Day 3 course

Regulatory Factors

Regional and International Policy Making bodies on Satellite Communications

By NIAMEOGO W. Eric

1- Regulatory factors

National spectrum management

Governments control the use made of radio by stations within their jurisdiction, typically by making spectrum management a function of a civil service department or by setting up an agency for the purpose. These national regulating bodies are known as ‘administrations’.

A key function in spectrum management is the assignment of carrier frequencies to transmitting and receiving stations, to be used for approved purposes and within stated parameters. In making these assignments, an administration aims to enable radio operating organizations to achieve their objectives without suffering or causing interference while using the spectrum efficiently, so that subsequent applicants will also be able to get access to the radio medium. When it is necessary to take account of cross-frontier interference liabilities, these administrations collaborate with equivalent agencies in neighbouring countries.

1- Regulatory factors

ITU

Where good use of the spectrum requires wider consultation or agreement to permanent policies and procedures, the administrations use the International Telecommunication Union (ITU) as their global forum.

Main decisions on policies and procedures are made at periodical World Radiocommunication Conferences (WRCs), held under the aegis of the ITU.

These conferences were called World Administrative Radio Conferences (WARCs) prior to **1993.** The ITU *Rudio Regulations* (RR) [l] bring together the decisions **of** past WRCs and WARCs, with any subsequent amendments.

1- Regulatory factors

Satellite Frequencies

There are specific frequency ranges used by commercial satellites.

L-band (~1.5 GHz) (MSS)

S-band (~2 GHz) (MSS, DARS)

C-band (3-7 GHz) (FSS 500 MHz)

X-Band (7-8 GHz) (FSS 500 MHz)

Ku-band (11-14.5 GHz) (FSS 500MHz, BSS 500 MHz)

Ka-band (17 - 31 GHz) (FSS several GHz)

The ITU maintains the frequency database and issues rules and regulations. National administrations (e.g., FCC) modify rules and regulations and *ENFORCE* **them.**

Note: FSS=Fixed Satellite Service, MSS=Mobile Satellite Service, BSS=Broadcast Satellite Service.

1- Regulatory factors

Interference

FSS satellites are separated by 2° to avoid interfering with each other.

This results in a minimum antenna dish size of 2.4m (8') for C-band earth stations and 80cm (31") for Ku-band earth stations.

BSS satellites are separated by 9° to allow for the use of smaller dishes.

Interference might be acceptable with antenna dish sizes as small as 20cm (8").

Power requirements usually dictate a larger antenna typically 45cm (18").

1- Regulatory factors

Power and Bandwidth

Transponders/Repeaters

- **The basic communications satellite unit is the transponder—a device that receives, amplifies, shifts the frequency and retransmits the earth station signal.**

- **The transponder has two components that determine performance: the TWTA power (watts) and the antenna gain. Higher gain results in smaller coverage patterns (TANSTAAFL)**

- **After Intelsat IV, the "standard" bandwidth of a transponder was set at 36 MHz. This is the result of a series of tradeoffs—non-standard bandwidths are common.**

1- Regulatory factors

Power and Bandwidth

Power and Bandwidth tradeoffs

- **When earth station antennas are medium-to-large and transponder power is moderate-to-high, 1 MHz can usually support 1 Mbps.**

- **Small earth station antennas and/or low transponder power can result in a situation which requires more power/bandwidth.**

- **Rain fade can also result in a need for additional power/bandwidth.**

1- Regulatory factors

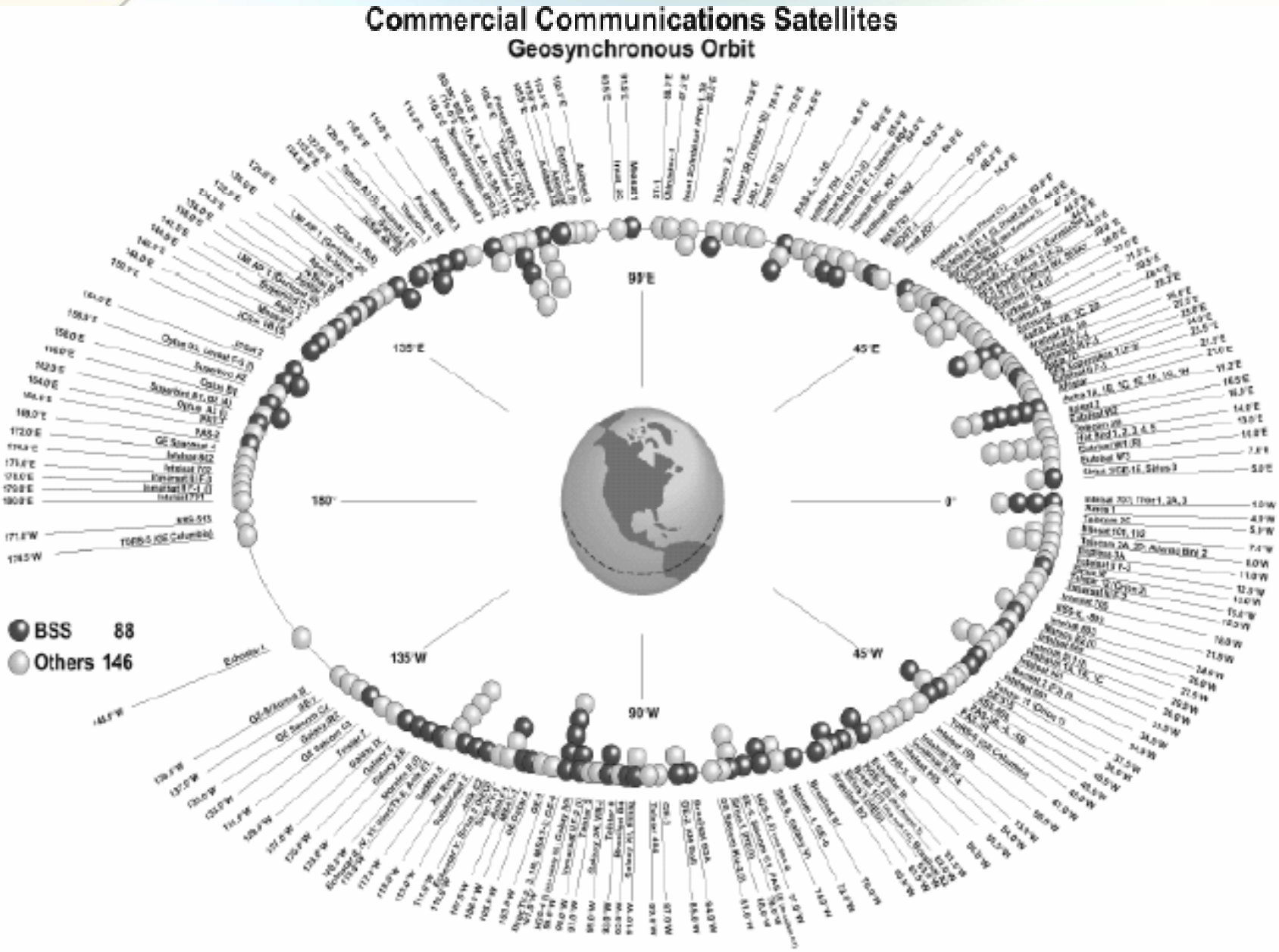
Satellite Sizing

- Given 36 MHz transponders separated by 40 MHz, 12 transponders occupy 500 MHz.
- Use of orthogonal polarization allows an increase to 24 transponders.

- At C-band, the maximum allowable power (flux) is such that a (50% efficient) TWTA of 50-75 Watts can illuminate all the visible land mass.
- At Ku-band, more power (flux) is required to allow for smaller dishes and rain fade. TWTA powers of 100-200 Watts are common.

- A satellite with 24 60 Watt C-band transponders and 24 150 Watt Ku-band transponders will generate about 6 kW of RF power and will require 12 kW of DC (solar array) power.

1- Regulatory factors



1- Regulatory factors

The Commercial Satellite Industry

Voice/Video/Data Communications

- Rural Telephony
- News Gathering/Distribution
- Internet Trunking
- Corporate VSAT Networks
- Tele-Medicine
- Distance-Learning
- Mobile Telephony
- Videoconferencing
- Business Television
- Broadcast and Cable Relay
- VOIP & Multi-media over IP

Direct-To-Consumer

- Broadband IP
- DTH/DBS Television
- Digital Audio Radio
- Interactive Entertainment & Games
- Video & Data to handhelds

GPS/Navigation

- Position Location
- Timing
- Search and Rescue
- Mapping
- Fleet Management
- Security & Database Access
- Emergency Services

Remote Sensing

- Pipeline Monitoring
- Infrastructure Planning
- Forest Fire Prevention
- Urban Planning
- Flood and Storm watches
- Air Pollution Management
- Geo-spatial Services

1- Regulatory factors

Fixed Satellite Services

Spacecraft

- GEO: 24-hour orbit
- C-band and Ku-band

Terrestrial Infrastructures

- Teleports, TT&C Centers
- Fiber Interconnects

Diverse market-base

- Media Distribution (Television)
- Telecom Infrastructure (Telephone)
- Enterprise Networks (Data, VSAT)
- Government Networks

1- Regulatory factors

Mobile Satellite Industry

Orbit

- Geosynchronous (GEO) Inmarsat, Thuraya
- Medium Earth Orbit (MEO) ICO
- Low Earth Orbit (LEO) Iridium, Globalstar
- System sizes range from (1) GEO satellite to (66) LEO Satellites

Frequencies

- L-Band/S-Band, UHF/VHF
- Feeder links use C, Ka, and Ku-Band

Applications

- Aeronautical
- Maritime
- Land

1- Regulatory factors

Global Manufacturing Environment

Major US Manufacturers

LOCKHEED MARTIN

LORAL Space & Communications

Orbital

BOEING

Other US Manufacturers

AeroAstro

Ball Aerospace & Technologies Corp.

NORTHROP GRUMMAN

Non-US Manufacturers

COM DEV

MITSUBISHI ELECTRIC

IAI ISRAEL AIRCRAFT INDUSTRIES ltd

CAST

ALCATEL

astrium

1- Regulatory factors

- *Launch Industry Overview*

U.S. Launch Service Providers

- Lockheed Martin (Atlas)
- Boeing Launch Services (Delta)
- Orbital – (Pegasus)
- SpaceX – (Falcon)

International Launch Vehicle Market

- Boeing + Ukraine - Sea Launch (Zenit)
- Lockheed + Russian - ILS (Proton)
- European- Arianespace (Ariane)
- India (PSLV)
- China –Great Wall - (LongMarch)
- Japan – Mitsubishi - (H2A)

1- Regulatory factors

LICENSING

The ITU Member States have established a legal regime, which is codified through the ITU Constitution and Convention, including the Radio Regulations. These instruments contain the main principles and lay down the specific regulations governing the following major elements:

- frequency spectrum allocations to different categories of radio communication services;
- rights and obligations of Member administrations in obtaining access to the spectrum/orbit resources;
- international recognition of these rights by recording frequency assignments and, as appropriate, orbital positions used or intended to be used in the Master International Frequency Register.

1- Regulatory factors

LICENSING

The above regulations are based on the main principles of efficient use of and equitable access to the spectrum/orbit resources laid down in No. 196 of the ITU Constitution (Article 44), which stipulates that *"In using frequency bands for radio services, Members shall bear in mind that radio frequencies and the geostationary-satellite orbit are limited natural resources and that they must be used 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 both, taking into account the special needs of the developing countries and the geographical situation of particular countries".*

1- Regulatory factors

Legal framework

- United Nations Outer Space Treaty (1967)

  - Outer space free for exploitation and use by all states in conformity with international regulations

  - States retain jurisdiction and control over objects they have launched into outer space

1- Regulatory factors

Legal framework

- United Nations Outer Space Treaty (1967)

- International Telecommunication Union

  - Allocation of frequency bands
  - Instruments (CS, CV, RR, RoPs, Recs)
  - Procedures, Plans, operational measures
  - Instruments (CS, CV, RR, RoPs, Recs)

1- Regulatory factors

"To ensure rational, equitable, efficient and economical use of the radio frequency spectrum by all radiocommunication services -- including those using the geostationary satellite orbit or other satellite orbits -- and to carry out studies on radiocommunication matters" *Constitution of the ITU, Article 12.*

Article 44

↓

Radio frequencies & satellite orbits are limited natural resources

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Rational, Efficient, Economical Use

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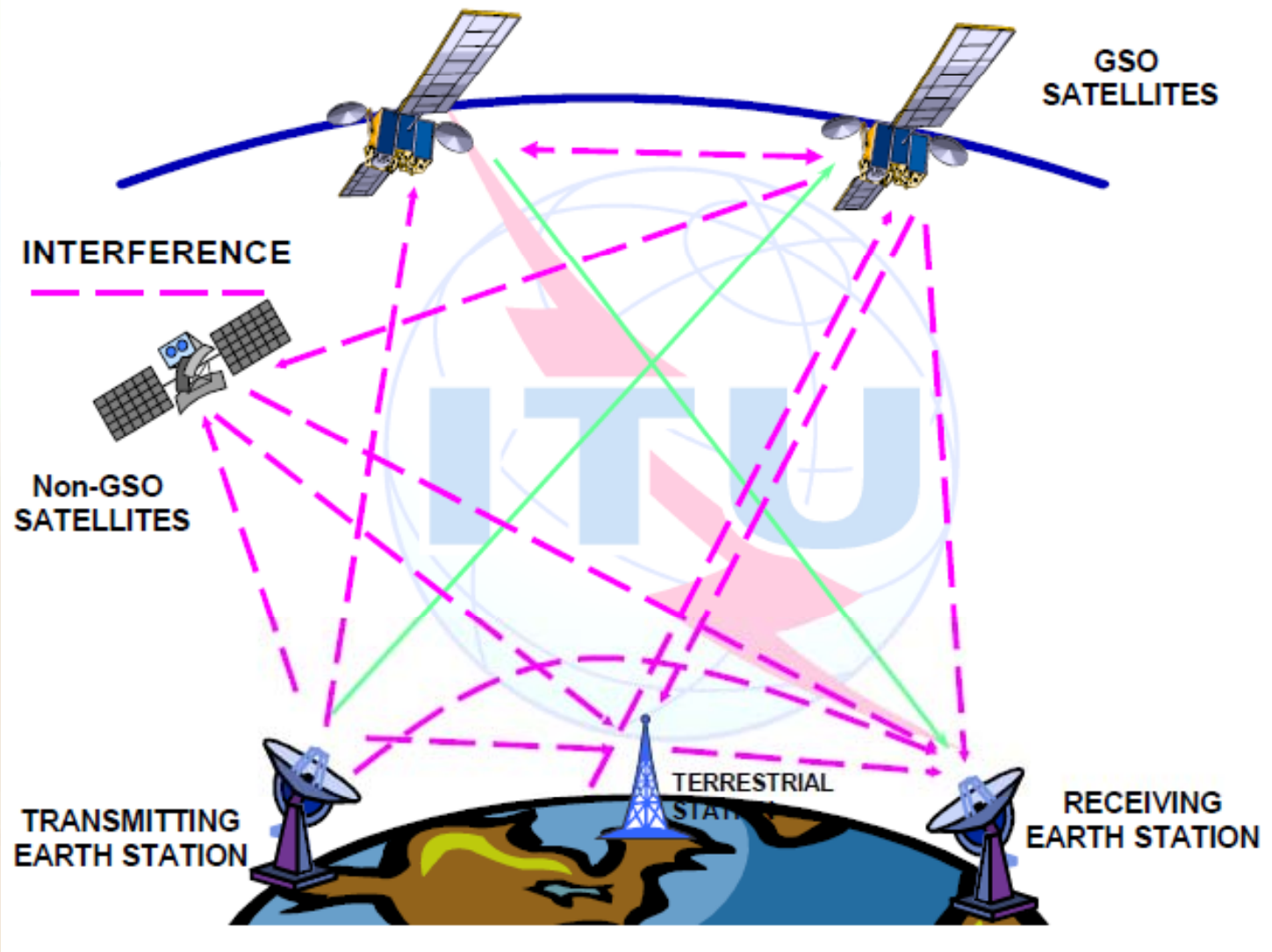
Equitable Access

1- Regulatory factors

Interferences



1- Regulatory factors

Interference-free operation

Propagation of Radio waves

- Laws of physics
- Radio waves do not stop at national borders

Interference

- possible between radio stations of different countries
- This risk is high in Space Radiocommunications

Radio Regulations (RR)

- One of its main purposes - Interference-free operation of RadioComms

1- Regulatory factors

Control of Interference

ALLOCATION

Frequency separation of stations of different services

REGULATORY PROTECTION

e.g. No. 22.2: Non-GSO to protect GSO (FSS and BSS)

POWER LIMITS

PFD to protect TERR services / EIRP to protect SPACE services / EPFD to protect GSO from Non-GSO

COORDINATION

between Administrations to ensure interference-free operations conditions

1- Regulatory factors

Radio Regulations

Lengthy & complex procedure

- Decided by Administrations during WRC
- Governed by:
  - More sophisticated use of spectrum
  - Individual requirements of administrations
- Trend towards simplification /improvement to certain procedures

1- Regulatory factors

Radio Regulations

Lengthy & complex procedure

- Efficient use of spectrum
- Equitable access
- Opportunity to resolve interference before operation
- Prevents loss of investment, customers & revenue by minimizing unusable capacity due to interference

1- Regulatory factors

- Rights & obligations + applicable procedures
- Two mechanisms of sharing orbit /spectrum:

<u>Coordination Approach</u>

- Efficiency ⇔First come, first served for actual requirements

<u>Planning Approach</u>

- Equitable access ⇔ Plan for future use

1- Regulatory factors

First Come, First Served Procedure

- Rights acquired through coordination with administrations concerning actual usage
- Efficient spectrum / orbit management
- Dense/irregular orbital distribution of space stations
- Continuing responsibility for the networks

Plan Procedure

- Congestion of the GSO
- Frequency / orbital position plans
- Guarantee for equitable access to the spectrum / orbital resources
  - Spectrum set aside for future use by all countries
  - Predetermined orbital position & frequency spectrum

1- Regulatory factors

ORBITAL SLOT REGISTRATION

The UN agency that regulates the use of geosynchronous orbitals is the International Telecommunications Union. Regulation of these satellites is necessary, because there are a limited number of places to put them in orbit without the risk of interference with other satellites or collision with space debris.

In addition, the “orbital slots” (where the satellites are placed) over industrialized areas are in much more demand than in lesser developed areas.

Slots over lesser developed countries with a location that would give a satellite coverage of industrialized countries are also in demand.

1- Regulatory factors

ORBITAL SLOT REGISTRATION

In 1988, the ITU acknowledged that all countries, including lesser developed countries, have an equal right to orbital slots. However, Article II of the Outer Space Treaty forbids any claim of sovereignty by any country in space, which would not allow countries to establish dominion over the orbital slots above their territory. At conferences in 1985 and 1988, the ITU did give all countries the rights an orbital slot directly over their territory, which would ensure at least some access to these satellites to all countries.

The actual orbital slots themselves are dispensed on what could be described as a first come, first served basis with some consideration given to the country making the request. There is no mandatory system to deal with disputes over orbital slots, but there are countries that have entered into an optional method to deal with disputes within the ITU.

7- Regulatory factors

FREQUENCY REGISTRATION

The orbital slots issue is just one of the issues that the ITU addresses. The frequencies on which the satellites broadcast are also regulated by the ITU.

This aspect of the ITU is important, because satellites that broadcast on the wrong frequencies can interfere with neighboring satellites or even radio or television transmissions on the ground.

Currently, the ITU has assigned about 87,000 frequencies to about 600 satellite networks in orbit (some of which are geosynchronous satellites).

7- Regulatory factors

INTERSYTEM REGISTRATION

Another important organ of the ITU is the International Frequency Board (IFRB), which is responsible for intersystem coordination at an international level.

This applies to the coordination of terrestrial systems with satellite systems, and to the coordination of a new satellite system with existing ones or systems simply registered at the IFRB at the time the new system is submitted to IFRB.

1- Regulatory factors

EARTH STATION AND VSAT REGISTRATION

The ITU controls frequency allocations, permitted power levels and modes of operation. These restrictions are intended primarily to prevent interference between all types of systems employing radio communications and to protect some telecommunications services, such as emergency services.

In addition to that, many governments currently impose restrictions and regulations on service providers and users. These national regulations are specific to each particular country.

1- Regulatory factors

EARTH STATION AND VSAT REGISTRATION

Due to the increasing uptake of sophisticated telecommunications systems, that are sold and used in all countries, the licensing regime for end-user equipment (such as VSAT terminals) is becoming simpler and less costly.

You will find the procedures and regulations that rule the installation and operation of VSAT terminals on regulations agencies in the countries or on ITU web site.

1- Regulatory factors

EARTH STATION AND VSAT REGISTRATION

A licence is to be delivered by the national telecommunications authority of a country where any earth station as a part of a network, be it the hub, a control station or a VSAT, is planned to be installed and operated.

The concern reflected here is to ensure compatibility between radio networks by avoiding harmful interference between different systems.

By doing so, any licensed operator within a certain frequency band is recognized as not causing unacceptable interference to others, and is protected from interference caused by others.

In the past, national telecommunication authorities have required licensing of individual VSAT terminals in addition to requiring a network operator's license. Then, the US Federal Communication Commission (FCC) implemented with success a *blanket licensing* approach for VSATs operated within the US.

1- Regulatory factors

EARTH STATION AND VSAT REGISTRATION

With blanket licensing, VSATs are configured based upon technical criteria (power level, frequency, etc.) to eliminate the risk of interference, so a single license can be issued covering a large number of VSAT terminals.

Blanket licensing has since gained interest among national telecommunications authorities all over the world, as a result of equipment manufacturers complying with the recommendations issued by international standardization bodies, such as the International Telecommunication Union (ITU) and the European Telecommunications Standard Institute (ETSI). Relevant documentation from these bodies is available at http://www.itu.int/home/index.html and http://www.etsi.org/.

1- Regulatory factors

EARTH STATION AND VSAT REGISTRATION

A licence usually entails the payment of a licence fee, which is most often in two parts: a one-time fee for the licensing work and an annual charge per station.

The licensing procedure is simpler when the network is national, as only one telecom authority is involved.

For transborder networks, licences must be obtained from the different national authorities where the relevant earth stations are planned to be installed and operated, and rules often differ from one country to another. To facilitate the access to these rules, telecommunications authorities around the world have begun posting data related to their nations' VSAT regulatory conditions on the World Wide Web.

1- Regulatory factors

INTERFERENCE BETWEEN C-BAND AND WIMAX

The “extended” C band frequencies (3.4 to 3.7 GHz) have already been identified by several national administrations for use by new services like Broadband Wireless Access (BWA) and WiMax.

In addition, other administrations are looking to deploy these new terrestrial services in the “standard” C band frequencies (3.7 to 4.2 GHz). In countries where WiMax services have been introduced, there have been significant in-band and out-of-band interference issues and services interruptions for satellite ground stations and their related services.

Some other interferences may occur, it is important to do electromagnetic survey before installation and make sure to have a valid license.

2- Policy Making bodies on Satellite communications

Communications satellites are an important delivery platform for information society services as diverse as interactive TV and mobile broadband internet access.

Communication satellites are particularly useful in rural and undeveloped regions, where other systems are difficult to deploy on a commercial basis.

Satellites can play a crucial role in ensuring that individuals, companies, organizations and Governments around the world can access and disseminate high quality information services.

2- Policy Making bodies on Satellite communications

Federal Communications Commission (FCC)

The **Federal Communications Commission** (**FCC**) is an independent agency of the United States government, created, directed and empowered by Congressional statute , and with the majority of its commissioners appointed by the current President.

The FCC works towards six goals in the areas of :

- Broadband
- Competition
- The spectrum
- The media
- Public safety and homeland security
- And modernizing the FCC.

2- Policy Making bodies on Satellite communications

FCC Goals

These are:

Broadband: "All Americans should have affordable access to robust and reliable broadband products and services. Regulatory policies must promote technological neutrality, competition, investment, and innovation to ensure that broadband service providers have sufficient incentives to develop and offer such products and services."

Competition: "Competition in the provision of communication services, both domestically and overseas, supports the Nation's economy. The competitive framework for communications services should foster innovation and offer consumers reliable, meaningful choice in affordable services."

Spectrum: "Efficient and effective use of non-federal spectrum domestically and internationally promotes the growth and rapid development of innovative and efficient communication technologies and services."

2- Policy Making bodies on Satellite communications

FCC Goals

Media: "The Nation's media regulations must promote competition and diversity and facilitate the transition to digital modes of delivery."

Public Safety and Homeland Security: "Communications during emergencies and crisis must be available for public safety, health, defense, and emergency personnel, as well as all consumers in need. The Nation's critical communications infrastructure must be reliable, interoperable, redundant, and rapidly restorable.

Modernize the FCC: "The Commission shall strive to be highly productive, adaptive, and innovative organization that maximizes the benefits to stakeholders staff, and management from effective systems, processes, resources, and organizational culture."

2- Policy Making bodies on Satellite communications

National Regulation Agencies (NRAs)

Governments control the use made of radio by stations within their jurisdiction, typically by making spectrum management a function of a civil service department or by setting up an agency for the purpose. These national regulating bodies are known as ‘administrations’.

A key function in spectrum management is the assignment of carrier frequencies to transmitting and receiving stations, to be used for approved purposes and within stated parameters. In making these assignments, an administration aims to enable radio operating organizations to achieve their objectives without suffering or causing interference while using the spectrum efficiently, so that subsequent applicants will also be able to get access to the radio medium.

When it is necessary to take account of cross-frontier interference liabilities, these administrations collaborate with equivalent agencies in neighbouring countries.

2- Policy Making bodies on Satellite communications

ITU

The **International Telecommunication Union** is an agency of the United Nations which regulates information and communication technology issues. As one of the most important organizations regulating telecommunications, the International Telecommunication Union (ITU) has a strong influence on the activities of National Regulatory Authorities (NRA)s.

In 2007 ITU has :

- 191 countries members
- More than 600 sectors members
- More than 130 associates

2- Policy Making bodies on Satellite communications

ITU

Where good use of the spectrum requires wider consultation or agreement to permanent policies and procedures, the administrations use the International Telecommunication Union (ITU) as their global forum.

Main decisions on policies and procedures are made at periodical World Radiocommunication Conferences (WRCs), held under the aegis of the ITU.

ITU *Radio Regulations* (RR) bring together the decisions **of** past WRCs, with any subsequent amendments. A major revision of the RR was agreed at WRC-95.

2- Policy Making bodies on Satellite communications

ITU Organization

The ITU comprises four sectors, each managing a different aspect of the matters handled by the Union:

- Radiocommunication (ITU-R) Managing the international radio-frequency spectrum and satellite orbit resources is at the heart of the work of the ITU Radiocommunication Sector (ITU-R).
- Standardization (ITU-T) ITU's standards-making efforts are its best-known — and oldest — activity; known prior to 1992 as the International Telephone and Telegraph Consultative Committee or **CCITT** (from its French name "Comité consultatif international téléphonique et télégraphique")
- Development (ITU-D) Established to help spread equitable, sustainable and affordable access to information and communication technologies (ICT).
- **ITU TELECOM** ITU TELECOM organizes events such as exhibitions.

A permanent **General Secretariat**, headed by the Secretary General, manages the day-to-day work of the Union and its sectors.

2- Policy Making bodies on Satellite communications

ITU Mission

ITU's mission is to enable the growth and sustained development of telecommunications and information networks, and to facilitate universal access so that people everywhere can participate in, and benefit from, the emerging information society and global economy. The ability to communicate freely is a pre-requisite for a more equitable, prosperous and peaceful world. And ITU assists in mobilizing the technical, financial and human resources needed to make this vision a reality.

A key priority lies in bridging the so called Digital Divide by building information and communication infrastructure, promoting adequate capacity building and developing confidence in the use of cyberspace through enhanced online security. Achieving cybersecurity and cyberpeace are amongst the most critical concerns of the information age, and ITU is taking concrete measures through its landmark Global Cybersecurity Agenda.

2- Policy Making bodies on Satellite communications

ITU Mission

ITU also concentrates on strengthening emergency communications for disaster prevention and mitigation. While both developing and developed countries are equally vulnerable to natural disasters, poorer nations are hardest hit because of their already fragile economies and lack of resources.

Whether through developing the standards used to create infrastructure to deliver telecommunications services on a worldwide basis, through equitable management of the radio-frequency spectrum and satellite orbits to help bring wireless services to every corner of the world, or through providing support to countries as they pursue telecommunication development strategies, all the elements of ITU's work are centred around the goal of putting every human being within easy and affordable reach of information and communication and to contribute significantly towards economic and social development of all people.

ITU remains dedicated to helping the world communicate.

2- Policy Making bodies on Satellite communications

Some ITU Mission

Specific objectives include:

- Reglementation of satellite communications
- Coordinate and develop international communications
- Harmonizing national politics
- Technical assistance to developing countries in the domain of telecommunications and information access

Some ITU Tasks

Amongst the tasks assigned to ITU we can mention:

- Electromagnetic spectrum frequency band attribution
- Register spatial orbital position of satellites
- Control of Radio interferences

2- Policy Making bodies on Satellite communications

ITSO

ITSO is the continuation of INTELSAT, the intergovernmental organization established by treaty in 1073.On July 18, 2001, the satellite fleet, customer contracts and other operational assets were transferred to Intelsat Ltd, a new private company now registered in Luxembourg and various amendments to the ITSO Agreement took effect.

Under the ITSO Agreement, as amended , ITSO's primary role was that of supervising and monitoring Intelsat's provision of public telecommunications satellite services as specified in the Public Services Agreement(PSA) entered into between ITSO and Intelsat. In addition, the Director General , on behalf of the Organization, must consider all issues related to the Common Heritage. ITSO currently has 150 Member State.

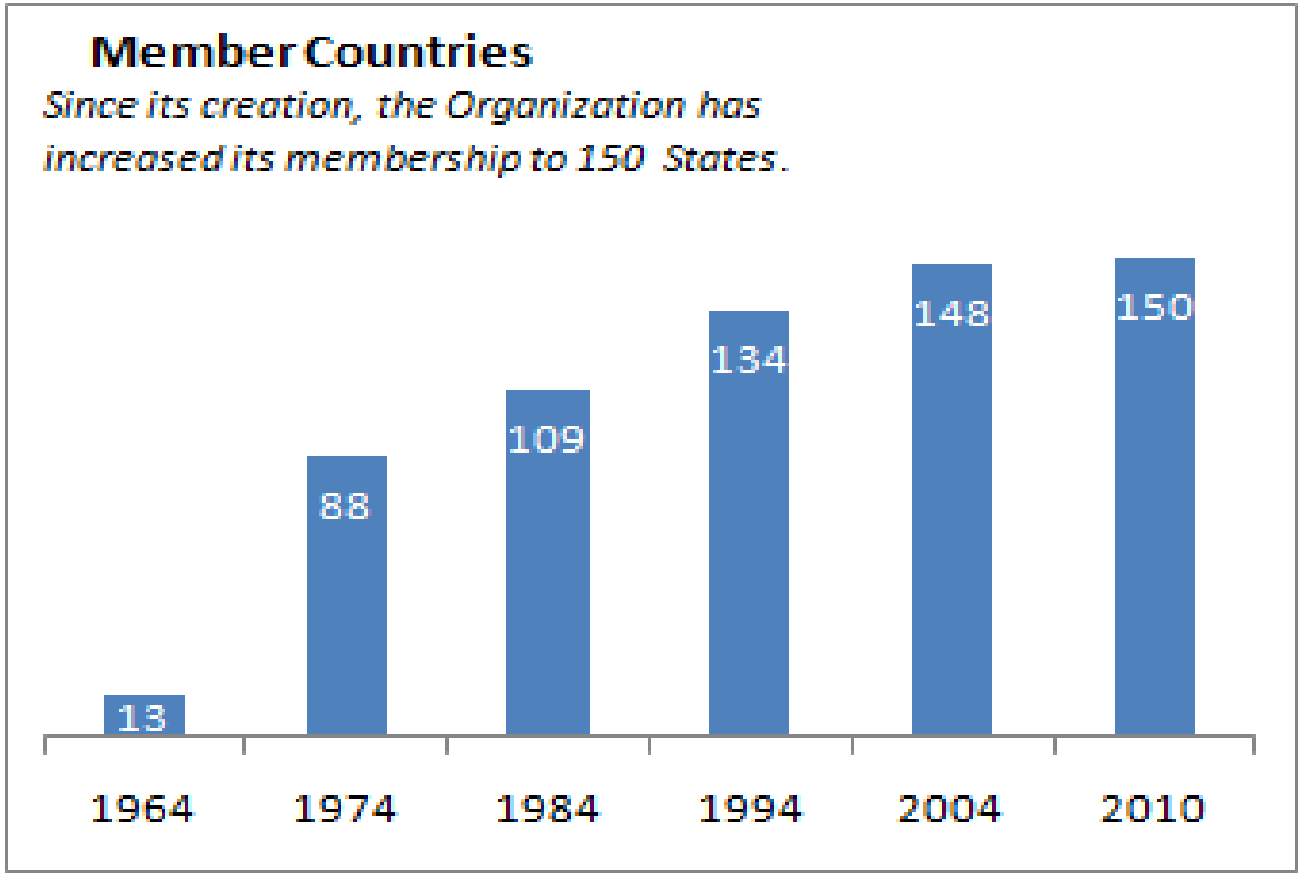
2- Policy Making bodies on Satellite communications

ITSO

For this purpose, ITSO transferred its global satellite system, including the geostationary-orbital locations, “landing rights” and the brand-name of “Intelsat,” to Intelsat, Ltd. Since this transfer in 2001, Intelsat has invested US$ 2.6 billion to substantially improve the global connectivity and coverage that it offers. As a result, Intelsat's global communications network, which was composed of 19 satellites in 2001, has expanded to 53 satellites through new launches and acquisitions, while Intelsat simultaneously has expanded its terrestrial facilities, including teleports, points of presence and fiber connectivity.

2- Policy Making bodies on Satellite communications

ITSO



3- Current issues related to satellite communications

Introduction and Regulatory Environment

- Insufficient spectrum for proposed new uses
  - private sector requesting access to Govt.-exclusive
  - spectrum either by reallocation or increased sharing
- International Telecommunications Union (ITU)
  - international spectrum allocations
  - advance publication/coordination/notification
  - filing fees, cost recovery, filing backlogs
- Domestic Spectrum Management
  - FCC: non-Govt. spectrum management
  - NTIA: Govt. spectrum management

3- Current issues related to satellite communications

Non-Government	Government
YOU WAREHOUSE SPECTRUM!	YOU WASTE SPECTRUM!
SPECTRUM IS CRUCIAL TO NATIONAL ECONOMIC SECURITY!	SPECTRUM IS CRUCIAL TO NATIONAL DEFENSE SECURITY!
YOU DON'T UNDERSTAND OUR REQUIREMENTS!	YOU DON'T UNDERSTAND OUR REQUIREMENTS!
WE DON'T KNOW HOW YOU USE SPECTRUM!	YOU ONLY WANT TO TAKE GOVERNMENT SPECTRUM !
YOU HIDE BEHIND SECURITY !	YOU INVOLVE CONGRESS OVER MINOR ISSUES!

INCREASED COOPERATION BETWEEN THE GOVERNMENT AND NON-GOVERNMENT SECTORS HELPS MEET NEW REQUIREMENTS AND INCREASES OVERALL SPECTRUM EFFICIENCY

3- Current issues related to satellite communications

International Satellite Regulation

- International Telecommunication Union
- Spectrum Regulation through ITU Radio Regulations
- ITU-R Recommendations of Technical Characteristics
- ITU World Radiocommunication Conference
  - new frequency allocations
  - regulations to facilitate sharing and prevent interference
  - regulations on procedures and requirements for country-to country coordination
- New Issues:
  - competition for “good” orbital slots
  - Sharing between GSOs and NGSOs
  - due diligence to reduce “paper” satellite filings

3- Current issues related to satellite communications

Current Spectrum Planning Issues

- WRC-2000 Issues:
  - NGSO FSS sharing with GSO FSS/BSS & terrestrial services
  - BSS-planned bands and feederlinks
  - Spectrum for satellite component of IMT-2000 (3G)
  - FS and FSS sharing in 36-51 GHz band
  - Spurious emissions (revision of Appendix S3)
  - IMT-2000/advanced mobile communications (terrestrial and satellite component)
  - High Altitude Platforms (HAPS) at 47-48 GHz
  - FSS C-band earth stations aboard vessels (ESV)
  - Coordination with terrestrial stations around satellite earth stations (Appendix S7)
  - The need for development of satellite regulations
  - The concerns about taxation

3- Current issues related to satellite communications

Current Spectrum Planning Issues

- WRC-2007 Issues:
  - Additional spectrum for Active Earth Exploration Satellites
  - Identification of Bands for IMT-2000
  - Spectrum for Aeronautical Telemetry
  - Additional spectrum for Aeronautical Mobile (Route) Service
  - Protection of the space Research Service (Passive) from the Mobile Satellite Service in the 1668-1668.4 MHz Band
  - High Altitude Platforms Stations (HAPS)
  - Broadcast Satellite Services (BSS) in the Band of 620-790 Mhz
  - Feeder links for Non-Geostionnary Satellites Systems at 1.4Ghz
  - Global Broadband Satellite Systems
  - Compatibilty between Radio Astronomy and Active Spare Services
  - The need for development of satellite regulations
  - The concerns about taxation

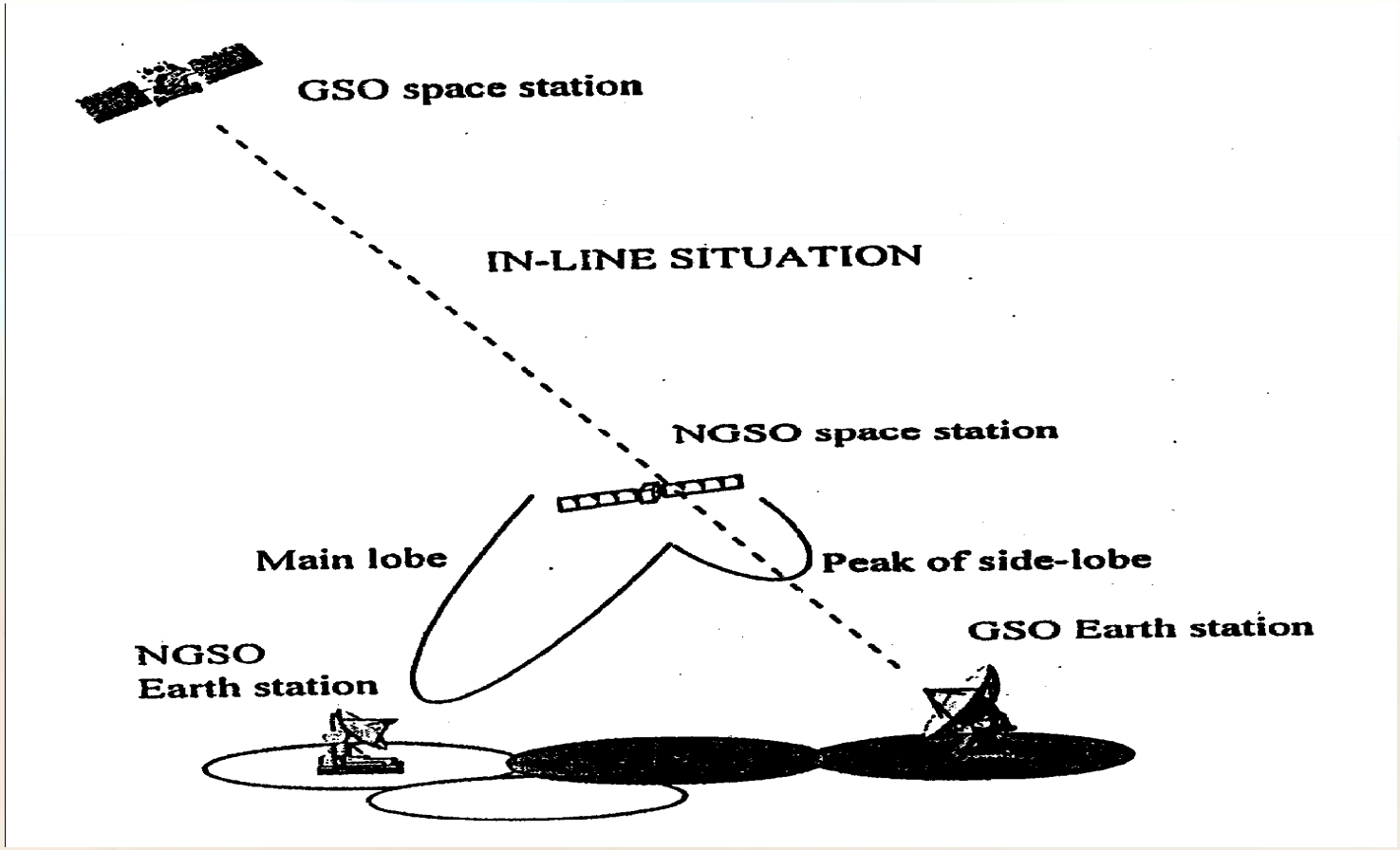
3- Current issues related to satellite communications

Current Spectrum Planning Issues

- Spectrum Management Considerations for NGSO Satellites
  - number of satellites in view simultaneously
  - generally will not be able to use polarization discrimination due to antenna beam size and satellite motion
  - may be able to take advantage of time sharing of coverage areas in addition to other sharing techniques (Little LEOs and NOAA)
  - minimum look angle restrictions can be used to avoid interference to GSO and to enhance sharing between satellite earth terminals and the FS result is larger satellite constellation
- New Regulatory Mechanisms Necessary for NGSO Sharing
  - Resolutions 130 and 538 for NGSO FSS sharing with other services
  - Resolution 46 (S9.11A) for NGSO MSS sharing with other services

3- Current issues related to satellite communications

Interference From NGSO to GSO Systems



3- Current issues related to satellite communications

Spectrum sharing techniques

- Virtually all primary FSS allocations between 2.5-40 GHz share spectrum with other terrestrial or space services
- Common techniques to facilitate sharing include:
  - spatial isolation (e.g., GSO orbital slot separation)
  - geographical separation (satellite earth terminals)
  - time/frequency/code isolation (modulation)
  - frequency band segmentation or band planning
  - minimum look angle restrictions (sharing between earth terminals and the FS) and GSO arc avoidance (NGSO sharing with GSO FSS and BSS)
  - co-coverage avoidance schemes (e.g., NOAA and Little LEOs) satellite and ET power limitations

3- Current issues related to satellite communications

Space and Earth Station Spurious Emissions

- Impact on Sharing with Other Services
  - FCC and NTIA regulations limit most OOB emissions
  - Radars exhibit high levels of OOB emissions…can interfere with satellite receivers unless preventive measures are taken
- Protection of GPS from MSS Handset OOB Emissions
  - limits placed on MSS handset OOB emissions in ITU-R recommendations and domestic/European regulations
  - limits on terrestrial services being investigated
- Protection of Radio Astronomy Observations
  - emissions from space-based and aeronautical transmitters are particularly problematic for RAS protection

3- Current issues related to satellite communications

Conclusion

- Spectrum management issues related to satellite communications have become more complex with the need to satisfy requirements of new applications and systems in the limited spectrum resource.

- Advances in satellite technology and new methods of sharing spectrum are being investigated to alleviate spectrum congestion and avoid interference to existing and planned space and terrestrial systems.

- Cooperation between countries, and between the government and non-government sectors, is essential to efficient spectrum management.

End of Day 3 course

Regulatory Factors

Regional and International Policy Making bodies on Satellite Communications