is important to recognise that, due to the international nature of satellite networks, appropriate provisions need to be in place to authorise delivery of these services to the domestic markets. We have noted that, in broad terms, there are two commonly used approaches:

- The general authorisation regime; and
- Authorisation from network infrastructure licensing and service provision licensing.

A **general authorisation regime** is where general conditions of entitlement apply to all providers. Under this regime, service licenses are not required to provide communications networks and services so long as a simple declaration of compliance with general obligations, typically outlined in the relevant national telecommunications act, is undertaken.

General obligations often include clauses related to compliance with minimum service performance requirements, subscriber data confidentiality, public safety and national security requirements, prevention of anti-competition and technical standards. There may be exceptions and specific conditions can also be defined under certain circumstances, for example, to address competition issues or where a provider is being designated as a universal service provider.

The general authorisation regime offers simplicity, minimised administrative process for the national regulator, transparency (as the conditions are in the public domain and no evaluation by the regulatory body is necessary), promotion of competition due to ease of access to the national market and, if adopted in neighbouring countries, simplified cross-border service provision for global or regional operators. On the other hand, the difficulties associated with adopting a general authorisation regime for satellite networks are mainly related to national security and domestic legislative limitations resulting from the way that the telecommunications market is regulated in a country.

There are different methods of implementing an **authorisation regime based on licensing of network infrastructure owners and service providers** where individual or class authorisations are used to allow satellite services.

One example approach is based on issuing an individual authorisation for network infrastructure owners only while facilitating class authorisation (based on a simple registration with the authority to confirm compliance with general conditions) for service providers who are using the authorised network infrastructure.

Some regulatory frameworks include a specific authorisation category for satellite networks – international service provision

category. Under this category, additional requirements are defined including, for example, information on ownership and the countries where services are to be provided.

The common feature of these authorisation regimes is establishing more control over the network and service providers compared to the general authorisation regime, for example, to protect the interest of national operators and/or to address concerns over national security issues. However, maintaining these regimes is likely to be increasingly challenging due to the current developments of mega constellations and associated services.



New generation constellations with thousands of satellites in near-Earth orbits coupled with diverse range of services offered, are putting a strain on satellite network authorisation regulations.

Authorisation for Access to Radio Spectrum

In addition to regulating satellite networks for providing telecommunications services, there is also a need to authorise access to the radio spectrum, which is a finite resource. The commonly adopted approach among authorities is to separate telecommunication service authorisation from the radio spectrum authorisation. Separate regulatory instruments are developed to enable Earth stations and/or satellites to access the radio spectrum.

Several authorities have a streamlined process, controlling the space service radio spectrum use by means of Earth station authorisation which follow standard International Telecommunications Union (ITU) procedures defined for handling satellite filings to address the issue of satellite spectrum authorisation. However, there are also authorities that define additional regulations for satellite spectrum authorisation.

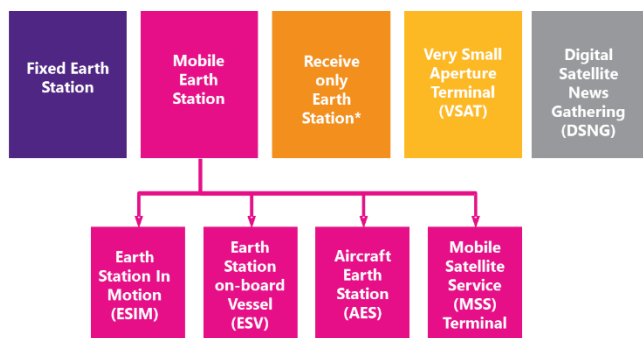
Earth station spectrum authorisation

We have noted that the established practice is to define distinct Earth station categories and describe associated authorisation obligations for each category. The regulatory structure tends to be defined in terms of:

- Definitions and scope;
- Categories of Earth stations;
- Technical conditions for each category; and
- Frequency assignments.

Most regulatory frameworks identify Earth stations split into categories shown in Figure 2.

Figure 2: Earth station categories



Note: * Receive-only earth stations may also be categories of fixed and mobile earth stations and VSAT terminals.

Spectrum authorisation of mobile Earth stations is one area where there has been significant recent activity. This is due to the rapid expansion of mobile satellite applications as shown in Figure 2. This has led to implementation of a mixture of individual spectrum authorisations and exemption arrangements, and, in some cases, authorisation is on an ad-hoc basis rather than following a strategy.

In cases where spectrum sharing conditions are favourable, spectrum class authorisation or licence exemption mechanisms are often employed to enable certain applications to access spectrum without the need for formal spectrum authorisation. These applications may, for example, include Mobile Satellite Service (MSS) terminals, receive only Earth stations and Global Navigation Satellite System (GNSS) receivers.

General regulatory conditions and technical conditions defined for each Earth station category need to be concise and include references to ITU Radio Regulations (for example, power flux density limits and antenna off-axis emission levels) and domestic regulations (for example, site clearance and coordination requirements).

Satellite spectrum authorisation

In addition to authorising various categories of Earth stations, there are also mechanisms defined for authorising satellites themselves. This is primarily implemented through ITU satellite filing procedures. Some authorities also define their own provisions for authorising the spectrum used by the satellites alongside ITU satellite filing procedures to achieve efficient use and raise revenues.

The preferred approach for handling satellite filings is to define applicable procedures in the form of guidelines which can be updated as necessary following decisions taken in World Radio Conferences. The level of detail provided in guidelines can vary

significantly among authorities. Figure 3 illustrates an example guidelines structure.

Figure 3: Example Satellite Filings Guidelines Structure



We have noted several different approaches. In some cases, the relevant regulatory authority may input a satellite filing by using an appropriate set of parameter values compatible with its national networks, submit it to ITU and undertake international coordination activities itself for future operations of satellite operators based in the country. The coordinated filing is then offered to satellite operators by using an appropriate award scheme which may be 'on merit' or auctioning.

In the case of space science filings, they usually follow an informal pre-ITU coordination procedure involving space agencies to address frequency coordination issues before the submission to ITU. This is because many space science applications need sustainable access to radio spectrum that is sufficiently free from interference to allow reliable and accurate observation.

In countries where additional satellite authorisation provisions are defined alongside satellite filing procedures, both are generally interlinked. For example, a satellite authorisation application can only be submitted within a defined period after the corresponding satellite filing data is submitted. However, satellite authorisation provisions have in general a limited scope and no uniform authorisation approach is adopted among authorities.

In our opinion, interlinked procedures involving satellite authorisation, ITU satellite filing and Earth station authorisation make regulations difficult to follow. Therefore, many authorities prefer to use Earth station authorisation for controlling the access to spectrum nationally while following ITU satellite filing procedures for satellite spectrum access.

The way forward

Discussions presented in the preceding sections indicate that satellite network regulations are fragmented, contrary to their international nature. As different approaches are adopted for service and spectrum access authorisations, depending on the specific needs and priorities of countries, fragmented regulations will eventually become a bottleneck with the increasing number and size of satellite networks. Therefore, national regulators and international bodies (e.g. ITU) will need to promote best practices and encourage more cooperation among countries while recognising that there is unlikely to be one solution that fits all.



The regulatory solutions need to match the size of the country's involvement in the space sector whilst ensuring that the necessary national and international regulations and procedures are met.

In this context, there are several challenges faced by national authorities in establishing appropriate regulatory frameworks that are suitable for their home market but are also compatible with international practices.

- Developing regulatory instruments using appropriate criteria derived from best practice. Principle common themes include:
 - *Transparency* (clear provisions following reasons);
 - *Proportionality* (provisions that are not onerous and sufficiently in depth for the market);
 - *Fairness* (provisions helping to ensure all treated equally);
 - *Comprehensiveness* (provisions covering everything required in sufficient detail);
 - *Efficiency* (provisions aiming to increase efficient use of scarce resources); and
 - *Attractiveness for investment* (provisions helping to encourage investment in the space sector).
- Achieving balance. Careful consideration is required in establishing regulations. For example, ensuring market certainty needs to be balanced against over regulation in the context of encouraging investment in the space sector. The level of details provided in regulatory instruments should be proportional and avoid discouraging investment.
- Maintaining flexibility. It is beneficial to avoid using prescriptive requirements to maintain flexibility for future

developments. This will also help to minimise effort required to update regulatory instruments.

- Being competitive. International credibility is an important factor, for example, in choosing an authority to file a satellite system. Procedures satisfying the principle common themes mentioned above are also key to achieve competitiveness.
- Separation of responsibilities. It is vital to establish clearly separated responsibilities between the national telecommunications regulator and space agency. An entity independent of government and industry is essential for equal treatment and fairness in allocation of resources. It is also important to have an entity to support the government in establishing overall policies, strategies and priorities to govern the space sector.
- Establishing appropriate fees. There are a range of methods used to set up appropriate fees for authorising Earth stations and/or satellites. Introducing charges for the effort spent by the authority in handling satellite filings has also become a hot topic in recent years.

In summary, it is important that all national authorities review the regulation of space services to ensure it is “fit for purpose” and address the challenges summarised above. This is particularly important for those countries that already have or want to develop their involvement in the space sector and attract the necessary investment for future satellite systems and space research missions. This requires commitment from governments to make sure that sufficient support is available in terms of finance and human resources.

About Plum

We are a leading independent consulting firm, focused on the telecommunications, media, technology, and adjacent sectors. We apply rigorous analysis to address challenges and opportunities across regulatory, radio spectrum, economic, commercial, and technology domains.

We understand the fundamental issues related to regulation of satellite networks and have a thorough knowledge of international space service regulation approaches. Using our knowledge, we can identify gaps in national regulatory frameworks, propose solutions and develop appropriate instruments to ensure that the framework is relevant, up-to-date and follows best practice.

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