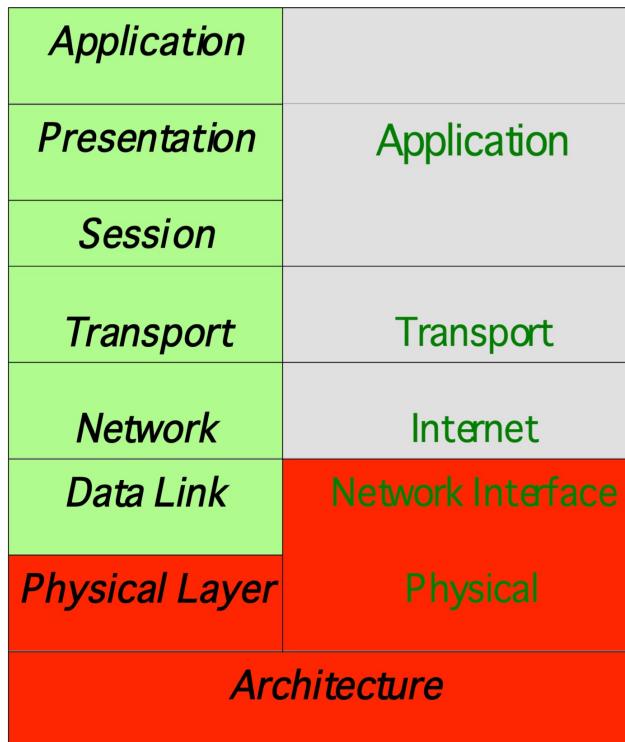


# STANDARDIZATION & REGULATION



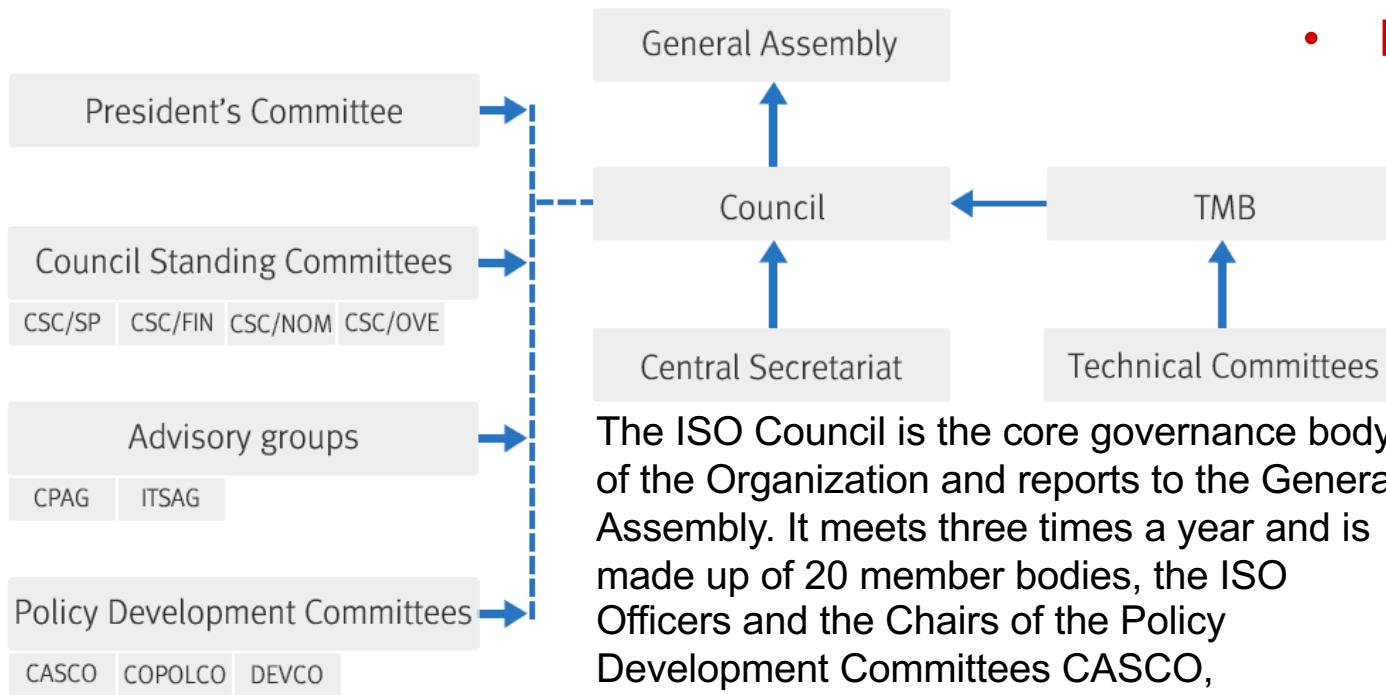
## Standardization bodies and fora

- ISO (International Organization for Standardization)
- ETSI (European Telecommunication Standard Institute)
  - DVB (Digital Video Broadcasting)
  - DVB RCS (DVB Return Channel on Satellite)
- DVB (Digital Video Broadcasting)
- IETF (Internet Engineering Task Force)
- ITU (International Telecommunication Union)
- 3GPP (3<sup>rd</sup> Generation Partnership Program)
- FCC (Federal Communication Committee)
- IEEE (International Electronics and Electrical Engineering)
- CEPT (Conference Européenne des Administrations des Postes et Télécommunications)
- GSC (Global Standards Collaboration)
- AIS (Alliance for the Information Society)
- MMAC (Multimedia Mobile Access Communication Systems)

## ISO MISSION

- ISO (International Organization for Standardization) is the world's largest developer and publisher of International Standards.
- ISO is a network of the national standards institutes of 165 national standard bodies, one per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system.
- ISO is a non-governmental organization that forms a bridge between the public and private sectors. Many of its member institutes are part of the governmental structure of their countries or are mandated by their government. Other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations.
- ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society.

# ISO Governance Structure



- **Procedures**

- Work brought by National standards bodies
- Technical committees develop drafts
- Documents approved by ISO members organizations
- Voting restricted, one vote per member organization
- Standards issued by ISO

The ISO Council is the core governance body of the Organization and reports to the General Assembly. It meets three times a year and is made up of 20 member bodies, the ISO Officers and the Chairs of the Policy Development Committees CASCO, COPOLCO and DEVCO.

The Council has direct responsibility over a number of bodies reporting to Council: The President's Committee advises Council on matters decided by Council. Membership to the Council is open to all member bodies and rotates to make sure it is representative of the member community.

Council Standing Committees address matters related to finance (CSC/FIN), strategy and policy (CSC/SP), nominations for governance positions (CSC/NOM), and oversight of the Organization's governance practices (CSC/OVE). Advisory Groups provide advice on matters related to ISO's commercial policy (CPAG) and Information Technology (ITSAG).

CASCO - provides guidance on conformity assessment / COPOLCO - provides guidance on consumer issues  
DEVCO - provides guidance on matters related to developing countries

## ETSI mission

- Founded in 1988, not-for-profit organization, 900 members, 65 countries (5 continents)
  - Manufacturers
  - Network operators
  - Government and public organizations
  - Service/content providers
  - Universities and Research bodies
  - User groups
  - Consultancies
- It is officially recognized by the European Commission as a European Standards Organization.
- Produces **globally-applicable standards for Information and Communications Technologies (ICT)**, including fixed, mobile, radio, converged, broadcast and internet technologies.
- By adhering to these standards, manufacturers and service providers can claim ‘presumption of conformity’ with the essential requirements of a directive (by self-declaration) rather than having to go through costly type approval processes in different Members States.

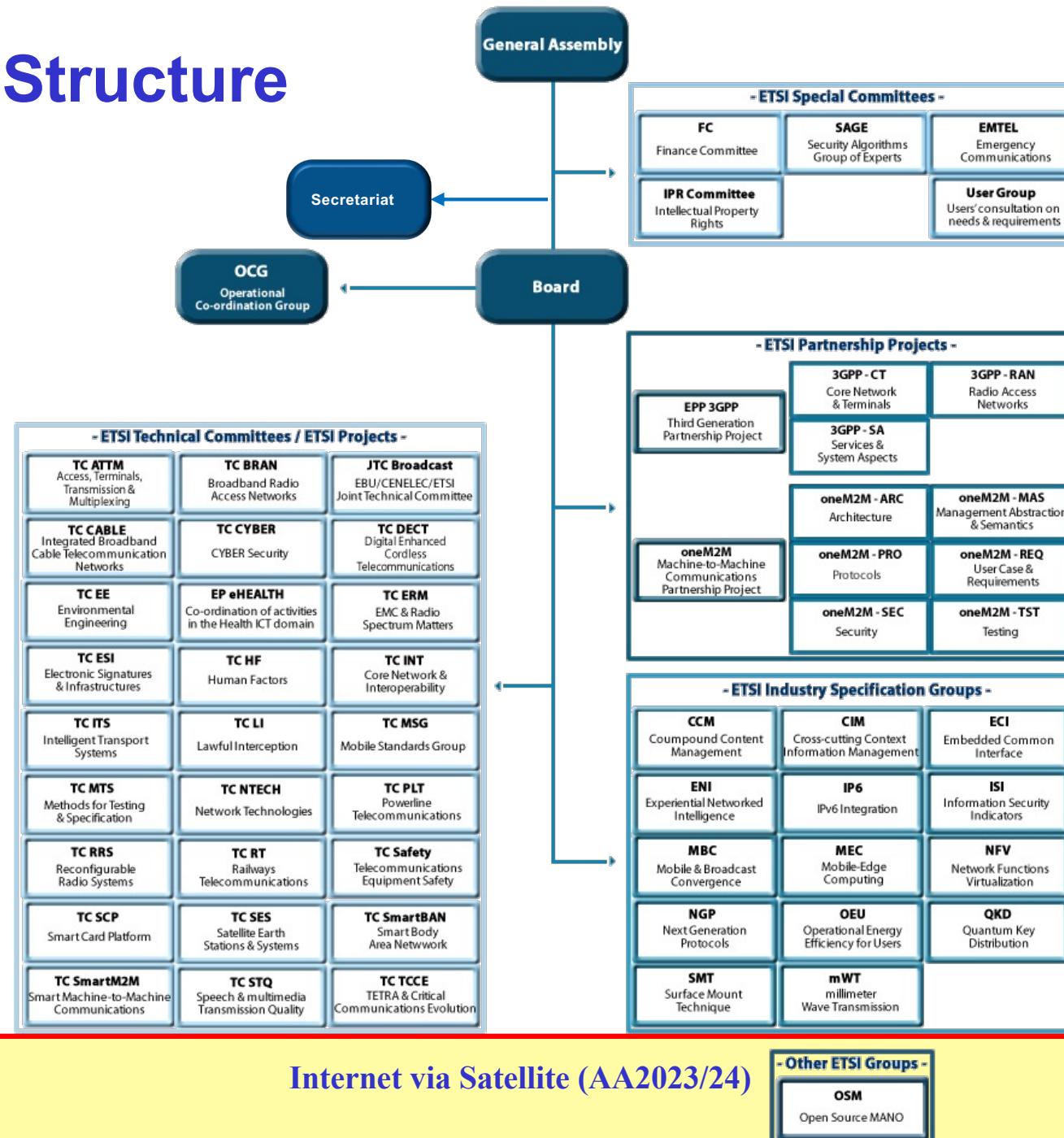
## ETSI Role

- **GSP: Global Standards Producer**
  - ETSI creates standards intended to meet global needs in ICT (global applicability of technical specifications)
- **ESO: European Standards Organization**
  - ETSI produces Harmonized Standards in all areas of telecommunications & ICT used to access European market
- **SPO: Service Providing Organization**
  - Interopolis: interoperability engineering
  - Forapolis: forum management
  - Plugtests events, home of TTCN-3
- **Documents**
  - EN European Standards
  - ES ETSI Standard
  - TS Technical Specification
  - EG ETSI Guide
  - TR Technical Report
  - SR Special Report

## Type of committees

- **Technical Committee (TC)** – addressing a number of standardization activities in a specific technology area.
- **ETSI Project (EP)** – similar to a Technical Committee but established to meet particular market sector needs rather than centered around a basic technology. ETSI Projects last for a fixed period of time.
- **ETSI Partnership Project** – established when there is a need to co-operate with other organizations to achieve a standardization goal. There are currently two Partnership Projects: the Third Generation Partnership Project (3GPPTM) and one M2M.
- **Industry Specification Group (ISG)** – operating alongside our traditional standards-making mechanisms and focusing on a very specific activity. ISGs are self-contained, decide their own work programme and approve their own specifications. They offer quick and easy alternative to creation of industry fora.
- **Special Committee (SC)** – like TCs, addressing a number of standardization activities in a specific technology area but SCs tend to handle co-ordination, the gathering of requirements and very specific support activities rather than drafting standards and specifications.
- **Specialist Task Force (STF)** – groups of technical experts who come together for a defined period (typically a few months) to work intensively on specific items. STFs operate under the guidance of a TC or EP.

# ETSI Structure



# ETSI Technical groups

**SES**

Satellite Earth Stations & Systems

## COMMITTEES, PROJECTS & OTHER GROUPS

ATM	Access, Terminals, Transmission and Multiplexing	BRAN	Broadband Radio Access Networks
BROADCAST	EBU/CENELEC/ETSI on Broadcasting	CABLE	Integrated broadband cable telecommunication networks
CYBER	Cyber Security	DECT	Digital Enhanced Cordless Telecommunications (DECT)
EE	Environmental Engineering	eHEALTH	eHEALTH
EMTEL	Emergency Communications	ERM	EMC and Radio Spectrum Matters
ESI	Electronic Signatures and Infrastructures	HF	Human Factors
INT	Core Network and Interoperability Testing	ITS	Intelligent Transport Systems
LI	Lawful Interception	MSG	Mobile Standards Group
MTS	Methods for Testing & Specification	OSM	OpenSource MANO
RSS	Reconfigurable Radio Systems	RT	Railway telecommunications
SAFETY	Safety	SES	Satellite Earth Stations & Systems
SET	Secure Element Technologies	SmartBAN	Smart Body Area Network
SmartM2M	Smart M2M	STQ	Speech and multimedia Transmission Quality
TCCE	TETRA and Critical Communications Evolution	TFS	TeraFlowSDN
USER	User Group		

## INDUSTRY SPECIFICATION GROUPS

ARF	Augmented Reality Framework	CDM	euopean Common information sharing environment service and Data Model
CIM	cross-cutting Context Information Management	ENI	Experiential Networked Intelligence
ETI	Encrypted Traffic Integration	F5G	Fifth Generation Fixed Network
MEC	Multi-access Edge Computing	mWt	millimetre Wave Transmission
NFV	Network Functions Virtualisation	NIN	Non-IP Networking
OEU	Operational energy Efficiency for Users	OSL	OpenSlice
PDL	Permissioned Distributed Ledger	QKD	Quantum Key Distribution
RIS	Reconfigurable Intelligent Surfaces	SAI	Securing Artificial Intelligence
THz	TeraHertz technology	ZSM	Zero-touch network and Service Management

Internet via Sate

# Technical Committee (TC) Satellite Earth Stations and Systems (SES)

- Responsible for all aspects related to satellite communications
  - All types of satellite communication systems, services and applications (including mobile and broadcasting),
  - All types of earth stations and earth station equipment, especially the radio frequency interfaces and network and/or user interfaces,
  - Protocols implemented in earth stations and satellite systems.
  - Responsibility outside ETSI - Primary Committee for coordinating the position of ETSI with relevant ITU Study Groups.
- Structure
  - **SCN** Satellite Communication and Navigation (created in July 2011)
    - previously MSS-Mobile Satellite Systems and BSM- Broadband Satellite Multimedia
  - **MAR ESV** Maritime & Railways Satellite Earth Stations on Board Vessels & Trains
  - **SatEC** Satellite Emergency Communications
  - **SDR** Satellite Digital Radio

## ETSI/TC-SES/ SCN WG

- Created in July 2011
- Responsible for radio and transmission aspects related to Fixed, Mobile and Global Navigation Satellite Systems operating in any bands allocated to FSS, MSS or RDSS.
  - To produce and maintain harmonized standards for satellite earth stations;
  - To produce and maintain technical specifications for satellite radio interfaces;
  - To encourage spectral efficiency on satellite links and harmonization of satellite radio interfaces;
  - To produce specifications that promote integration and inter-working between satellite and terrestrial networks.
  - To produce architecture and service requirements, interfaces (user, control and management planes), transport and network protocols, service enablers.
  - To encourage the development of network, transport and service layers compatible with various fixed and mobile satellite access networks.

## MAR-ESV

- **Scopes**
  - All types of Earth Stations installed on ships, vessels or trains operating in all types of frequency bands allocated to MSS, FSS and BSS
- **Responsibility**
  - This Working Group had received mandate from ETSI SES to produce and monitor standards for those Earth Stations including when transmitting on the move.
  - To analyze the Standards produced in ERM TG26, in order to resolve the potential conflicting specifications
- **Liaison**
  - Liaison with all other fora dealing with such Earth Stations, for example ITU R WP 4-9S, WP 4A, CEPT-ECC WG SE, SE40 and SE19 and CEPT-ECC WG RA5 and RA6

## SatEC WG

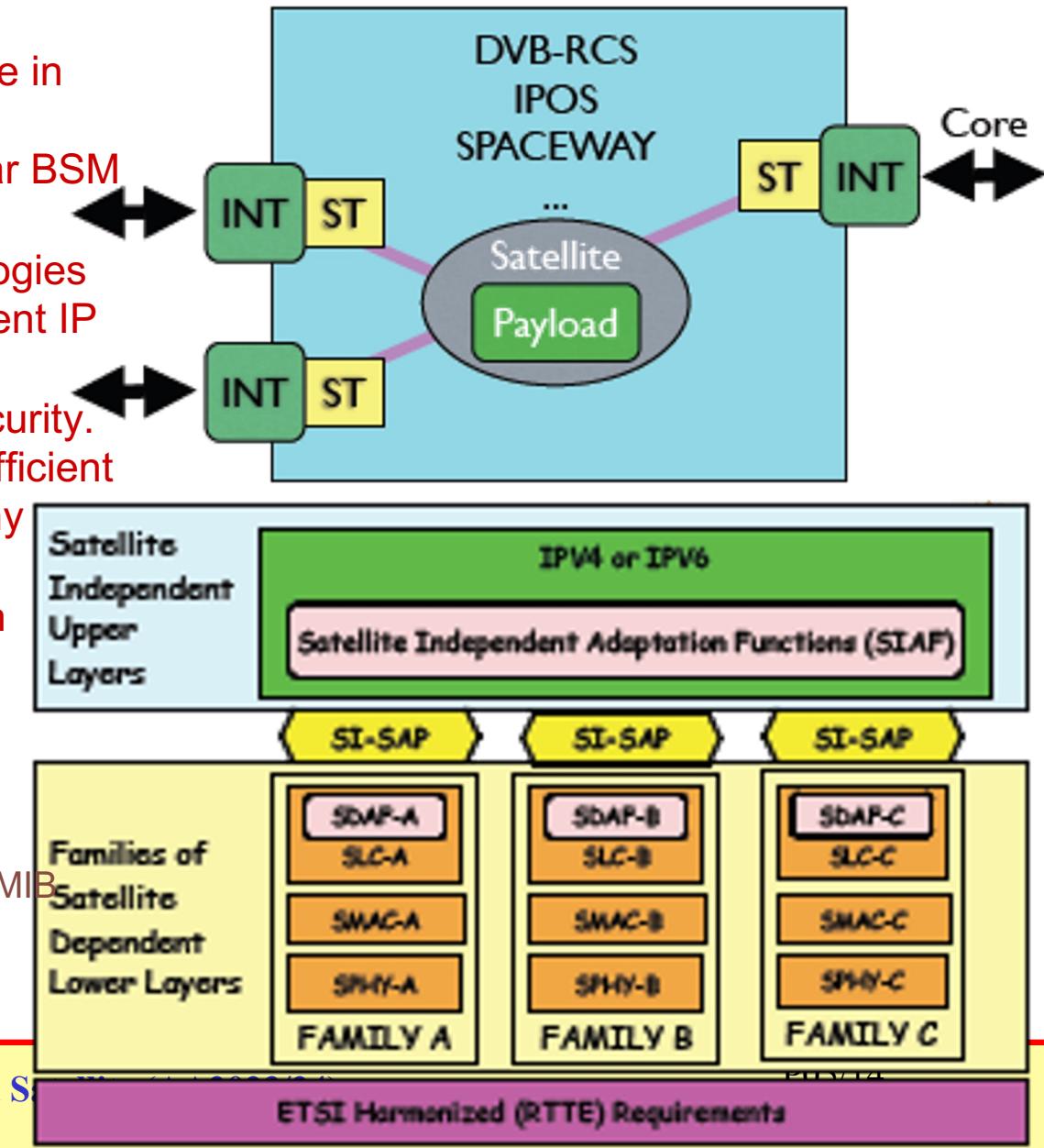
- **Scope activity**
  - To perform standardization in the area of satellite emergency communication in particular involving broadband services.
- **Liaison**
  - The WG will liaise with any relevant bodies, in particular with EMTEL and MESA

# SDR

- **Scope**
  - To produce Technical Specification(s) or other ETSI deliverables for Digital Radio system.
- **Responsibility**
  - ETSI TC-SES gives TC mandate to this Working Group to produce Technical Specification(s) for Satellite Digital Radio (SDR) systems.
  - The Working Group will define the Technical Specifications for radio interfaces used by SDR systems to receive signals from the satellite and from the complementary terrestrial transmitters.
  - The working group shall also investigate whether there is a need to produce Harmonized Standards for transmitting elements of SDR systems, such as earth stations operating in the FSS uplink or complementary terrestrial transmitters.
- **Liaison**
  - The working group will liaise with any relevant body, inside and outside ETSI, on matters regarding the development of standards for SDR systems.

# ETSI former BSM WG

- ETSI SES TC develops standards for BSM (Broadband Satellite Multimedia) communications that are designed for use in IP-based satellite access networks. The standards are designed around a modular BSM architecture, which combines families of satellite-dependent transmission technologies with a set of common, satellite-independent IP interworking functions such as quality of service, addressing, multicasting and security. The resulting set of standards promote efficient methods of interworking IP traffic over any satellite network, while optimizing the IP interoperability and compatibility between satellite and terrestrial networks.

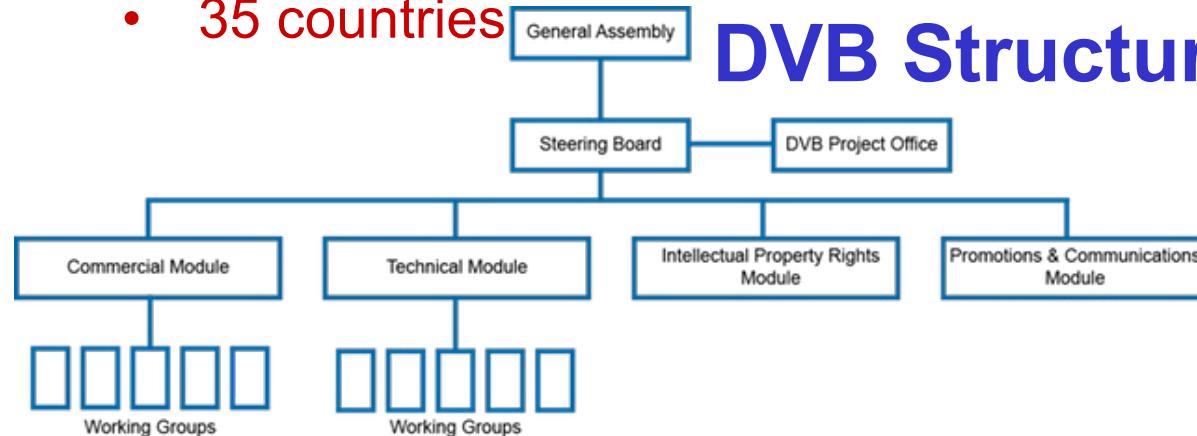


## On going work

SES SCN	
<u>ETSI TR 103 896 V1.1.1 (2023-07)</u>	Considerations on off-axis EIRP density mask applicability for Ka band GSO ESOMPs in relation to potential revision to ETSI EN 303 978 (V2.1.2)
ETSI TS 103 179 V1.2.1 (2023-06)	Return Link Encapsulation (RLE) protocol
ETSI EN 303 980 V1.3.1 (2022-10)	Fixed and in-motion Earth Stations communicating with non-geostationary satellite systems (NEST) in the 11 GHz to 14 GHz frequency bands; Harmonised Standard for access to radio spectrum
ETSI EN 303 981 V1.3.1 (2022-10)	Fixed and in-motion Wide Band Earth Stations communicating with non-geostationary satellite systems (WBES) in the 11 GHz to 14 GHz frequency bands; Harmonised Standard for access to radio spectrum

# DVB (Digital Video Broadcasting)

- Industry led consortium formed in 1993
- 159 broadcasters, manufacturers, operators, software developers, regulatory bodies
- 35 countries



## Modules

The activities of the DVB Project are carried out in four main Modules, each covering a specific element of the work undertaken. The Commercial Module and Technical Module are the driving force behind the development of the DVB specifications, with the Intellectual Property Rights Module addressing IPR issues and the Promotion and Communications Module dealing with the promotion of DVB around the globe.

## Observers

A number of organizations have been granted a non-voting Observer status, including such entities as the European Broadcasting Union, the European Telecommunications Standards Institute, the Korean Electronics and Telecommunications Research Institute and CableLabs®.

## General Assembly

The General Assembly is the highest body in the DVB Project and meets once a year, usually in November. All Members are represented in the General Assembly.

## Steering Board

The Steering Board is elected by the General Assembly and meets 3 times per year. It sets the overall policy direction for the DVB Project and handles its coordination, priority setting and management. The Steering Board approves DVB specifications and offers them for standardization to the relevant international standards bodies.

## Working Groups

The ad hoc Working Groups are where the real development of the DVB specifications takes place. Originating from the Modules and focusing on specific topics, they work towards clearly defined goals. Made up of experts, they are the beating heart of the DVB Project.

## DVB Procedure

- Commercial module and its WGs identify the Commercial requirements (CR)
- Technical module and its WGs develop specification
- Documents approved by voting (only members)
- Approval by steering board
- Standard issued by ETSI/SES or CENELEC (European Committee for Electrotechnical Standardization)
- DVB's Intellectual Property Rights Module addresses the issue of any intellectual property rights that may arise for DVB specs
- Promotions & Communications Module coordinates the flow of information regarding DVB specs to all parts of the world.

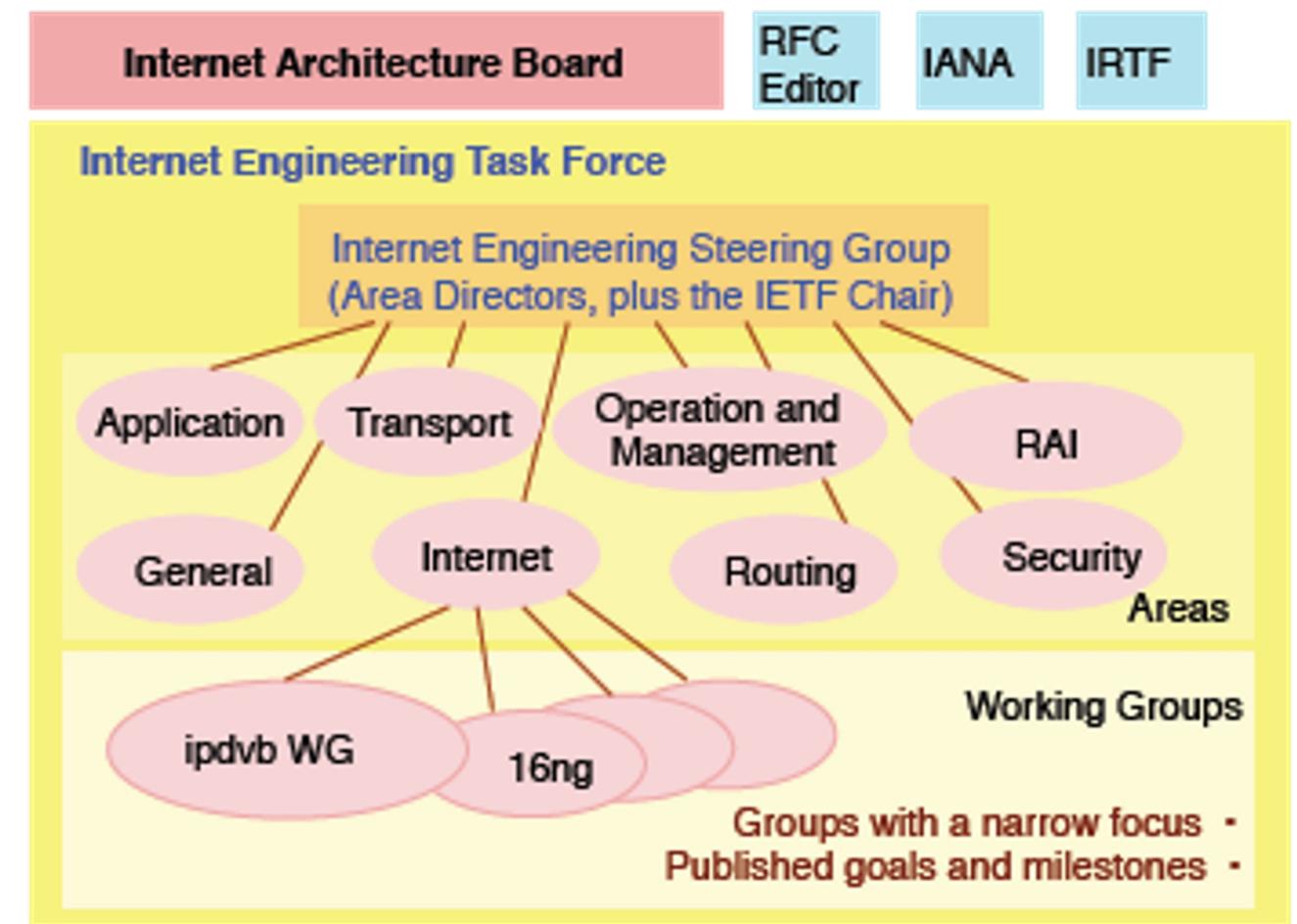
# IETF MISSION

- To produce high quality, relevant technical and engineering documents that influence the way people design, use, and manage the Internet in such a way as to make the Internet work better. These documents include protocol standards, best current practices, and informational documents of various kinds.
- The IETF will pursue this mission in adherence to the following cardinal principles:
  - Open process - any interested person can participate in the work, know what is being decided, and make his or her voice heard on the issue. Part of this principle is the commitment to making documents, WG mailing lists, attendance lists, and meeting minutes publicly available on the Internet.
  - Technical competence - the issues on which the IETF produces its documents are issues where the IETF has the competence needed to speak to them, and that the IETF is willing to listen to technically competent input from any source. Technical competence also means that IETF output is expected to be designed to sound network engineering principles - this is also often referred to as "engineering quality".
  - Volunteer Core - participants and leadership are people who come to the IETF because they want to do work that furthers the IETF's mission of "making the Internet work better".
  - Rough consensus and running code - standards are based on the combined engineering judgment of participants and real-world experience in implementing and deploying specifications.
  - Protocol ownership - when the IETF takes ownership of a protocol or function, it accepts the responsibility for all aspects of the protocol, although some aspects may rarely or never be seen on the Internet. Conversely, when the IETF is not responsible for a protocol or function, it does not attempt to exert control over it, even though it may at times touch or affect the Internet.

# IETF composition and structure

- ISPs and Carriers
- Researchers
- Vendors
- Inventors
- Liaison

**Only individuals**



# IETF Documents and RFC process

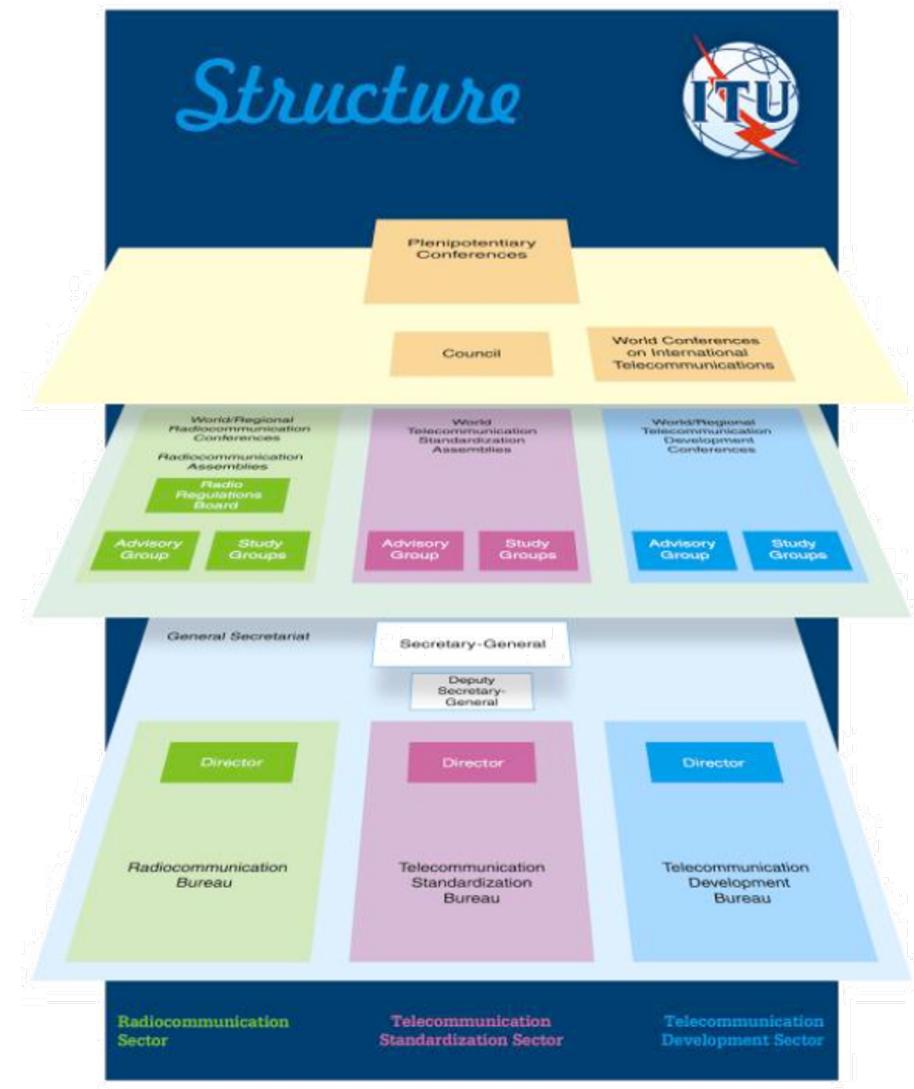
- Internet Draft (IDs)
  - Individual Submissions
  - Working Group Drafts
- Request For Comments (RFCs)
  - Informational
  - Best Current Practices (BCP)
  - Standard Track
    - Propose Standard
    - Draft Standard • Standard
  - Experimental
  - Historic
- Ideas
- Working Groups
- Internet Draft (ID)
- Working group last call
- IETF last call
- IESG (AD) - Internet Engineering Steering Group
- IANA (Internet Assigned Numbers Authority)
- RFC Editing
- RFC issued

# ITU structure

Headquartered in Geneva, Switzerland, is an international organization within the United Nations System where governments and the private sector coordinate global telecom networks and services. In addition to 193 Member States, membership includes ICT regulators, many leading academic institutions and 700 tech companies.

Three main sectors:

- *Radiocommunications (ITU-R)*
- *Standardization (ITU-T)*
- *Development (ITU-D)*



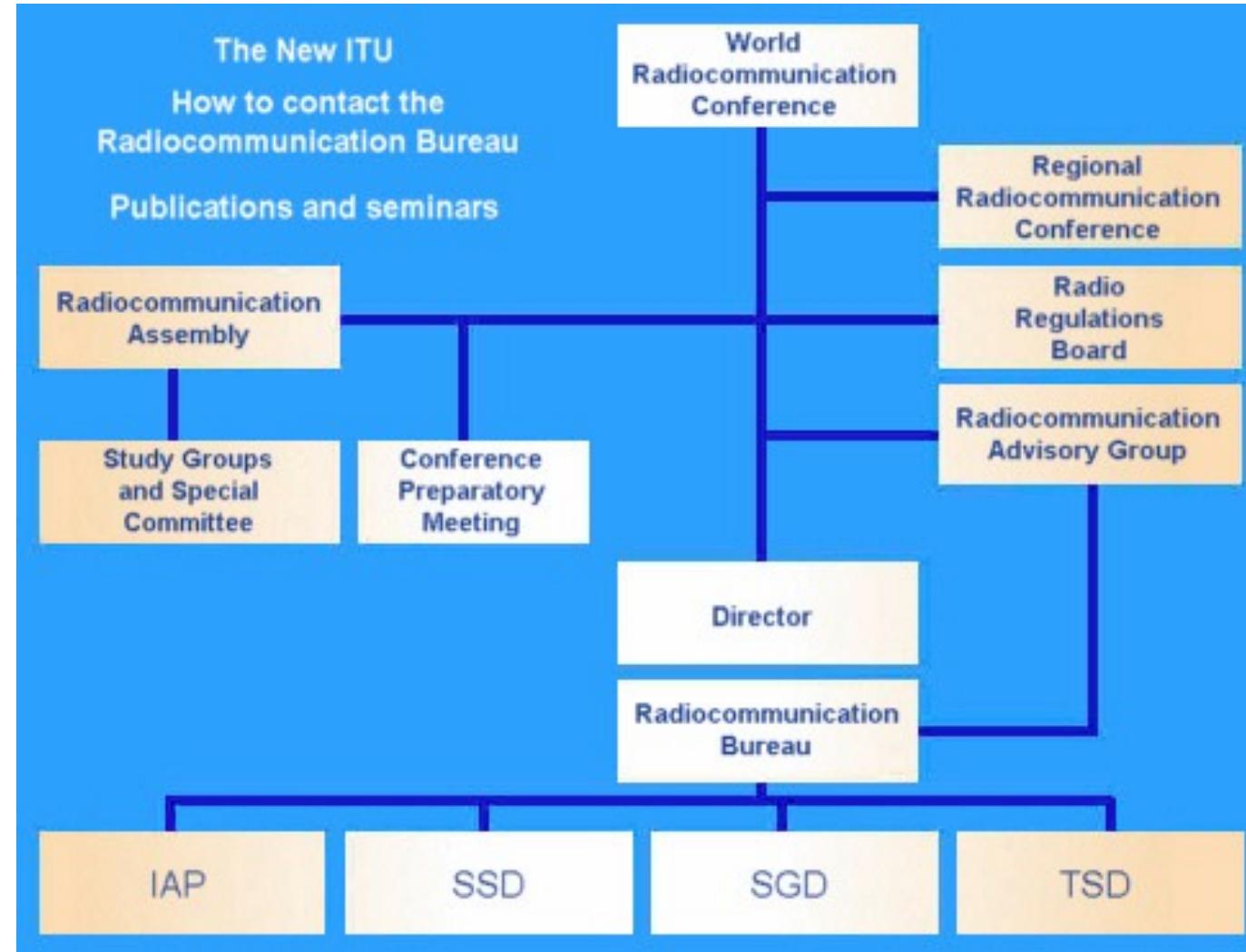
# ITU Council (2023-2026) - 48 members

- **Region A (Americas): 9 seats**
  - Argentina, Bahamas, Brazil, Canada, Cuba, El Salvador, Mexico, Paraguay, United States
- **Region B (Western Europe): 8 seats**
  - France, Germany, Italy, Spain, Sweden, Switzerland, Türkiye, United Kingdom
- **Region C (Eastern Europe and Northern Asia): 5 seats**
  - Azerbaijan, Bulgaria, Czech Republic, Poland, Romania
- **Region D (Africa): 13 seats**
  - Algeria, Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Tunisia, Uganda
- **Region E (Asia and Australasia): 13 seats**
  - Australia, Bahrain, China, India, Indonesia, Japan, Korea (Republic of), Kuwait, Malaysia, Philippines, Saudi Arabia, Thailand, United Arab Emirates

## ITU-R Role

- The ITU-R plays a vital role in the management of the
  - radio-frequency spectrum
  - satellite orbits,
- for a large number of services
  - fixed,
  - mobile,
  - broadcasting,
  - amateur,
  - space research,
  - meteorology,
  - global positioning systems,
  - environmental monitoring
  - communication services that ensure safety of life at sea and in the skies.

# ITU-R Structure



# Entities

- World Radiocommunication Conferences (WRC)
- Radiocommunication Assemblies (RA)
- Regional Radiocommunication Conferences (RRC)
- Radio Regulations Board (RRB)
- Radiocommunication Study Groups
- Radiocommunication Advisory Group (RAG)

# ITU-R Study groups

-  **SAT** • **SG1 Spectrum Management**
-  **SAT** • **SG3 Radiowave Propagation**
-  **SAT** • **SG4 Satellite Service**
  - **SG5 Terrestrial services**
-  **SAT** • **SG6 Broadcasting Service (terrestrial and satellite)**
- **SG7 Science Services**

## Group 4: Scope and working parties

- Systems and networks for the fixed-satellite service, mobile-satellite service, broadcasting-satellite service and radiodetermination-satellite service.
  - Working Party 4A - Efficient orbit/spectrum utilization
  - Working Party 4B - Systems, air interfaces, performance and availability objectives for the fixed-satellite service (FSS), broadcasting- satellite service (BSS) and mobile-satellite service (MSS), including IP-based applications and satellite news gathering (SNG)
  - Working Party 4C - Efficient orbit/spectrum utilization for the mobile- satellite service (MSS) and the radiodetermination-satellite service (RDSS)

## Group 6: Scope and working parties

- Radiocommunication broadcasting (terrestrial and satellite), including vision, sound, multimedia and data services principally intended for delivery to the general public.
- Production and radiocommunication, including the international exchange of programs as well as the overall quality of service.
  - Working Party 6A - Terrestrial broadcasting delivery
  - Working Party 6B – Broadcast service assembly and access
  - Working Party 6M – Programme production and quality assessment

# World Radiocommunication Conference (WRC)

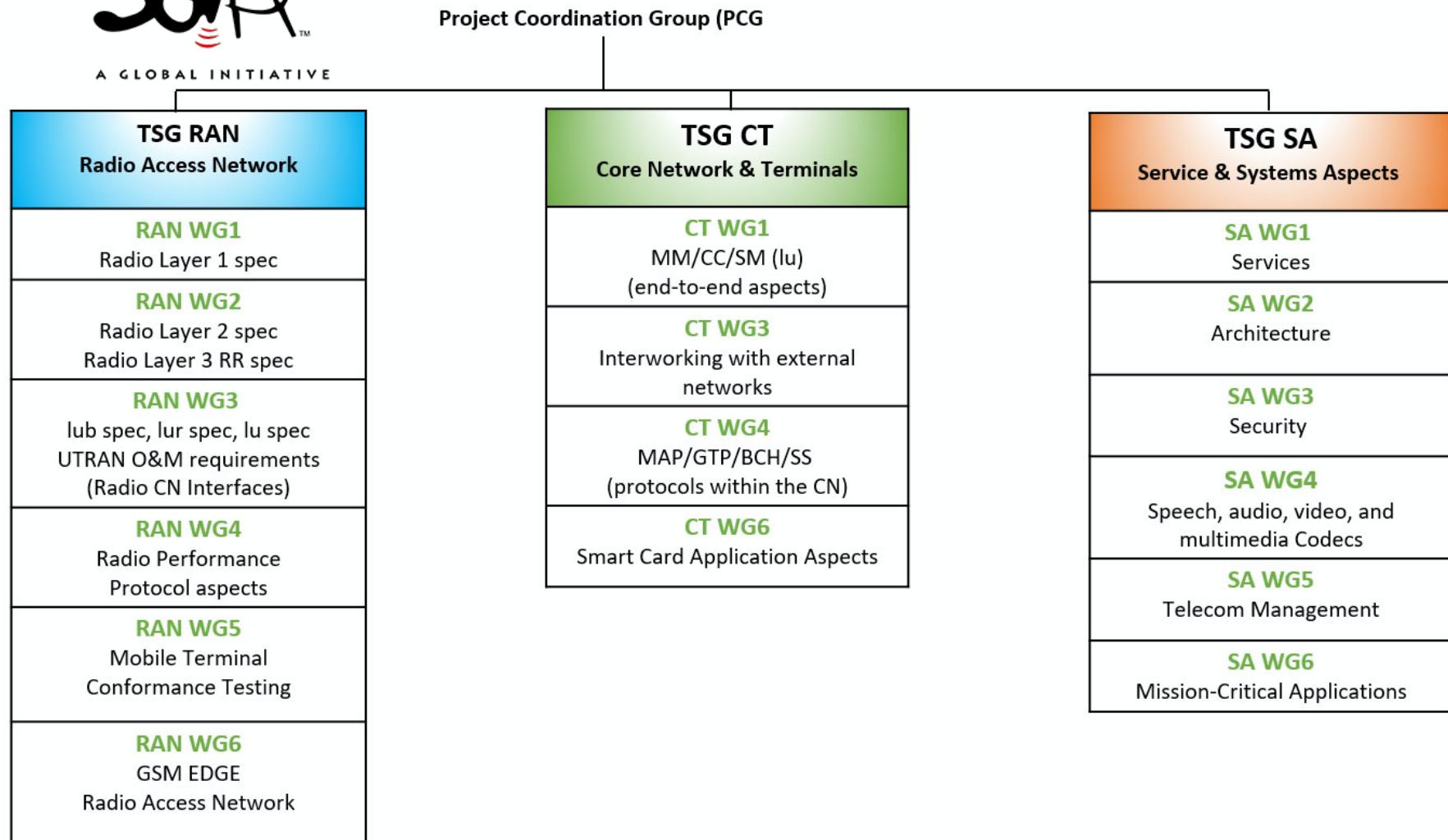
- Held every two to three years to review, revise the Radio Regulations, the international treaty governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits.
- The agenda determined by the ITU Council, takes into account recommendations made by previous world radiocommunication conferences. The general scope of the agenda is established four to six years in advance, the final agenda two years before.
- Under the terms of the ITU Constitution, a WRC can:
  - revise the Radio Regulations and any associated Frequency assignment and allotment Plans;
  - address any radiocommunication matter of worldwide character;
  - instruct the Radio Regulations Board and the Radiocommunication Bureau, and review their activities;
  - determine Questions for study by the Radiocommunication Assembly and its Study Groups in preparation for future Radiocommunication Conferences.
- Conference preparatory meeting (CPM)
  - On the basis of contributions from administrations, the Special Committee, the Radiocommunication Study Groups, and other sources concerning the regulatory, technical, operational and procedural matters to be considered by World and Regional Radiocommunication Conferences, the CPM shall prepare a consolidated report to be used in support of the work of such conferences.

## 3GPP

- The 3rd Generation Partnership Project (3GPP) unites [Seven] telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as “Organizational Partners” and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.
- The project covers cellular telecommunications technologies, including radio access, core network and service capabilities, which provide a complete system description for mobile telecommunications.
- The 3GPP specifications also provide hooks for non-radio access to the core network, and for interworking with non-3GPP networks.
- 3GPP specifications and studies are contribution-driven, by member companies, in Working Groups and at the Technical Specification Group level.



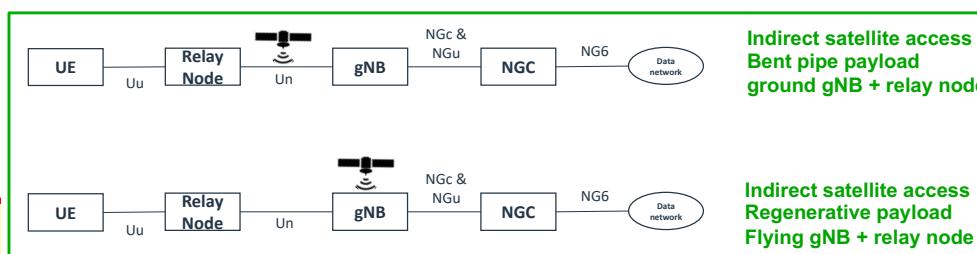
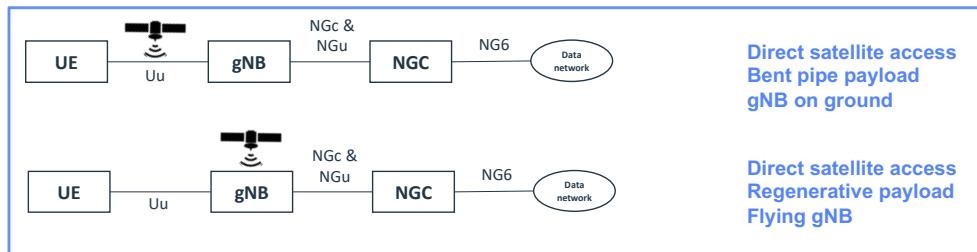
# 3GPP structure



# Standardization activities concerning satellite in 5G

## Status

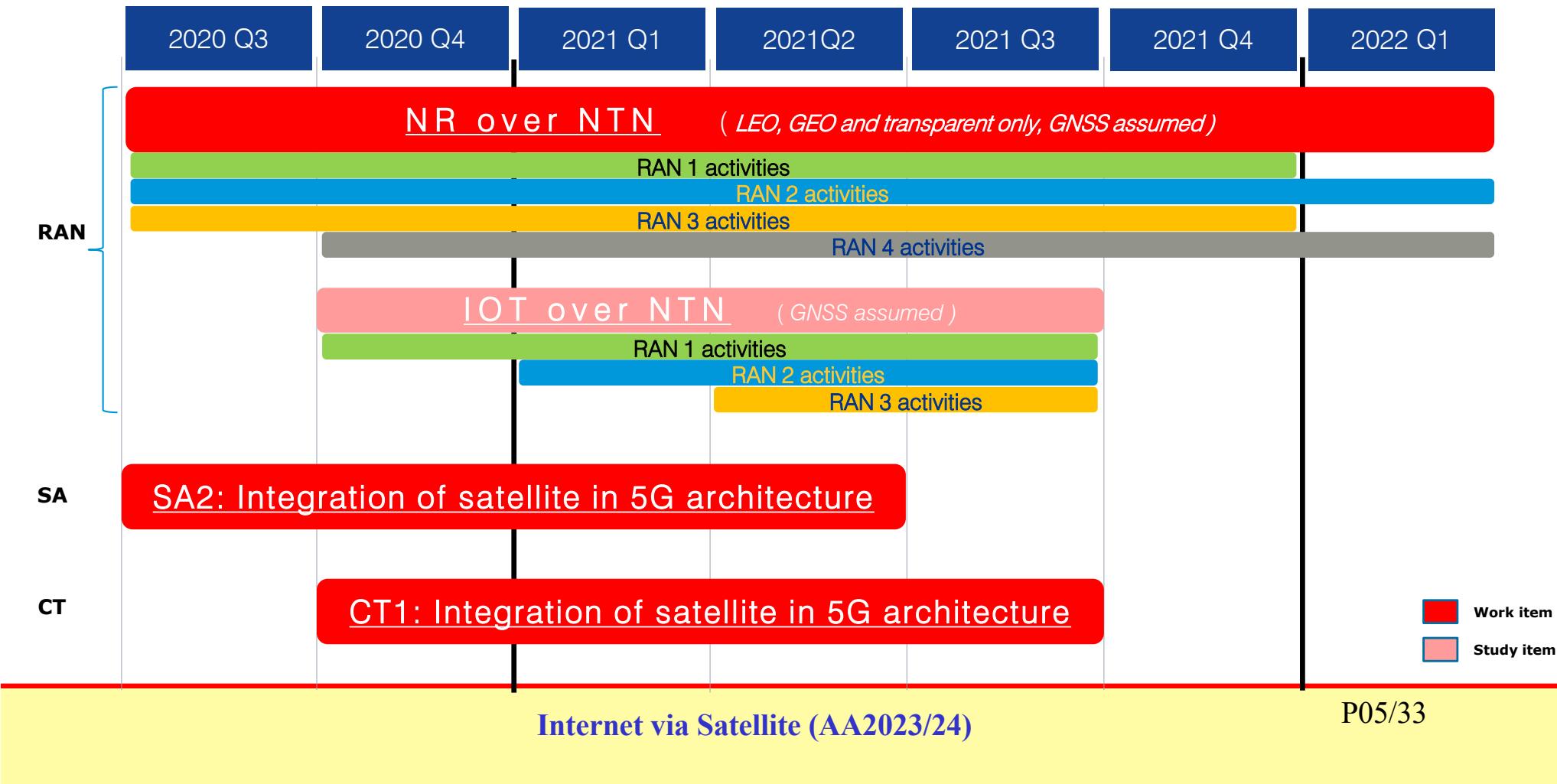
- SatCom related activities are currently ongoing at TSG-SA in the form of several study items that produce technical reports, and one work item in WG-SA1 that led to Change Requests to the top level 5G system services technical specification.
- Prioritization of the work items to be included in Release 17 are under way and will be finalized by December 2019. The 3GPP timeline for 5G foresees in fact the development of release 17 in 2020 with a planned completion for 2021.



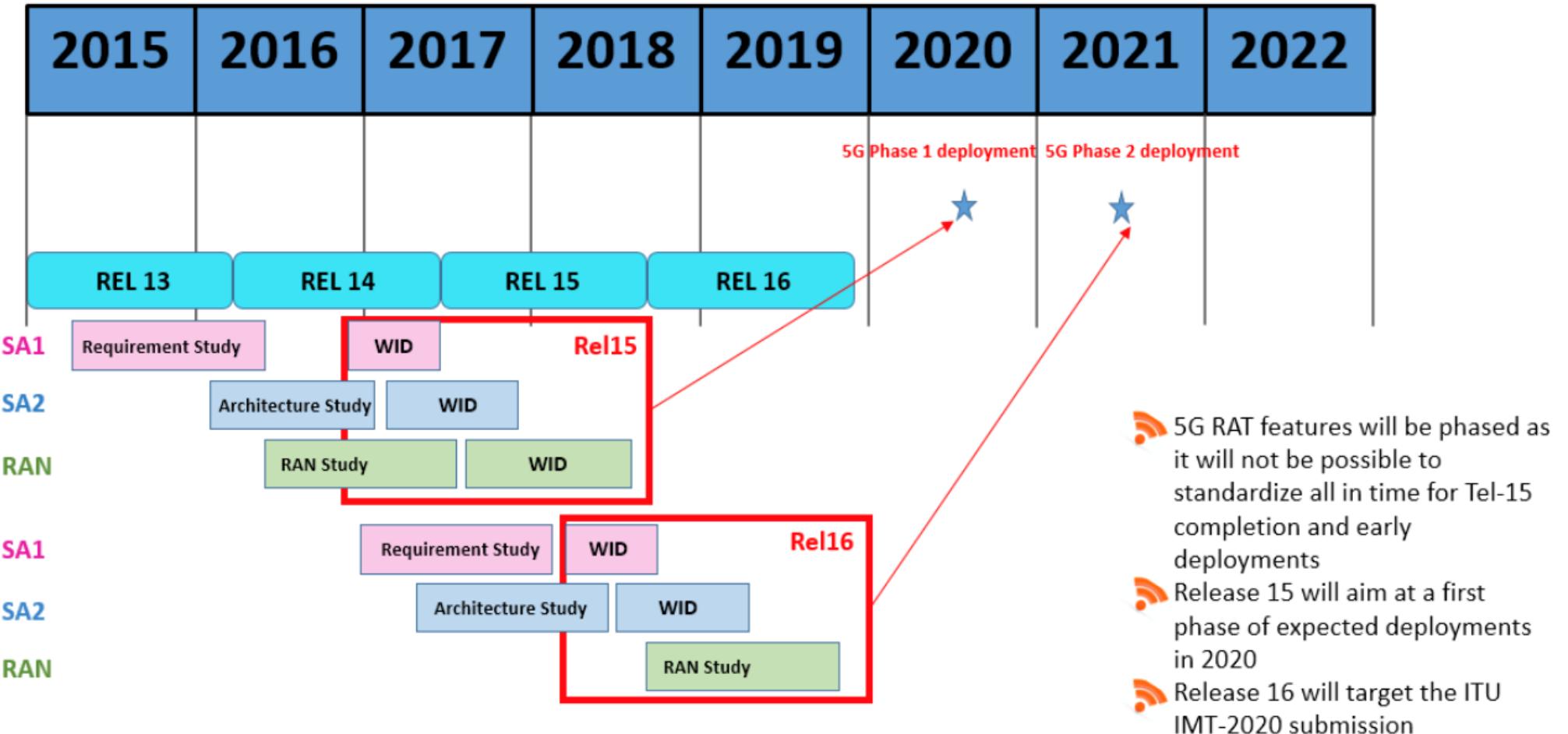
## Action plan

- By December 2019: promote and push as much as possible the SatCom industries to lobby in favour of kick-starting the normative phase on Non-Terrestrial Networks in Release 17. This action shall be
  - implemented before the TSG-RAN & TSG-SA meetings #86 (to be held in December 2019) that will decide the content of Release 17;
  - carried out through actual participations and contributions of the SatCom industries to the 3GPP meetings and through off-line discussion with the SatCom and Terrestrial stakeholders;
- After December 2019: be involved as much as possible to the execution phase of the NTN related work items in 3GPP. This action shall be implemented by
  - dedicated ESA support studies of appropriate dimensions to be activated in the first quarter of 2020;
  - in continuity with the SSIG, the creation of a technical task force, consisting in industrial experts and scientific researchers, with the mandate of coordinating and facilitating, though provision of consultancies and direct R&D activities, the overall research and development of technologies in support of the 3GPP standardization;
  - the support of studies related to the analysis of possible benefits of the NTN component for vertical markets and cellular stakeholders.

# Time plan for standard release



## 3GPP roadmap



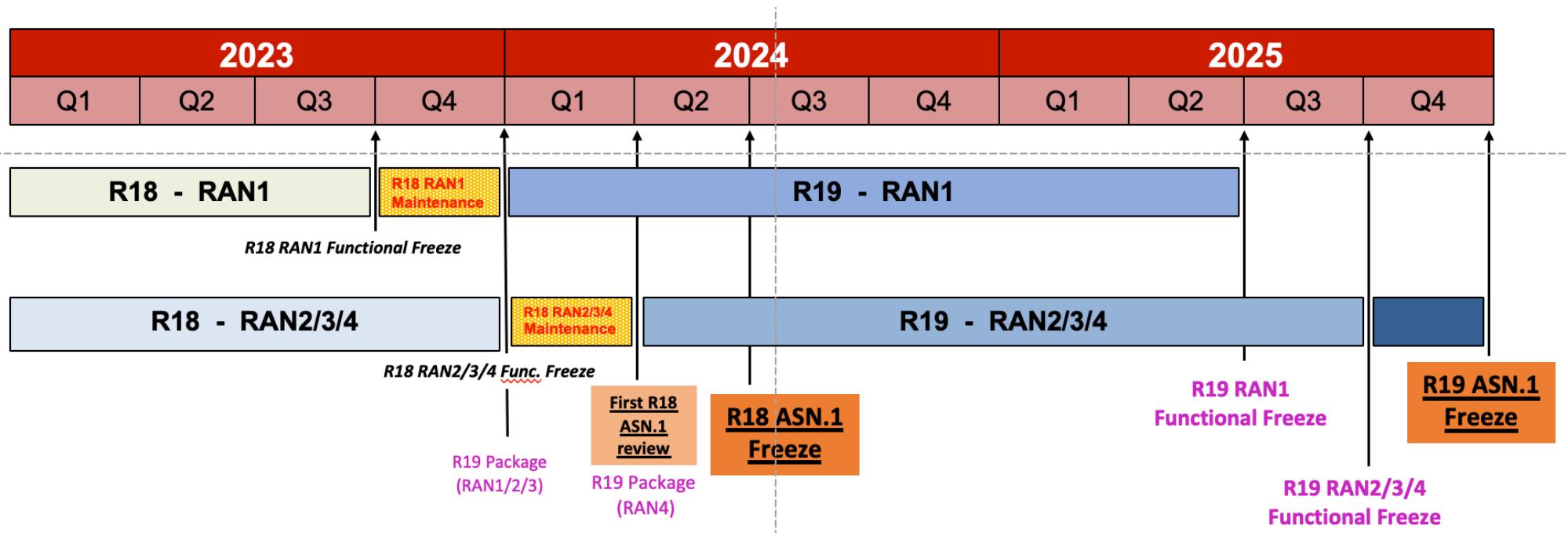
# 3GPP roadmap for Satellite (updated)



Releases	Approach for 5G satellite	Satellite related standardization activities	End of release	Initial deployment
5G	Rel-15	Introduction of the subject  Satellite propagation model definition & issues for 5G support in NTN	June 2018	N/A
	Rel-16	Assessment of the technical issues	March 2019	N/A
	Rel-17	Definition of first <b>Market enabling features</b>	March 2022	2023-24
	Rel-18	Definition of <b>enhancements optimizing performance and enabling new capabilities</b>	Sept 2023	2025
	Rel-19	Definition of 2 <sup>nd</sup> set of <b>enhancements optimizing performance and enabling new capabilities</b>	2025	2027
6G	Rel-20	<i>Contribution to initial 6G work</i>	<i>2027</i>	<i>2029</i>

# Time plan for standard release Approved

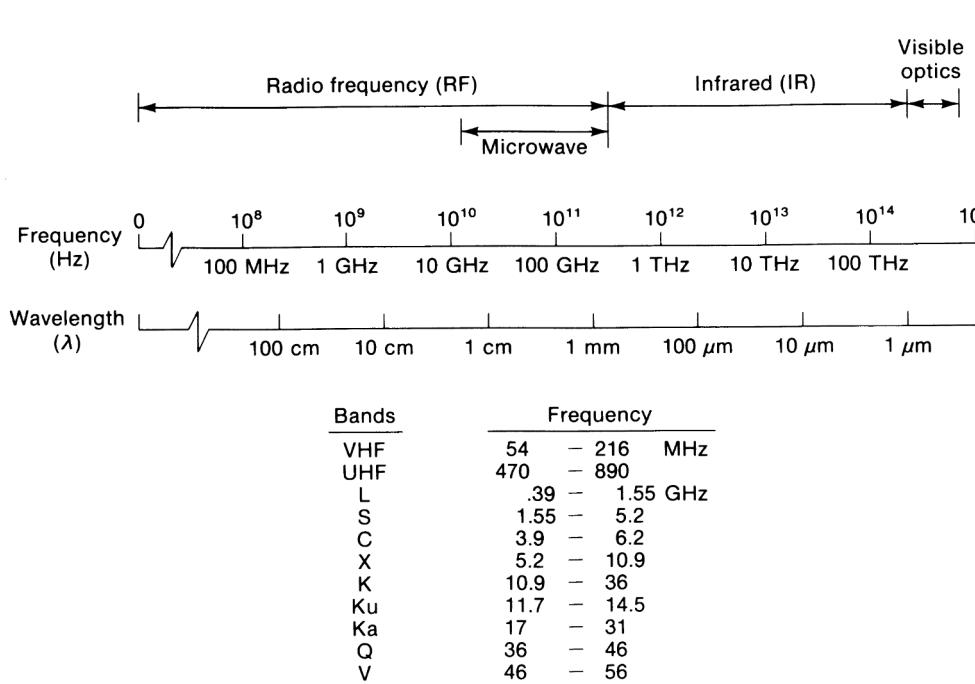
## Timeline in March 2023



# Radio Regulations

- The Radio Regulations (RR) incorporates the decisions of the World Radiocommunication Conferences (WRCs), including all Appendices, Resolutions, Recommendations and ITU-R Recommendations incorporated by reference.
- The Rules of Procedure are approved by the Radio Regulations Board (RRB). They complement the RR by providing clarification of the application of particular Regulations or establishing the necessary practical procedures that may not be provided for in the current Regulatory Procedures.

# The Radio Spectrum



ACRONYM	BAND	WAVELENGTH
VLF (Very Low Frequency)	3-30 kHz	100-10 km
LF (Low Frequency)	30-300 kHz	10-1 km
MF (Medium Frequency)	300-3000 kHz	1000-100 m
HF (High Frequency)	3-30 MHz	100-10 m
VHF (Very High Frequency)	30-300 MHz	10-1 m
UHF (Ultra High Frequency)	300-1000 MHz	100-30 cm
SHF (Super High Frequencies)		
L	1-2 GHz	30-15 cm
S	2-4 GHz	15-7.5 cm
C	4-8 GHz	7.5-3.75 cm
X	8-12 GHz	375-25 mm
Ku	12-18 GHz	25-16.7 mm
K	18-27 GHz	16.6-11 mm
Ka	27-30 GHz	11-10 mm
EHF (Extremely High Frequency)		
	30-36 GHz	10-8.3 mm
Q	36-46	8.3-6.5 mm
V	46-56	6.5-5.3 mm
W	90-94	3.3-3.2 mm
	Up to 300	1 mm

## Band Allocation

	Up Link	Down Link
<i>Fixed Satellite Services</i>	5925-6425 MHz 7900-8400 MHz  13.75-14.5 GHz  27.5-30 GHz 30-31 GHz	3700-4200 MHz 7250-7750 MHz 10.95-11.2 GHz 11.45-11.7 GHz 12.5-12.75 GHz 17.7-20.2 GHz 20.2-21.2 GHz
<i>Mobile Satellite Services</i>	148-150.05 MHz 1626.5-1660.5 MHz 1610-1626.5 MHz 2170-2200 MHz 2655-2690 MHz 7900-8025 MHz 29.9-30 GHz 30-31 GHz	137-138 MHz 1525-1559 MHz 2483.5-2500 MHz 1980-2010 MHz 2500-2535 MHz 7250-7375 MHz 20.1-20.2 MHz 20.2-21.2 MHz

# Spectrum Management

- A combination of technical and administrative procedures aiming at enabling radio stations everywhere to operate on interference free frequencies and without causing interference to other stations.
- Two levels: NATIONAL and INTERNATIONAL
- The procedures are described in the RADIO REGULATIONS
- **Category of allocation**
  - Primary or permitted
  - Secondary or subject to not causing interference
    - A station in the secondary service has to avoid causing interference to a station in primary service and it has to accept any interference caused by a station in the primary service
  - Subject to the application of certain procedures before being recognized on an equal footing with other services sharing the same band.
    - A station operating in out of band assignment must protect both the primary and the secondary services

# Solutions to harmful interference

- Frequency adjustment
- Use of directional antennas
- Schedule adjustment or operational arrangements (time sharing)
- Change of class of emission
- Accommodation of individual channels in multichannel emission
- Transfer of traffic to other available frequencies
- Cessation of the station.

## Coordination

- Bilateral negotiation to achieve an agreeable arrangement on the use of shared frequency bands.
- The procedures for coordination of space communication systems are established in the following provisions of the Radio Regulations (RR):
  - Article 11 Three main procedures of coordination
    - Geostationary satellite network with other networks
    - Earth stations with stations for terrestrial services
    - Transmitting terrestrial stations with earth stations
  - Resolution 46 (WRC 95)
    - Non geo systems and geo in certain frequency bands (the difference in the determination of the need to coordinate)
- Article 7 of Appendix 30
  - Fixed satellite services in the bands 11.7-12.2 GHz (Reg 2), 12.2-12.7 GHz (Reg 3) and 12.5-12.7 GHz (Reg 1) for broadcasting
- The required data to be supplied at the initial coordination stage is described by a single regulatory text in the RR: Appendix S4.

## Coordination area

- Determined on the basis of technical assumptions that will provide interference free operation between the earth station and any terrestrial station lying outside the coordination area
- Whenever the coordination must be effected the coordination area will represent the geographical territory around the earth station location where it has the right to operate with its characteristics and levels of interference
  - An administration intending to put into operation terrestrial stations within the coordination area of an earth station and that have not been considered during the coordination of the earth station, shall request coordination to the administration responsible for the earth station
- Relevant procedures: Section IV of RR Art 11, sect IV of annex 1 to Res 46.

# Coordination process

- Frequency allocation (RR art 8)
  - Only in case of frequency shared
- Regulatory procedures (Art 11 of RR and Res 46)
  - Based on bilateral discussion
- Coordination data (RR app 3)
- Coordination area (Art 11 of RR, Res 46)
  - Earth station in a fixed location
    - distance calculation method in Appendix 28 of RR
  - Mobile (not aero) earth station
    - Coordination area encompassing all the coordination areas determined for each location within the service area (App 28)
  - Aero station
    - 1000 km with (terrestrial) aeronautical mobile services
    - 500 km with terrestrial service, other than aeronautical mobile
  - Receiving stations in meteo service
    - The visibility distance as a function of the Earth station horizon elevation angle for a radiosonde at an altitude of 20 km above the mean sea level, assuming a 4/3 Earth radius.

## Appendix S4: Network coordination

- At the end of the advance publication period, coordination is required with administrations whose satellite systems are identified by using the method of RR Appendix 29 (the equivalent satellite temperature of any link is increased by 6% due to interference from the other network)
- Coordination may need to be effected with administrations whose space systems have a frequency overlap with the planned systems (no particular method, responsibility of administration to decide if their service are likely to be affected by the system of the administration seeking coordination).
- Coordination is required (article 7 of Appendix 30) if there is frequency overlap and if the power flux density produced by the FSS assignment exceeds the value specified in Annex 4 of AP30.
- Actions required to administration planning the new satellite system for coordination
  - Collect all necessary Appendix S4 data for its planned satellite network
  - Send to the administrations, with which coordination is required, a formal request for coordination with the Appendix S4 data attached
  - Send to the Bureau a set of the Appendix S4 data and copies of the coordination required

# Network coordination: Relevant Data and Forms

- Info required in Annexes 2A and 2B to Appendix S4
  - General information (network characteristics, orbital data) **Form ApS4/II- 1a,1b**
  - Characteristics in the satellite receiving direction (for each satellite antenna beam)  
**Form ApS4/II-2a,2b**
  - Characteristics in the satellite transmitting direction (for each satellite antenna beam)  
**Form ApS4/II-3a,3b**
  - Overall link characteristics (up and down frequencies, transmission gain and equivalent satellite noise temperature for each link for Appendix 29 calculations)  
**Form ApS4/II-4a,4b**— Date of bringing into use and info on agreement obtained or requested
- Two types of earth station
  - Typical, to operate within a given service area
  - Specific, precise geographical coordinates must be provided
- Additional Info
  - Space station antenna beam coverage in graphical format
  - Steerable satellite antenna beam
  - Optional info (modulation, exact frequency, ...)
- After that the Radiocommunication Bureau will examine all the material and will provide or not the assignment.

## Appendix S4: Earth Station Coordination

- Coordination of an earth station with stations in terrestrial services is required with administrations of neighboring countries whose territory lie partially or entirely within the earth station coordination area, determined by the method of RR Appendix 28 (Article 11) or by predetermined coordination distance (Res 46)
- The administration responsible for the earth station shall:
  - Collect all necessary Appendix S4 data for its station;
  - Send to the administrations with which coordination is required a formal request with data attached, along with diagrams containing the station location and its associated coordination area;
  - Send to the Bureau data and attachments.

# Earth Station Coordination: Relevant data and Forms

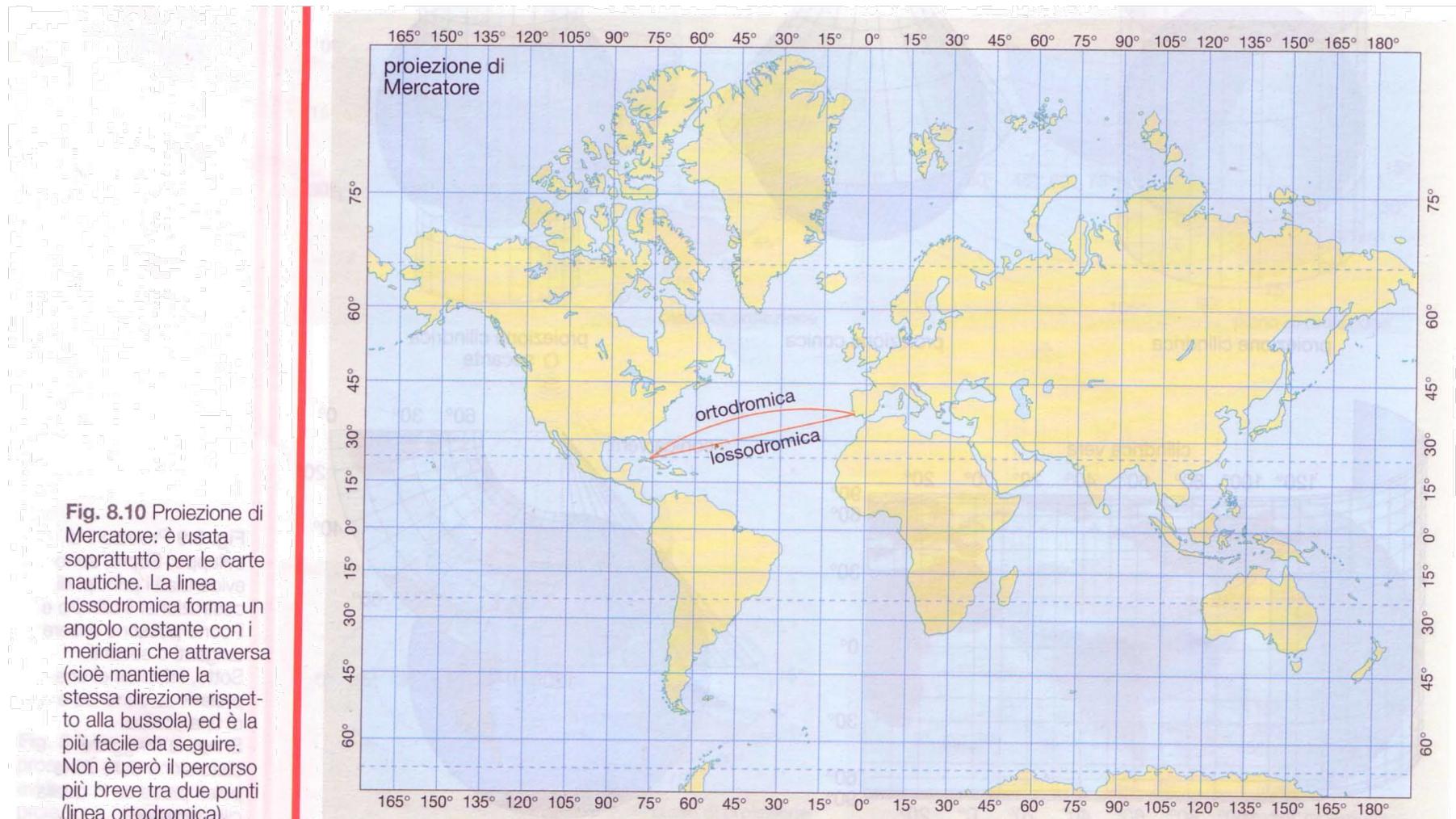
- Info required in Annexes 2A and 2B to Appendix S4
  - General information: (identify and location, associated space station) **Form ApS4/III-1**
  - Characteristics of the transmitting earth station (antenna characteristics, associated satellite receiving antenna beam, emission and frequency data) **Form ApS4/III-2a,2b**
  - Characteristics of receiving earth station (antenna characteristics, associated satellite transmitting antenna beam, emission and frequency data) **Form ApS4/III-3a,3b**

**After that the Radiocommunication Bureau will examine all the material and will provide or not the assignment.**

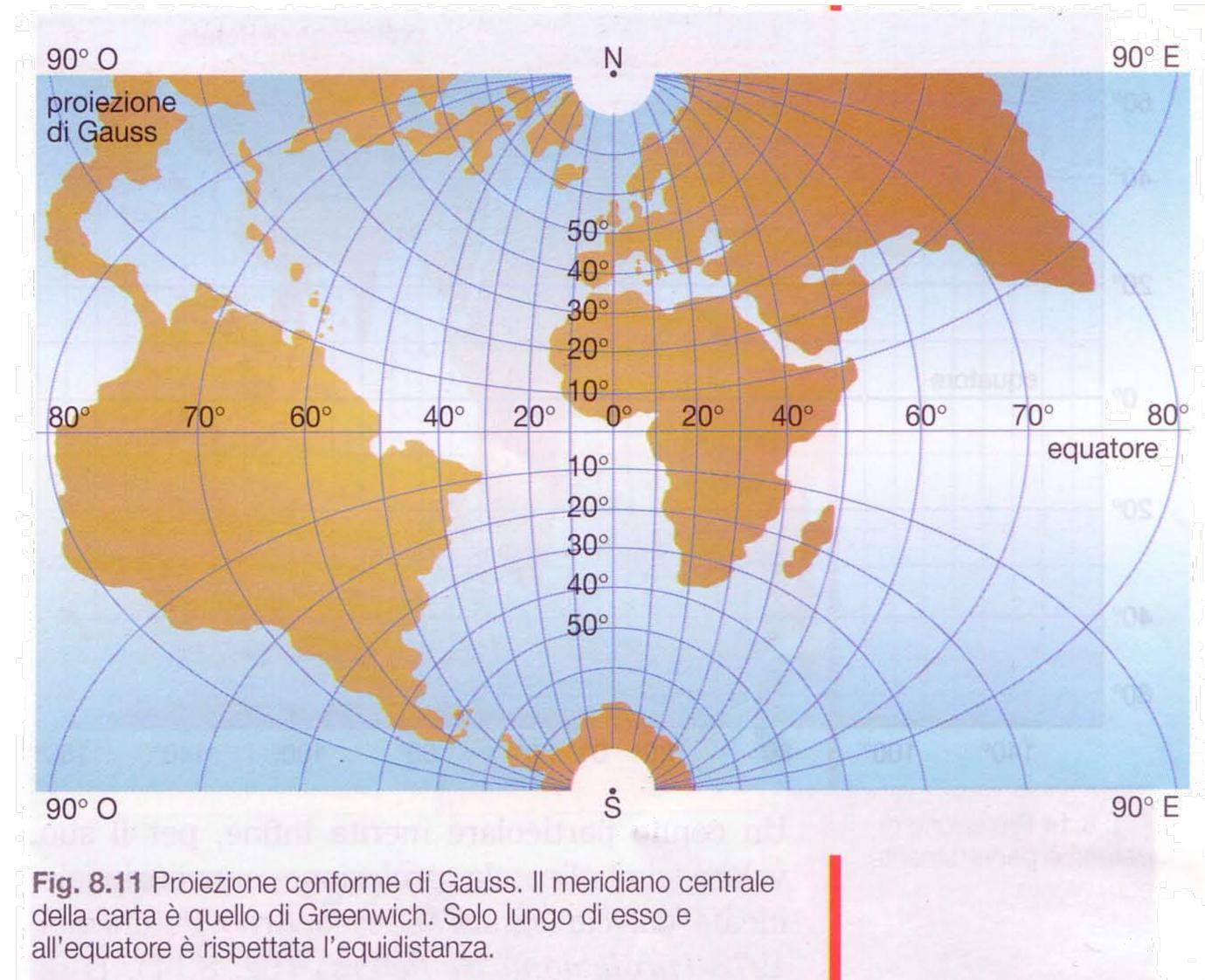
## Graphical data (app 3 and 4 of RR)

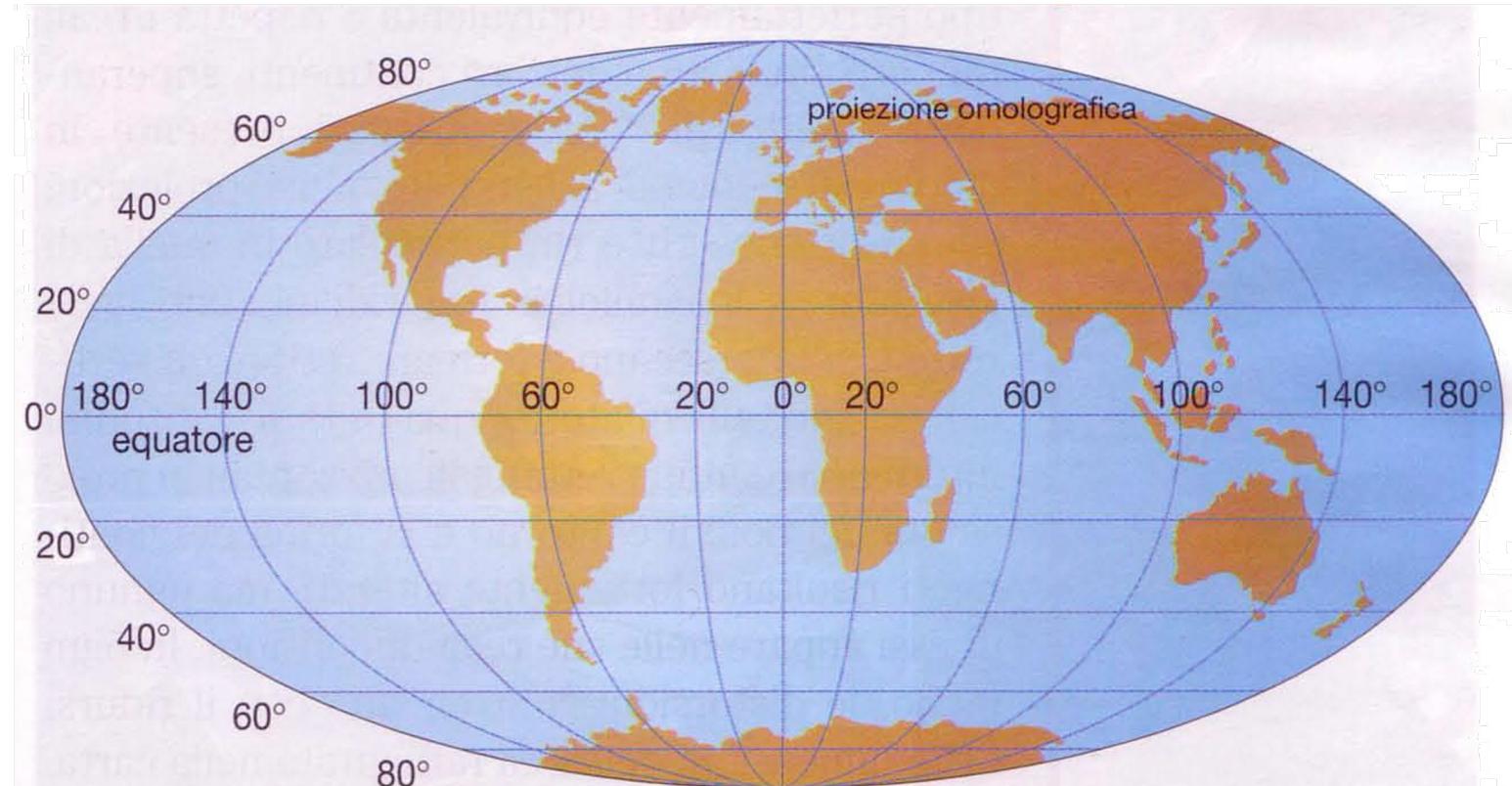
- Measured radiation diagrams of earth station antennas;
- The horizon elevation diagrams of earth stations;
- The service area of the satellite networks;
- The antenna gain contours of geostationary space stations;
- The diagram of the antenna gain of geostationary space stations towards the geostationary-satellite orbit;
- The antenna radiation pattern of space stations.
- The Graphic Interference Management System (GIMS) allows to present data on a map in the following projections:
  - Orthomorphic
  - Cylindrical equidistant
  - Mercator
  - Cylindrical equal area
  - Equidistant conical with one standard parallel (only for Northern hemisphere)

# Mercator

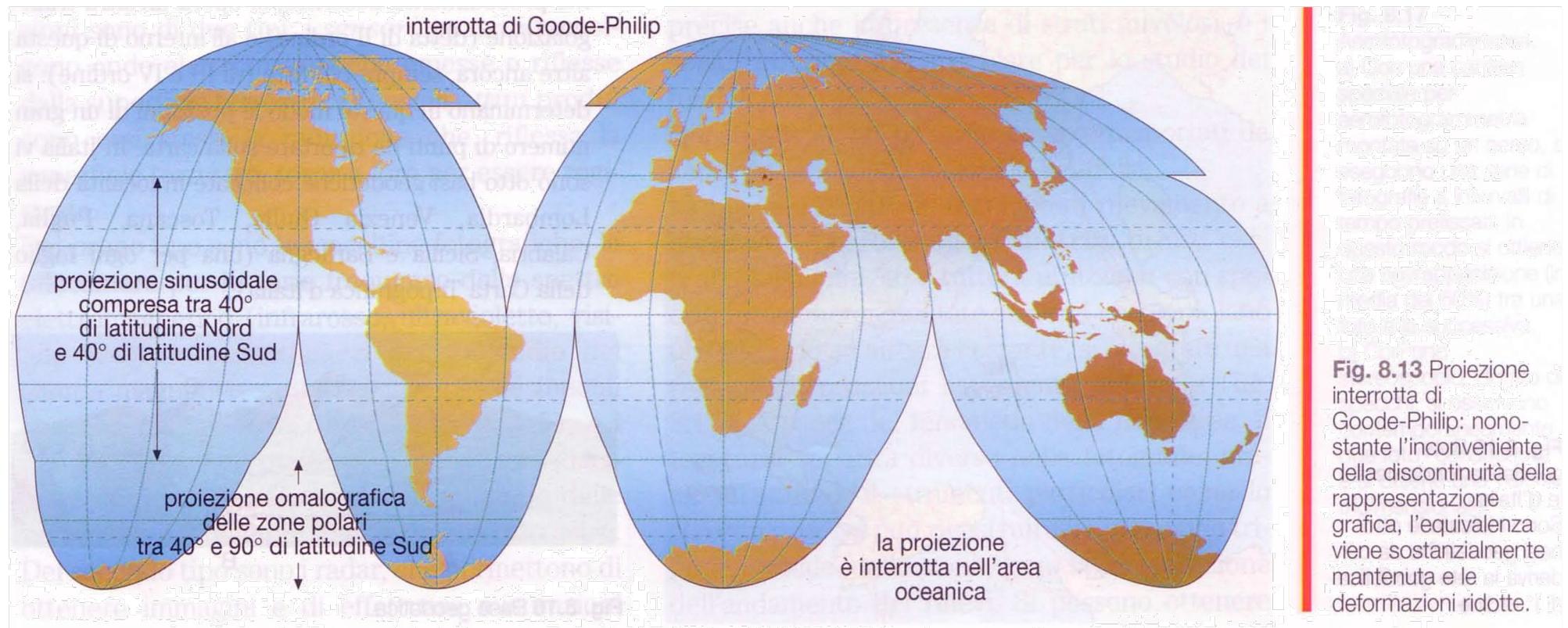


# Gauss

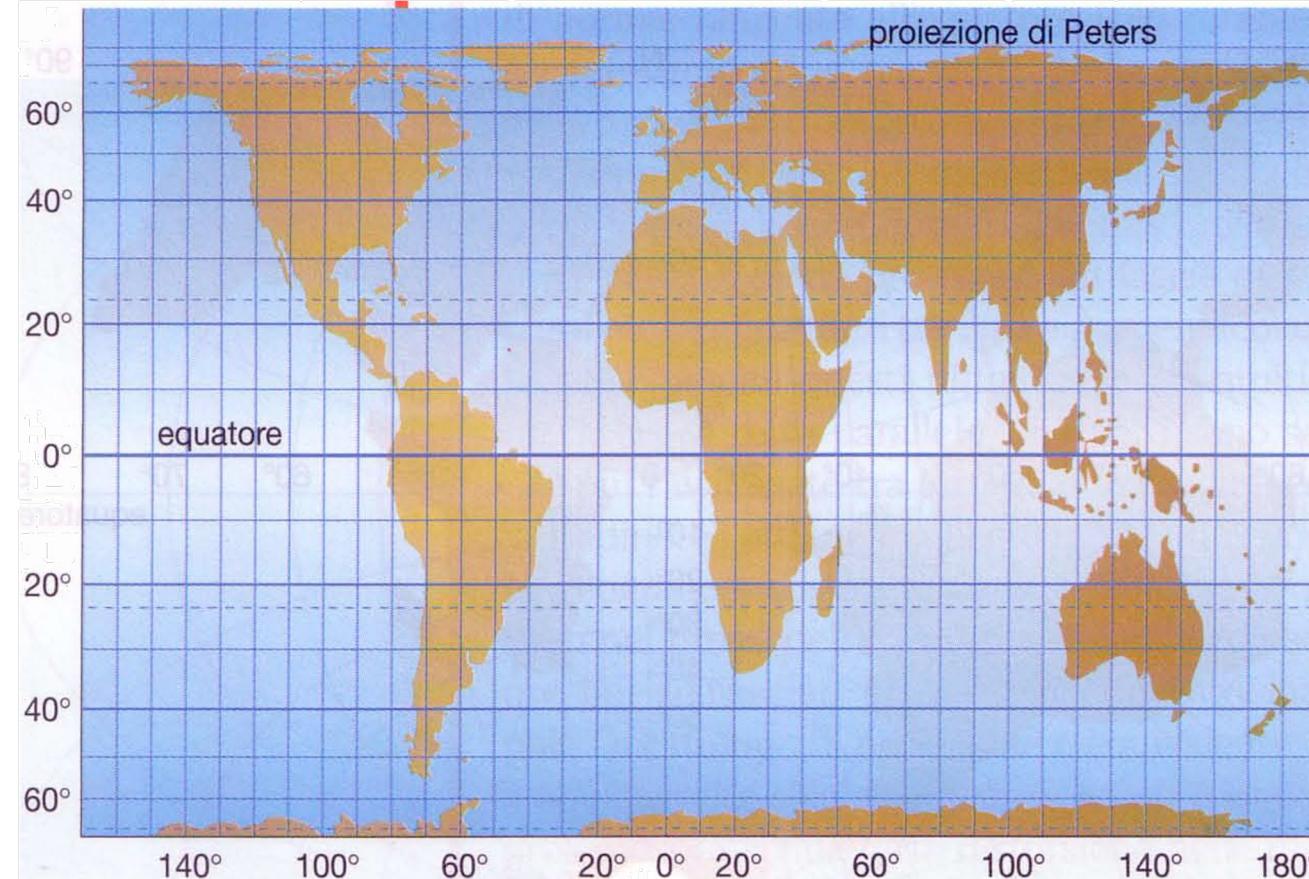




**Fig. 8.12** Proiezione omolografica di Mollweide-Babinet:  
è di tipo equivalente ma deforma i continenti, tanto più ci si  
allontana dal meridiano centrale e dall'equatore.



## Cylindrical equal area



**Fig. 8.14** Proiezione di Peters: è perfettamente equivalente.

Un cenno particolare merita infine, per il suo valore simbolico, la proiezione convenzionale ideata dal cartografo tedesco Alwin Dotens nel