

Frequencies for satellite communication systems

Groupement des Industries Françaises
Aéronautiques et Spatiales



Sector situation

Stakes

Satellite communication systems address broadcast, broadband and narrowband services to fixed, portable and mobile terminals over global or regional coverage for land, maritime and aeronautical applications. They are well recognised in providing a resilient and ubiquitous service and to be particularly cost effective for multimedia service delivery, broadband connectivity in unserved or underserved areas, wide area sensor networks as well as safety communications. This large range of applications is represented on the picture below.

Space segments of communication systems are located in outer space following different types of orbit: Geostationary (GEO), Medium Earth Orbiting (MEO), High Elliptical Orbit (HEO) or Low Earth Orbiting (LEO). SatComs operate in Frequency bands allocated to Broadcasting, Fixed or Mobile Satellite services. The commonality between all of the frequency bands is the need for **harmonised allocations** available across the whole satellite footprint and for **clear regulatory frameworks** as a pre-requisite to high up-front investments.

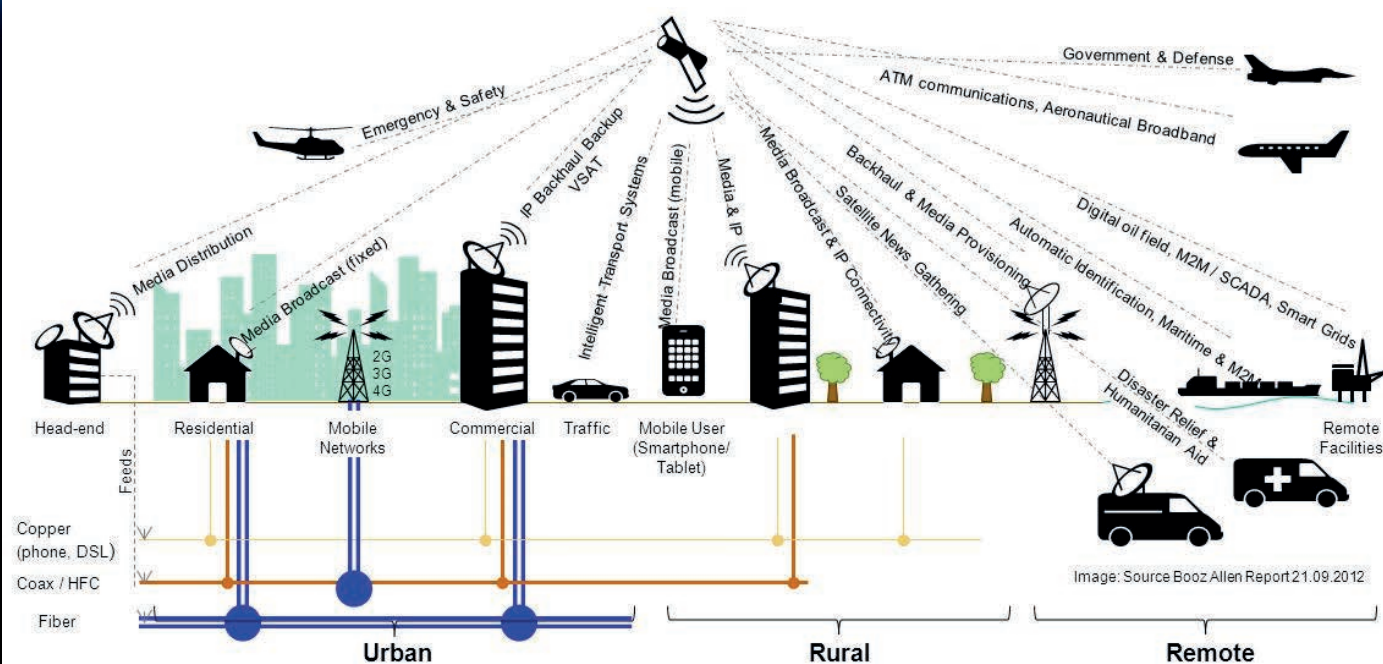
Social and economic importance

The telecommunication satellite sector provides a **significant and growing contribution to the global economy**, particularly in Europe which is the hub of the global satellite industry. With a chain comprising of launchers, manufacturers, insurance, operators, and application developers, a Booz Allen report identified, a few years ago, direct & indirect contributions of 200,000 highly skilled jobs, €10bn revenue with a growth potential to €100bn for EU economies.

A Euroconsult study determined that every 1 Euro of public investment into satcoms generates 47 Euros of downstream turnover!

As the number of satellite systems increases with the current active trend of flexible software-defined satellites and the deployment of satellite constellations, complementing established Geostationary satellites, it is crucial for regulators to recognise that technical limitations prevent satellites from moving in alternative bands when in orbit. **Satellite service allocations must therefore be well-guarded and remain unchanged.**

SATELLITE COMMUNICATION SYSTEMS: A VERY WIDE RANGE OF APPLICATIONS





Specificities

The unique ability of telecommunication satellite systems is to be a large-scale communications technology, enabling to reach and connect a large number of users across borders at any given time. Their functionality therefore depends on international governance of spectrum. Any political decision made, or initiative taken at national or regional level that contradicts international arrangements is irrefutably and directly to the detriment of this industry sector.

The development of telecommunication satellites systems requires **high up-front investments** before they are in operation for a large number of years. A satellite is constructed from the outset according to a specific frequency plan which cannot be widely modified after launch. A secure tenure in the form of primary allocations to satellite services at ITU level, and associated **harmonised conditions** at regional level, are therefore required to support the deployment and operation of SatComs which contribute to support the growing traffic demands for resilient operation as well as for sovereignty considerations including Defence.

Because of the law of physics, spectrum used by telecommunication satellites is in direct relation with the corresponding application. Lower frequencies (UHF, L, S) have the property to be only marginally affected by rain attenuation, can serve wide areas of the globe, and are mostly associated with non-directional antenna earth stations for mobile applications. On the other hand, higher frequencies (C, X, Ku, Ka and Q/V bands) allow smaller and more directional antenna earth stations to be used, possibly while in motion, with more focused service beams on regional areas.

UHF band 200-400 MHz

L band 1-2 GHz

S band 2-3 GHz

C band 3-7 GHz

X band 7-8 GHz

Ku band 10-17 GHz

Ka band 17-31 GHz

Certain bands are reserved for specific usages or user communities, either de facto or because of associated regulation. For instance, parts of UHF, X and Ka bands are mainly dedicated to governmental services and harmonised at NATO level.

Evolution: an industry viewpoint

The telecommunication satellite sector has been facing success and **continuous growth** for several years, as demonstrated by the **intensive use of most satellite allocations** which, for some of them, are reaching congestion.

In terms of applications, TV broadcast and broadband applications are expected to remain the main demand drivers, supported by HDTV spread, the need for high-speed broadband internet everywhere including on board vessels and aircraft, the exponential growth of sensors to be monitored worldwide through IoT constellations, and the increasing need for high bandwidth safety communications to serve security and defence missions. With an increasing number of users, and a higher demand for more bandwidth-intensive services (5G), satellite network architectures are **evolving towards more spectrum efficient architectures** based on multispot satellite antennas permitting frequency reuse, more flexibility to adapt the satellite mission to the evolving context over its lifetime and smooth integration with terrestrial network infrastructures. In addition, constellations of non-geostationary satellites are being developed to support broadband services with global coverage. Satellite is part of the 5G infrastructure and serves the vertical markets (transport, public services, connected cars, Machine Type Communications...). Some satellite systems are now targeting consumer smartphones thanks to satellites acting as mobile base stations in the sky.

The trend is also towards the development of satellite systems operating in **higher frequency bands**, as shown, for example, by the on-going regulatory work for the Fixed Satellite Service allocations contained in the 40/50 GHz and 70/80 GHz ranges.

Spectrum requirements

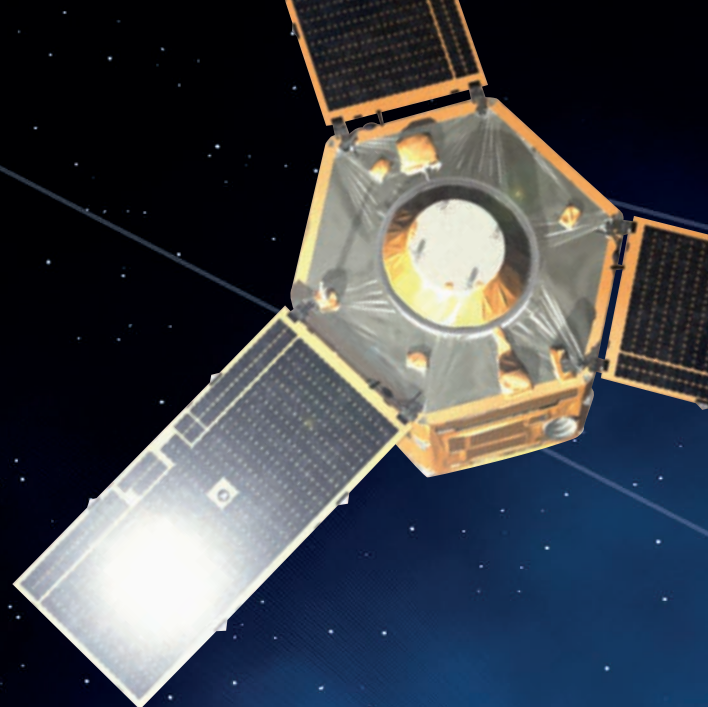
Telecommunication satellites correspond to a large variety of applications, and therefore to a large variety of spectrum needs in different frequency ranges. **Spectrum being the lifeblood of satellites, preserving and securing its access is absolutely essential to satisfy the growing demand for consumer, critical safety and strategic services worldwide over the lifespan of a satellite system.** The continuous growth of these needs is demonstrated by the agendas of ITU-R World Radiocommunication Conferences (WRC), which usually include a number of items in the field of satellite telecommunications.

The next World Radiocommunications Conference planned in 2025 is representative of this large variety, with a record number of challenges for our industry which will be dealt with through a number of agenda items, such as:

- **1.1:** Use of Fixed satellite service allocations in the 40/50 GHz range (Q/V bands) by earth stations in motion, both for geostationary and non-geostationary systems.
- **1.2:** Revision of the sharing conditions in the band 13.75-14 GHz to allow the use of uplink Fixed satellite service earth stations with smaller antenna sizes.
- **1.3:** Enabling use of the uplink Fixed satellite service allocation 51.4-52.4 GHz by gateway earth stations in non-geostationary systems.
- **1.4:** Worldwide extension of the downlink Fixed satellite service allocation in the band 17.3-17.7 GHz.
- **1.5:** Regulatory measures to limit the unauthorised operations of earth stations of non-geostationary in the Fixed or Mobile satellite services.
- **1.6:** Technical and regulatory measures for equitable access to Fixed satellite service allocations in the 40/50 GHz range (Q/V bands).
- **1.7:** Defence of satellite frequency bands (planned C band, X band) against the appetites of the mobile.
- **1.10:** Development of limits for the Fixed, Mobile and Broadcasting satellite services allocations in the bands 71-76 GHz and 81-86 GHz to protect the fixed and mobile services.

- **1.11:** Satellite to satellite links within certain Mobile satellite service allocations in L/S bands.
- **1.12:** New Mobile satellite service allocations in L/S bands for IoT satellite systems.
- **1.13:** Studies on possible new Mobile satellite service allocations in certain mobile bands to allow direct connectivity to user equipment and complement the terrestrial coverage.
- **1.15:** Studies on space research service allocations for lunar communications.
- **1.16:** Studies on the protection of the radio astronomy service in specific Radio Quiet Zones and in certain frequency bands, from aggregate interference caused by non-geostationary satellite systems.
- **7:** Evolution of procedures for the recording of frequency assignments pertaining to satellite networks, in order to facilitate rational, efficient and economical use of radio frequencies and any associated orbits.

Decisions taken during these discussions will have a significant impact on the aerospace sector economy.



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About GIFAS

GIFAS is a Trade Association with 517 members, from major prime contractors and system suppliers to small specialist companies. They cover the full spectrum of skills from the design, development and production of aerospace systems to marketing, maintenance and operation. GIFAS members are active in all sectors of the aerospace industry including civil and military aircraft, helicopters, engines, missiles and weapons, satellites and launch systems, UAV, large aerospace, defence and security systems, equipment, subassemblies and associated software applications. Managed through dedicated entities, GIFAS structures its recommendations in the spectrum domain through the Frequencies Commission.

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