

REGULATORY PROCEDURES for Small Satellites

Space Service Department
Radiocommunication Bureau
International Telecommunication Union
www.itu.int

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ITU is the United Nations **specialized agency**
for information and communication
technologies (ICTs)



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STATES



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ITU in Brief

#ICT4SDG

What would you like to search for?



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Regional Presence

Careers

- For a century and a half since 1865, **the International Telecommunication Union (ITU)** has been at the centre of advances in communications – from telegraphy through to the modern world of satellites, mobile phones and the Internet.
- The story of ITU is one of international cooperation, among governments, private companies and other stakeholders. The continuing mission is to achieve the best practical solutions for integrating new technologies as they develop, and to spread their benefits to all.
- Headquartered in Geneva, Switzerland, currently has a membership of **193 Member States and over 700 private-sector entities, associates and over 150 academic institutions**. Beyond this, many other individuals and organizations are welcomed to contribute their views at events such as the WSIS Forum.
- The rights and obligations of the ITU membership in the domain of international frequency management of the spectrum/orbit resources are incorporated in the **Constitution (CS)** and **Convention (CV)**, as well as in the **Radio Regulations (RR)** with the **Rules of Procedures (RoP)**, and **Recommendations (REC)**.

ITU Membership

- **Member states**
- **Sector Members**
- **Associates**
- **Academia**

➤ **SERVICES:**

- Global Directory: Basic information on ITU membership, as well as detailed information on Focal Points within the organizations associated with ITU.
- TIES Services: User account to access documents, reports, mailing lists, etc.
- ITU Events: Upcoming Meetings and Conferences.
- Letters and Notifications
- ITU Digital Member Badge
- ICT Services: Practical information on IT services offered to delegates.
- Delegates Corner: Practical information for delegates coming to Geneva.
- ITU Library and Archives Service: Access to a wide range of materials on telecommunications and related topics.

➤ **Contact: membership@itu.int**

<https://www.itu.int/en/membership/Pages/default.aspx>

Legal Framework for Spectrum Access/Use

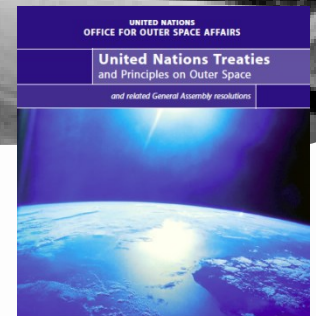


1963

Extraordinary Administrative Radio Conference to allocate frequency bands for space radiocommunication purposes

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
- States shall be liable for damage caused by their space objects



ITU Constitution / Convention

Art. 1 : *ITU shall **effect allocation of bands** of the radio-frequency spectrum, the allotment of radio frequencies and the **registration of radiofrequency assignments** and, for space services, of **any associated orbital position** in the geostationary-satellite orbit or of any associated characteristics of satellites in other orbits, in order to **avoid harmful interference** between radio stations of different countries.*



ITU Constitution / Convention

- To apply the **latest technical advances** as soon as possible
- To avoid **harmful interference**
- To establish global standards and associated material to assure the necessary required performance, interoperability and quality
- To ensure the **rational**, **equitable**, **efficient** and **economical** use of the radio-frequency spectrum and satellite-orbit resources

Article 44
Article 45
RES 71



ITU Convention

SECTION 5 – Radiocommunications Sector

- 🔖 SECTION 5 – Radiocommunication Sector
 - 🔖 ARTICLE 7 – World Radiocommunication Conference
 - 🔖 ARTICLE 8 – Radiocommunication Assembly
 - 🔖 ARTICLE 9 – Regional Radiocommunication Conferences
 - 🔖 ARTICLE 10 – Radio Regulations Board
 - 🔖 ARTICLE 11 – Radiocommunication Study Groups
 - 🔖 ARTICLE 11A – Radiocommunication Advisory Group
 - 🔖 ARTICLE 12 – Radiocommunication Bureau



Collection of the basic texts adopted
by the Plenipotentiary Conference
2015

Legal Framework for Spectrum Access/Use

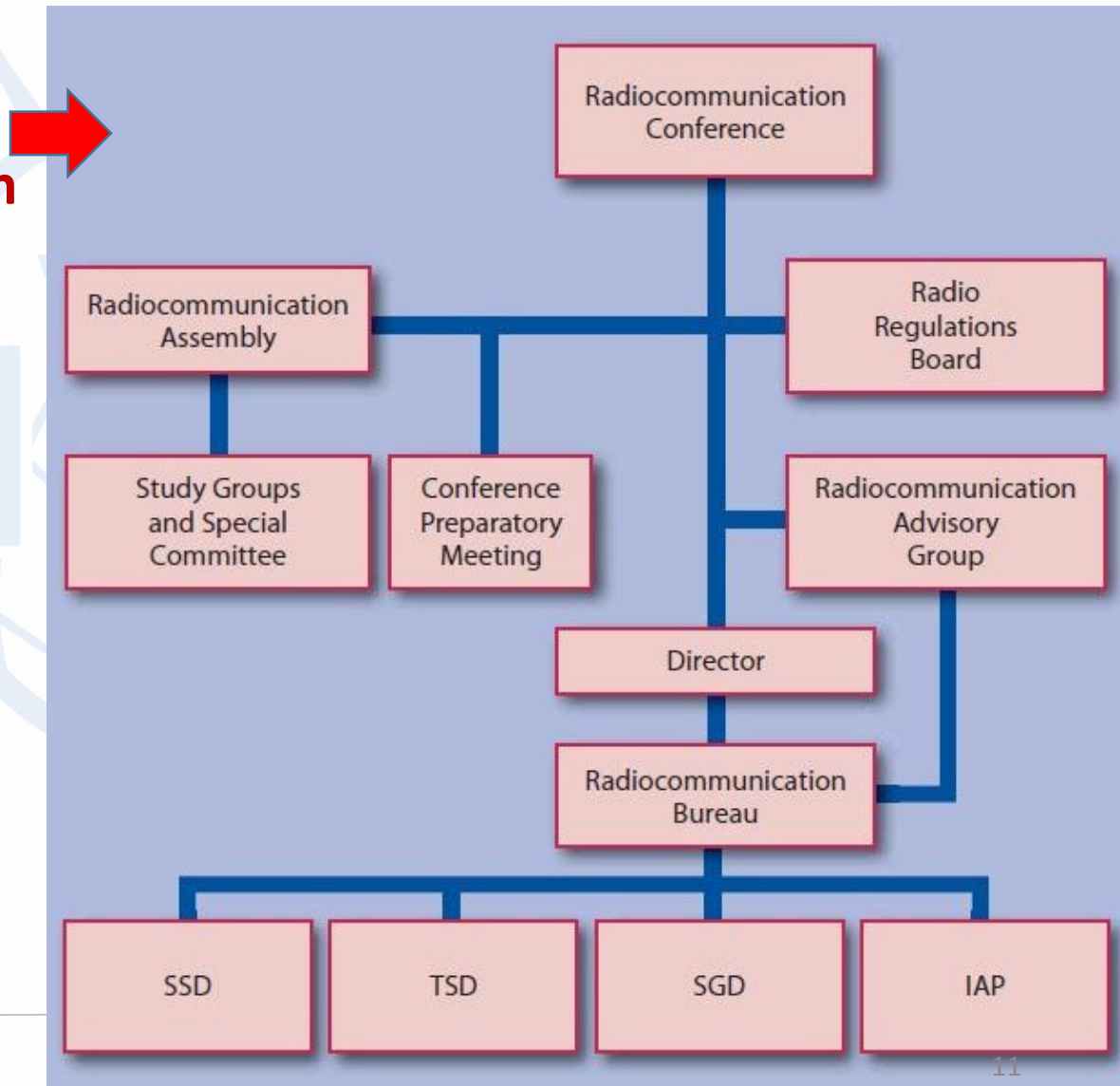


➤ ITU – R Radiocommunication Sector

➤ ITU – T Telecommunication Standardization Sector

➤ ITU – D Telecommunication Development Sector

➤ ITU – TELECOM

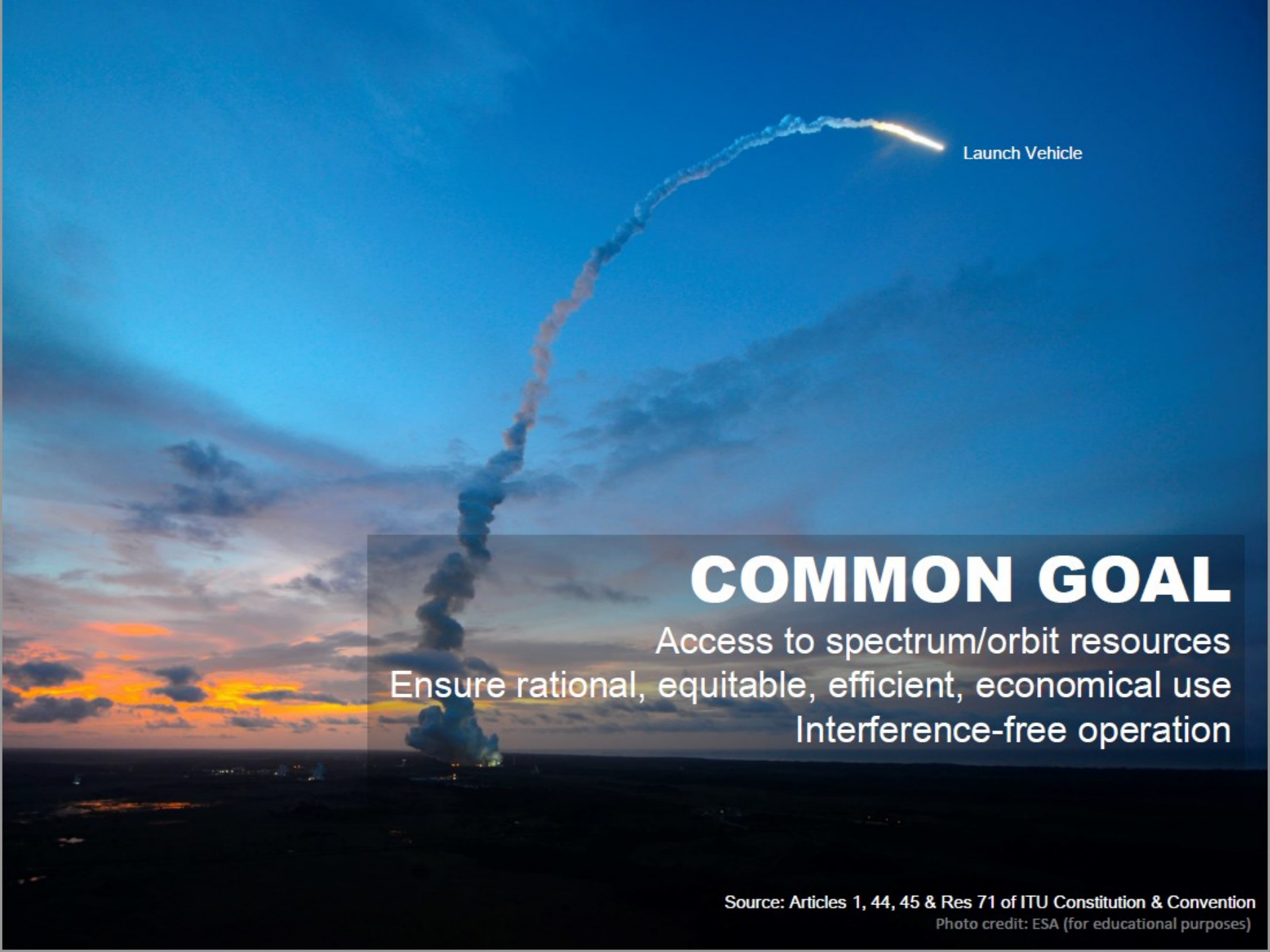


Radio Regulations

- Intergovernmental Treaty governing the use of spectrum/orbit resources by administrations
- Define the **rights** and **obligations** of Member States in respect of the use of these resources
- Recording of a frequency assignment in the Master Register (**MIFR**) provides international recognition and protection



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A photograph of a rocket launch at dusk. The sky is a deep blue with some clouds. A large, dark plume of smoke and fire rises from the launch site on the left. A bright, glowing launch vehicle is visible in the upper right portion of the sky, moving away from the launch site. The horizon is dark, and some lights are visible on the ground.

Launch Vehicle

COMMON GOAL

Access to spectrum/orbit resources
Ensure rational, equitable, efficient, economical use
Interference-free operation

Source: Articles 1, 44, 45 & Res 71 of ITU Constitution & Convention

Photo credit: ESA (for educational purposes)

Radio Regulations - Mechanisms



Control of Interference

ALLOCATION

Frequency separation of stations of different services

POWER LIMITS

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

MONITORING

International monitoring system

COORDINATION

between Administrations to ensure **interference-free** operations conditions

RECORDING

In the Master International Frequency Register (**MIFR**)
International recognition



Radio Regulations

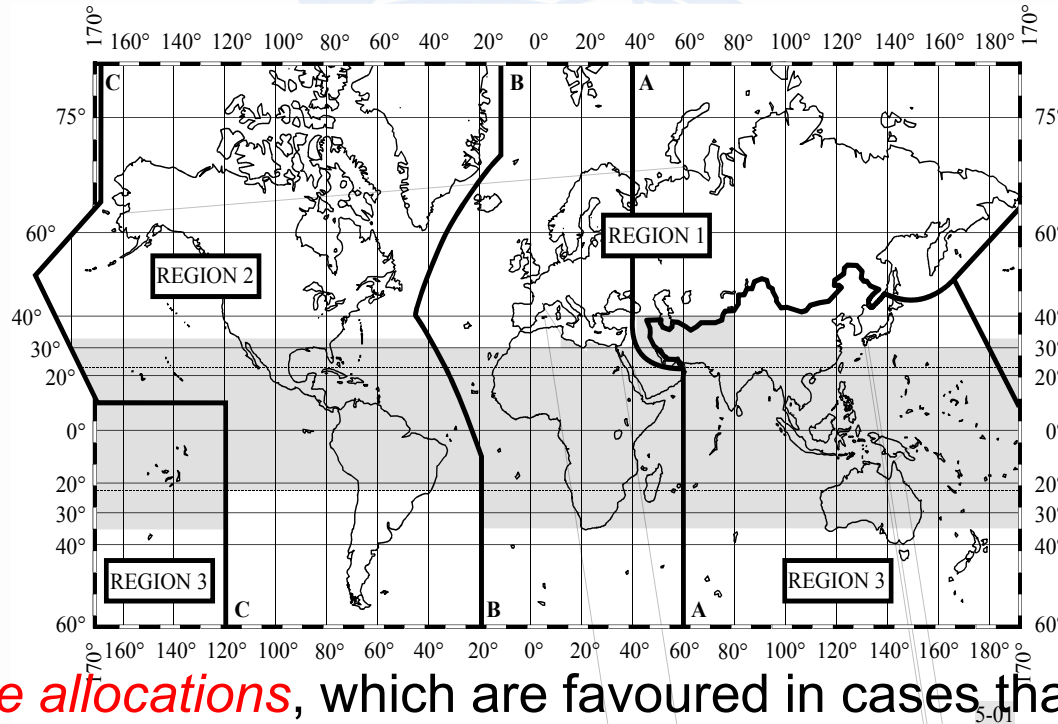


– useful sections for small satellite missions

- **Article 1** Definitions
- **Article 5** Table of Frequency Allocations
- **Article 9** and **11** Procedures for the advance publication (**API**), coordination (**CR/C**) and notification
- **Article 21/22** Power limits
- **Article 25** Amateur and Amateur-satellite service
- **Article 29A** Radio services related to Earth observation
- **Appendix 1** Classification of emissions
- **Appendix 4** Data required for satellite filings

ART. 5 frequency allocations - 1

- No. 5.2 - For the allocation of frequencies the world has been divided into **three “radiocommunication” Regions**



- **Exclusive allocations**, which are favoured in cases that involve *broad international use of equipment*
- **Shared frequency allocations**, which are applied to maximize the use of the available spectrum when *two or more radiocommunication services can effectively utilize the same frequency band*

ART. 5 frequency allocations - 2

- **A shared frequency band** can be allocated to more than one service (**PRIMARY** or **secondary**), either on a worldwide or Regional basis
- **No. 5.28 - Stations of a secondary service:**
 - **No. 5.29** - *shall not cause harmful interference to stations of PRIMARY services to which frequencies are already assigned or to which frequencies may be assigned at a later date;*
 - **No. 5.30** – *can not claim protection from harmful interference from stations of a PRIMARY service to which frequencies are already assigned or may be assigned at a later date;*
 - **No. 5.31** - *can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.*
- **A footnote to a frequency band or service may include a restriction on the service or services concerned**
 - For example:
 - *to operate in a particular country(ies) or service area*
 - *not causing harmful interference to another service*
 - *not claiming protection from another service*

Example page of Table of frequency allocations



335.4-410 MHz

Allocation to services				
Region 1	Region 2	Region 3		
335.4-387	FIXED MOBILE 5.254	PRIMARY		
387-390	FIXED MOBILE Mobile-satellite (space-to-Earth)	5.208A	5.208B	5.254 5.255
390-399.9	FIXED MOBILE 5.254			
399.9-400.05	MOBILE-SATELLITE (Earth-to-space)	5.209	5.220	
400.05-400.15	STANDARD FREQUENCY AND TIME SIGNAL- SATELLITE (400.1 MHz) 5.261 5.262			
400.15-401	METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Space operation (space-to-Earth) 5.262 5.264	5.208A	5.208B	5.209

footnotes



*“ Administrations of the Member States shall **not** assign to a station any frequency **in derogation of** either the **Table of Frequency Allocations** in this Chapter or the other **provisions** of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall **not** cause **harmful interference to**, and shall **not** claim **protection** from harmful interference caused by, a station operating in accordance with the provisions of the **Constitution**, the **Convention** and these **Regulations**. ”*

Decisions of the 78th RRB meeting



- Administrations, prior to bringing into use any frequency assignment to a transmitting station operating under **No. 4.4**, shall determine:
 - a) That the intended use of the frequency assignment to the station under **No. 4.4** will not cause harmful interference into the stations of other administrations operating in conformity with the Radio Regulations;
 - b) What measures it would need to take in order to comply with the requirement to immediately eliminate harmful interference pursuant to **No. 8.5**.
- When notifying the use of frequency assignments to be operated under **No. 4.4**, the notifying Administration shall provide a confirmation that it **has determined** that these frequency assignments meet the conditions referred to above in item a) and that it **has identified measures to avoid harmful interference** and **to immediately eliminate such** in case of a complaint.

A detailed illustration of the Sputnik 1 satellite in orbit above the Earth. The satellite is a spherical metal ball with three long, thin antennas extending from it. A bright light source, likely the Sun, is positioned behind the satellite, creating a strong lens flare effect. The Earth's blue and white horizon is visible in the background against the blackness of space.

Sputnik 1

1957....

development of
communication satellites

The 1st “small” satellite

Sputnik 1 was the first artificial Earth “**SMALL**” satellite launched on 4th October 1957 with external radio antennas to broadcast radio pulses. It was a **58 cm** diameter, **83 kg** polished metal sphere with a **1 W** transmitter on **20.005 MHz** and **40.002 MHz**. Analysis of the radio signals was used to gather information about the electron density of the ionosphere. Temp and pressure were encoded in the duration of radio beeps.

... .. **2016, 2017, 2018**



A “standard 1U” CubeSat has a volume of one liter - 10 cm cube and a mass of 1 kg, orbiting at 300-600 km circular orbit, 1W transmitter on 145 MHz or 435 MHz amateur-satellite service bands. It’s used for academic education, research and technology validation applications but also for complex science and governmental use.

Why Small Satellites ?

“Faster, Cheaper, Better, Easier, Smaller”

- **Faster** to build/launch (**<1 year**)
- **Cheaper** to build/launch (**10's of K\$**)
- **Easier** modular & standardised (**CubeSats standard**)
- **Smaller** latest technology (**lighter and efficient**)

Also promotes:

Technology transfer, Collaboration, Education, Earth Science,
Testing innovative technologies, ...

But this comes with drawbacks

Drawbacks!



No regulatory definition for small satellites in the ITU RR
only geostationary(GSO) and non-GSO satellites

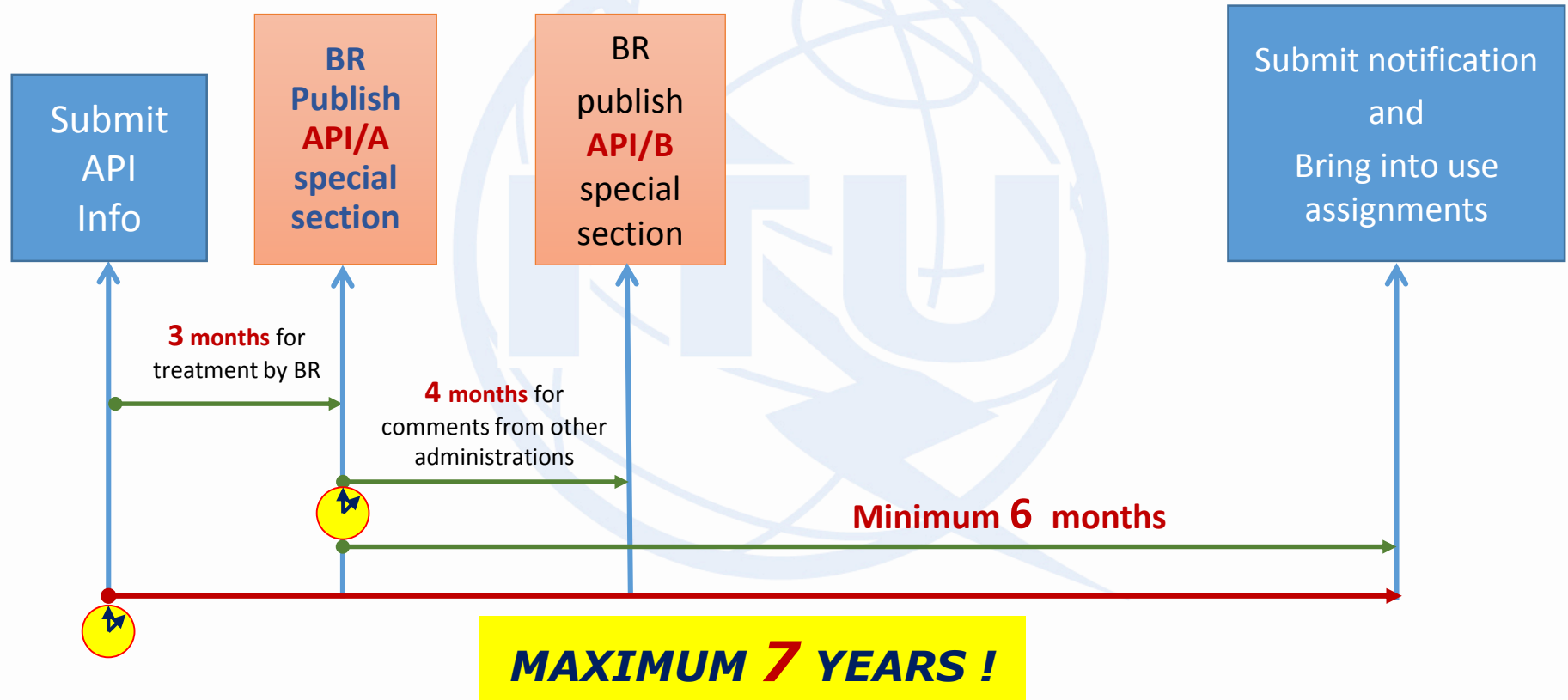
- **Limited Launching opportunities**
 - ➔ **mission delays**
- **No/Little Orbit Control**
 - ➔ **higher collision risks**
- **Small/Unreliable Power Source on Spacecraft**
 - ➔ **large & costly ground stations**
- **Limited Lifetime**
 - ➔ **low reliability of electronics**
- **Limited Regulatory Certainty**
 - ➔ **Lengthy time for Space Activity License**

Regulatory Challenges!



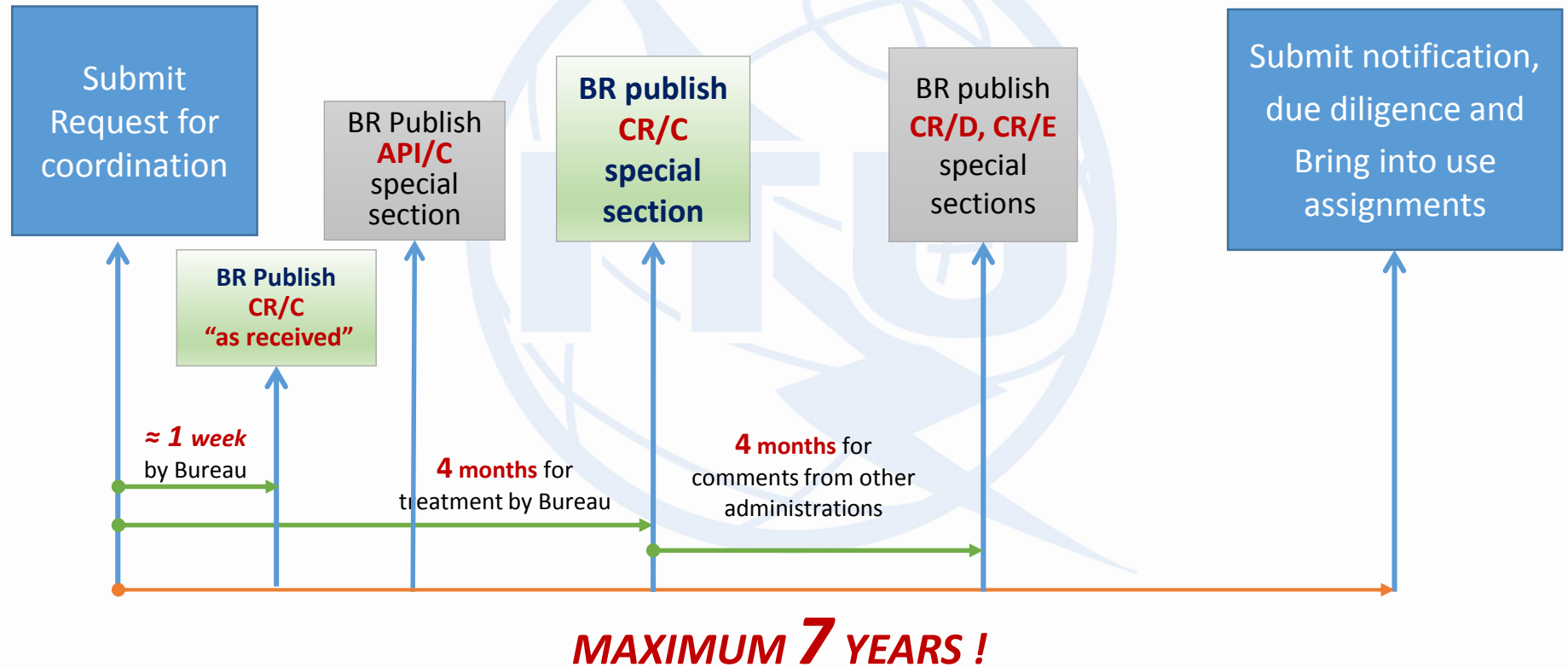
- **Many New Developers/Operators**
 - know little or unaware of regulations
- **Limited Budgets**
- **Very Fast Development**
- **Large Numbers of Spacecraft**
 - overwhelm regulators
- **New Operational Concepts**
 - large constellations for some complex systems
 - regular replenishment/augmentation
 - global coverage

ITU process for satellite networks not subject to coordination



In total, ≈ 9 MONTHS to 7 YEARS !

ITU process for satellite network subject to coordination (from 1.1.2017)



Advance Publication Information (API)



- **API** is a mandatory procedure (**No.9.1**)
for all satellite network **not subject to coordination procedure**
- To know whether a frequency band is subject to coordination,
read the footnotes in **the Table of Frequency Allocations**
Examples of footnote indicating coordination is required:
 - **No. 5.364** *The use of the band 1 610-1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. 9.11A.*
(For coordination under **No. 9.11A**, see also **Rule of Procedure**)
 - **No. 5.286** *The band 449.75-450.25 MHz may be used for the space operation service (Earth-to-space) and the space research service (Earth-to-space), subject to agreement obtained under No. 9.21.*
- For such systems **not subject to coordination**, the provisions of **Article 9, Sub-Section IA** (API on satellite networks that are not subject to coordination procedure under Section II), are applicable.
- Although not subject to coordination, there is a **commenting procedure and resolutions of difficulties specified under No.9.3**
- Small satellites **usually** make use of frequency bands that are **not subject to coordination**

Regulatory Procedures for comments and resolution of difficulties



➤ **Commenting procedures**

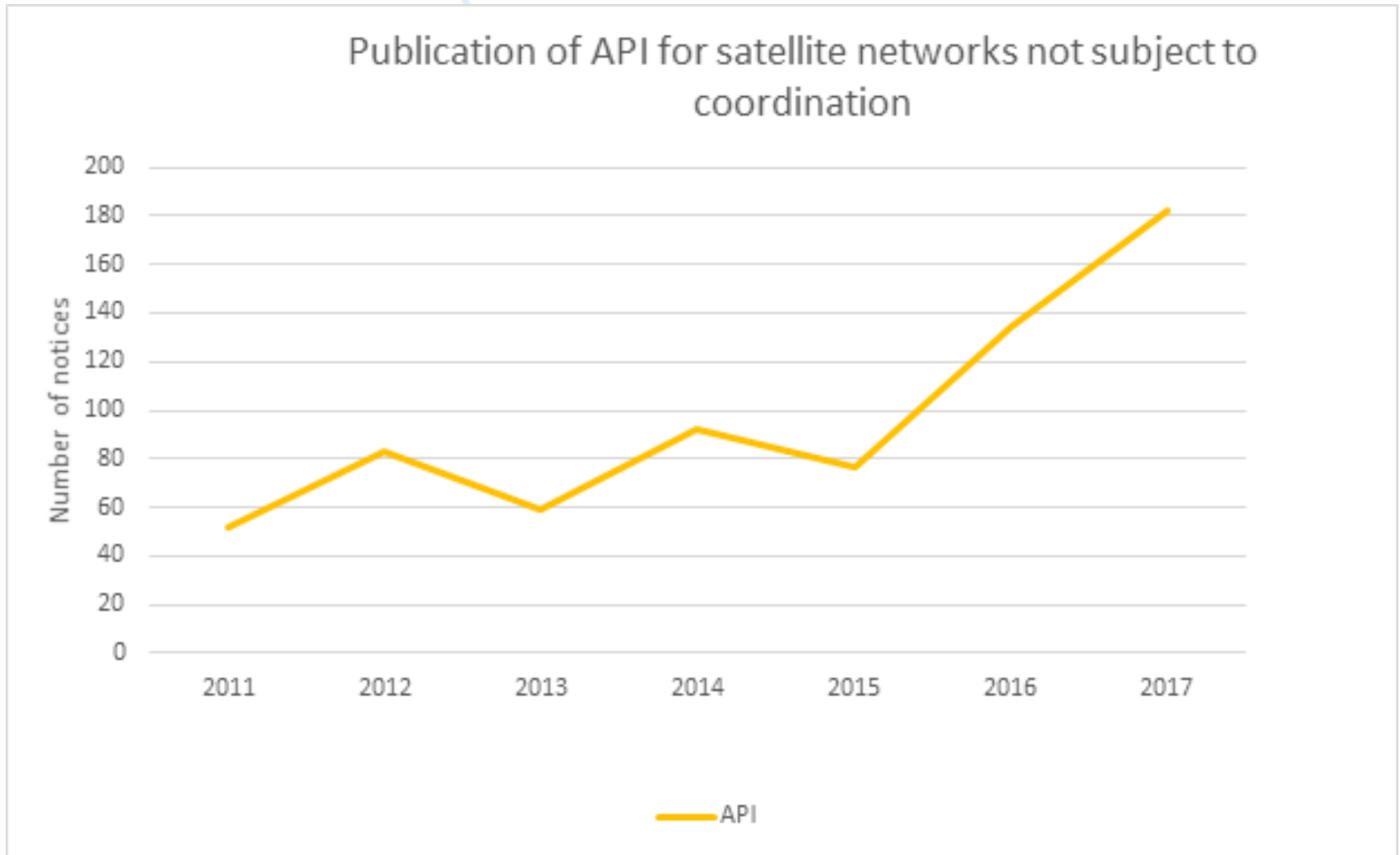
- Comments to an API/A should be submitted within **4 months** of API (No.9.3)
- Comments to be captured using **SpaceCom software** (RES-55)
- The Bureau publishes the list of administrations which have sent comments in an **API/B** Special Section in a BR IFIC

➤ **Resolution of difficulties**

- Both administrations shall endeavor to **cooperate** in joint efforts to resolve any difficulties and shall exchange any additional relevant information that may be available
- Either party can request for the **assistance** of the Radiocommunication Bureau (**No.9.3**)
- **In case of difficulties**, the administration responsible for the planned satellite network **shall explore all possible means** to resolve the difficulties without considering the possibility of adjustment to networks of other administrations
- **If no such means can be found**, it **may request the other administrations to explore** all possible means to meet its requirements
- The administrations concerned **shall make every possible effort** to resolve the difficulties by means of **mutually acceptable adjustments** to their networks

ITU Publication of API

not subject to coordination



Regulatory Procedures for Amateur-Satellite Service



- API must be submitted to ITU **before** coordinating frequency with **IARU**
- Note that frequency assignments in **notification must be covered** by frequency bands in **API**, therefore avoid submitting a very narrow frequency band at the API, in case there is a change needed during the comments/consultation process
- Administrations authorizing space stations in the **amateur-satellite service** shall ensure that **sufficient earth command stations** are established before launch to ensure that **any harmful interference** caused by emissions from a station in the amateur-satellite service **can be terminated immediately** (see No. **25.11**)
- Amateur-satellite service is **exempted from cost recovery fee** (please refer to **DEC 482**)

WHEN TO INITIATE THE NOTIFICATION PROCEDURE ?

- No. 9.1 of the RR stipulates that **before initiating any action under Article 11** (Notification) in respect of frequency assignments for a satellite network, *an administration shall send to the Bureau* a general description of the network for **API** publication *not earlier than seven years* and preferably *not later than two years* before the planned *date of bringing into use (DBiU)* of the satellite network or system
- API phase is *obligatory*
- Starts the ***“regulatory clock”*** for date of ***bringing into use***

Notification

for recording in the Master Register



- **What assignments should be notified? (No.11.2)**
 - Any frequency assignments of transmitting and receiving earth and space stations:
 - *Capable of causing harmful interference; or*
 - *Used for international radiocommunication; or*
 - *Seeking to obtain international recognition; or*
 - *Non conforming assignment seeking to be recorded for information purposes only.....*
- **No.11.14** Frequency assignments to earth stations in the amateur-satellite service is **not** required to be notified for recording in the MIFR
- Information received for notification will first be published in **Part I-S of BR IFIC** as an acknowledgement for the receipt of the data,
- The notification will be examined in detailed and given a finding, which will be published in a **Part II-S** if the finding is **favourable**, and a **Part III-S** if the finding is **unfavourable**

Information required for filing (1)



➤ Specified in Appendix 4 of the Radio Regulations, including:

- Satellite name, responsible administration and op_agcy
- Orbital characteristics
- Antenna beam characteristics
- Frequency band
- Service Areas
- Power levels/designation of emissions etc.
- Earth stations
- etc. ...

➤ All submissions should be in BR software **SpaceCap** compatible format (**Resolution-55**)

Information required for filing (2)



➤ Sensors specific information

- **Active Sensors**
 - *Transmit beam*
 - Mean peak power and mean power density
 - Pulse length and pulse repetition frequency
 - *Receive beam*
 - Receiver noise bandwidth
 - Noise temperature at output of signal processor
- **Passive sensors**
 - Observed bandwidth
 - Sensitivity
- To capture sensor information in SpaceCap, go to Beam tab, check the box “**Beam has Sensors**”
- Class of stations – **E1, E2, E3, E4** (consult the Preface)

Symbol	Space Station Class of Station
E1	Space research (active sensor) space station
E2	Space research (passive sensor) space station
E3	Space station in the Earth exploration-satellite service (active sensor)
E4	Space station in the Earth exploration-satellite (passive sensor)

Appendix 4 – example (1)



Items in Appendix	<p><i>C- CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY ASSIGNMENTS FOR A SATELLITE ANTENNA BEAM OR AN EARTH STATION OR RADIO ASTRONOMY ANTENNA</i></p>
C.1	FREQUENCY RANGE
C.1.a	the lower limit of the frequency range within which the carriers and the bandwidth of the emission will be located for each Earth-to-space or space-to-Earth service area, or for each space-to-space relay
C.1.b	the upper limit of the frequency range within which the carriers and the bandwidth of the emission will be located for each Earth-to-space or space-to-Earth service area, or for each space-to-space relay
C.2	ASSIGNED FREQUENCY (FREQUENCIES)
C.2.a.1	<p>the assigned frequency (frequencies), as defined in No. 1.148</p> <ul style="list-style-type: none"> – in kHz up to 28 000 kHz inclusive – in MHz above 28 000 kHz to 10 500 MHz inclusive – in GHz above 10 500 MHz <p>If the basic characteristics are identical, with the exception of the assigned frequency, a list of frequency assignments may be provided</p> <ul style="list-style-type: none"> In the case of advance publication, required only for active sensors In the case of geostationary and non geo-stationary satellite networks, required for all space applications except passive sensors In the case of Appendix 30B, required only for notification under Article 8
C.2.a.2	the channel number
C.2.b	<p>the centre of the frequency band observed</p> <ul style="list-style-type: none"> – in kHz up to 28 000 kHz inclusive – in MHz above 28 000 kHz to 10 500 MHz inclusive – in GHz above 10 500 MHz

Appendix 4 – example (2)

AP4-65



Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
									C.1	
X	X	X						X	C.1.a	
X	X	X						X	C.1.b	
									C.2	
		+	+	+	X	X	X	+	C.2.a.1	
						X	X		C.2.a.2	
		+	+	+					C.2.b	X

Eg. Antenna patterns



Kindly submit the appropriate diagrams, or indicate the antenna pattern IDs by selecting from the Antenna Pattern Library available at the webpage:

<https://www.itu.int/en/ITU-R/software/Pages/ant-pattern.aspx>

Eg. Earth Station Antenna Patterns

AP7	APERR_012V01	Appendix 7 Earth station antenna pattern for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105 GHz.	Receiving	32
			Transmitting	75
Non-directional	APEND_099V01	Non-directional earth station antenna pattern.	Receiving	607
			Transmitting	608

Eg. Space Station Antenna Patterns

Non-directional	APSND_499V01	Non-directional space station antenna pattern.	Receiving	610
			Transmitting	609

or by describing them with equations, or submitted in graphical format in JPEG or PDF files

Typical services for small satellites

- Amateur-Satellite Service
- Earth Exploration-Satellite Service
- Meteorological-Satellite Service
- Space Research-Satellite Service
- Space Operation Service
- Others

Amateur Satellite Service

– example of frequency allocations



Frequency band	Service	Type of allocation
28-29.7 MHz	Amateur-Satellite Service	Primary
144-146 MHz	Amateur-Satellite Service	Primary
435-438 MHz	Amateur-Satellite Service	Secondary (No.5.282)
1260 – 1270 MHz	Amateur-Satellite Service (E-S)	Secondary (No.5.282)
2400 – 2450 MHz	Amateur-Satellite Service	Secondary (No.5.282)
3400 – 3410 MHz	Amateur-Satellite Service	Secondary (No.5.282)
5650 – 5670 MHz	Amateur-Satellite Service (E-S)	Secondary (No.5.282)
5830 – 5850 MHz	Amateur-Satellite Service (S-E)	Secondary
.....		

For more details and the conditions for the usage of these bands, please refer to **Article 5** of the Radio Regulations.

Earth Exploration-Satellite Service

– example of frequency allocations



Generally usable for TTC

Frequency band	Service	Type of allocation
401-403 MHz	EESS (E-S)	Primary
401-402 MHz	SOS (S-E)	Primary
1427 – 1429 MHz	SOS (E-S)	Primary
2025 – 2110 MHz	EESS (E-S, S-S) SOS (S-E, S-S)	Primary
2200 – 2290 MHz	EESS(S-E, S-S) SOS(S-E, S-S)	Primary
7190 – 7250 MHz	EESS (E-S)	Primary
8025 – 8400	EESS (S-E)	Primary
13.75 – 14 GHz	EESS	Secondary
.....		

For more details and the conditions for the usage of these bands, please refer to [Article 5](#) of the Radio Regulations.

Earth Exploration-Satellite Service

– example of frequency allocations



Frequency band	Service	Type of allocation
460-470 MHz	EESS (S-E)	Secondary
1690 – 1710 MHz	EESS (S-E)	Secondary
2200 – 2290 MHz	EESS (S-E)	Primary
8025 - 8400 MHz	EESS (S-E)	Primary
.....		

Frequency band	Service	Type of allocation
1400– 1427 MHz	EESS (passive)	Primary
2677 – 2690 MHz	EESS (passive)	Secondary
2690 – 2700 MHz	EESS (passive)	Primary
15.35 – 15.4 GHz	EESS (passive)	Primary
18.6 – 18.8 GHz	EESS (passive)	Primary
21.2 – 21.4 GHz	EESS (passive)	Primary
....		

Earth Exploration-Satellite Service

– example of frequency allocations



Frequency band	Service	Type of allocation
432-438 MHz	EESS (active)	Secondary
1215– 1300 MHz	EESS (active)	Primary 1260-1300MHz is subject to coordination under No.9.11A
3100 - 3300 MHz	EESS (active)	Secondary
5250 – 5570 MHz	EESS (active)	Primary
8250 – 8650 MHz	EESS (active)	Primary
9200 – 9800 MHz	EESS (active)	Primary
9800 – 9900 MHz	EESS (active)	secondary
9900 – 10000 MHz	EESS (active)	Primary
10 – 10.4 GHz	EESS (active)	Primary
13.25 – 13.75 GHz	EESS (active)	Primary
17.2 – 17.3 GHz	EESS (active)	Primary
.....		

For more details and the conditions for the usage of these bands, please refer to **Article 5** of the Radio Regulations.

Meteorological-Satellite Service

– example of frequency allocations



Frequency band	Direction	Service and Type of allocation
137 – 138 MHz	S-E	MetSat Primary
400.15 – 401 MHz	S-E	MetSat Primary
460 – 470 MHz	S-E	EESS and MetSat secondary Under 5.290, MetSat: primary in some countries
1670 – 1710 MHz	S-E	MetSat Primary
7450 – 7550 MHz	S-E	MetSat Primary; Limited to GSO only
7750 – 7790 MHz	S-E	MetSat Primary; Limited to NGSO only
18.0 – 18.3 GHz	S-E	MetSat Primary in XR2, Limited to GSO only
18.1 – 18.4 GHz	S-E	MetSat Primary in XR1 and XR3, Limited to GSO only
65 – 66 GHz	S-E	EESS Primary
.....		

MetSat is a sub-class of the Earth exploration-satellite service(EESS) (see **No.1.52**)

For more details and the conditions for the usage of these bands, please refer to **Article 5** of the Radio Regulations.

Meteorological-Satellite Service

– example of frequency allocations



Frequency band	Direction	Service and Type of allocation
401 – 403 MHz	E-S	EESS and MetSat Primary
2025 – 2110 MHz	E-S, S-S	EESS Primary
2200 – 2290 MHz	S-E, S-S	EESS Primary
8025 – 8400 MHz	S-E	EESS Primary
8175 – 8215 MHz	E-S	MetSat Primary
25.5 – 27 GHz	E-S and S-S in 25.25 – 27.5 GHz	EESS Primary
28.5 – 30 GHz	E-S	EESS secondary
37.5 – 40 GHz	S-E	EESS secondary
40 – 40.5 GHz	E-S	EESS Primary
... ..		

MetSat is a sub-class of the Earth exploration-satellite service(EESS) (see **No.1.52**)

For more details and the conditions for the usage of these bands, please refer to **Article 5** of the Radio Regulations.



Frequency band	Direction	Type of allocation
137 – 138 MHz	S-E	Primary (No.5.208B)
410 – 420 MHz	S-S	Primary (No.5.268)
1215 – 1300 MHz	S-E, E-S	Primary (active) 1260-1300MHz is subject to coordination under No.9.11A
1400 – 1427 MHz	E-S	Primary (passive) (No.5.340, 5.341)
1750 – 1850 MHz	E-S	Primary (No. 5.386 limited in specific region)
7145 – 7190 MHz	E-S	Primary (deep space) (No.5.458, 5.459)
8400 – 8500 MHz	S-E	Primary (deep space) (No.5.465, 5.466)
13.4 – 13.65 GHz	S-E, E-S, S-S	Primary (No. 5.501A, 5.501B)
15.35 – 15.4 GHz	E-S	Primary (passive) (No.5.340)
.....		

For more details and the conditions for the usage of these bands, please refer to **Article 5** of the Radio Regulations.

Space Operation Service

– example of frequency allocations



Frequency band	Service	Direction
30.01 – 37.5 MHz	Space Operation Service	S-E, E-S
174 – 184 MHz	Space Operation Service	S-E
267 – 273 MHz	Space Operation Service	S-E
470 – 485 MHz	Space Operation Service	S-E
1525 – 1535 MHz	Space Operation Service	S-E
1750 – 1850 MHz	Space Operation Service	E-S
2025-2100 MHz	Space Operation Service	S-E, E-S
2200-2290 MHz	Space Operation Service	S-E, E-S
7100-7155MHz	Space Operation Service	E-S
7290-7235MHz	Space Operation Service	E-S

... ..

For more details and the conditions for the usage of these bands, please refer to **Article 5** of the latest Radio Regulations.

Space operation service : ET Space operation functions: EK, ER, ED

RoP No.1.23

2 In the No. 11.31 examinations, notices concerned with space operation functions will be considered in conformity with the Table of Frequency Allocations (favourable Finding) in the case where the assigned frequency (and the assigned frequency band) lies in a frequency band **allocated to** the:

- **space operation service, or**
- **the main service in which the space station is operating (e.g. FSS, BSS, MSS).**

3 In the case where the assigned frequency concerning space operation functions lies in a frequency band allocated to a service in which the space station has no operating function the No. 11.31 Finding will be unfavourable.

Modification of characteristics



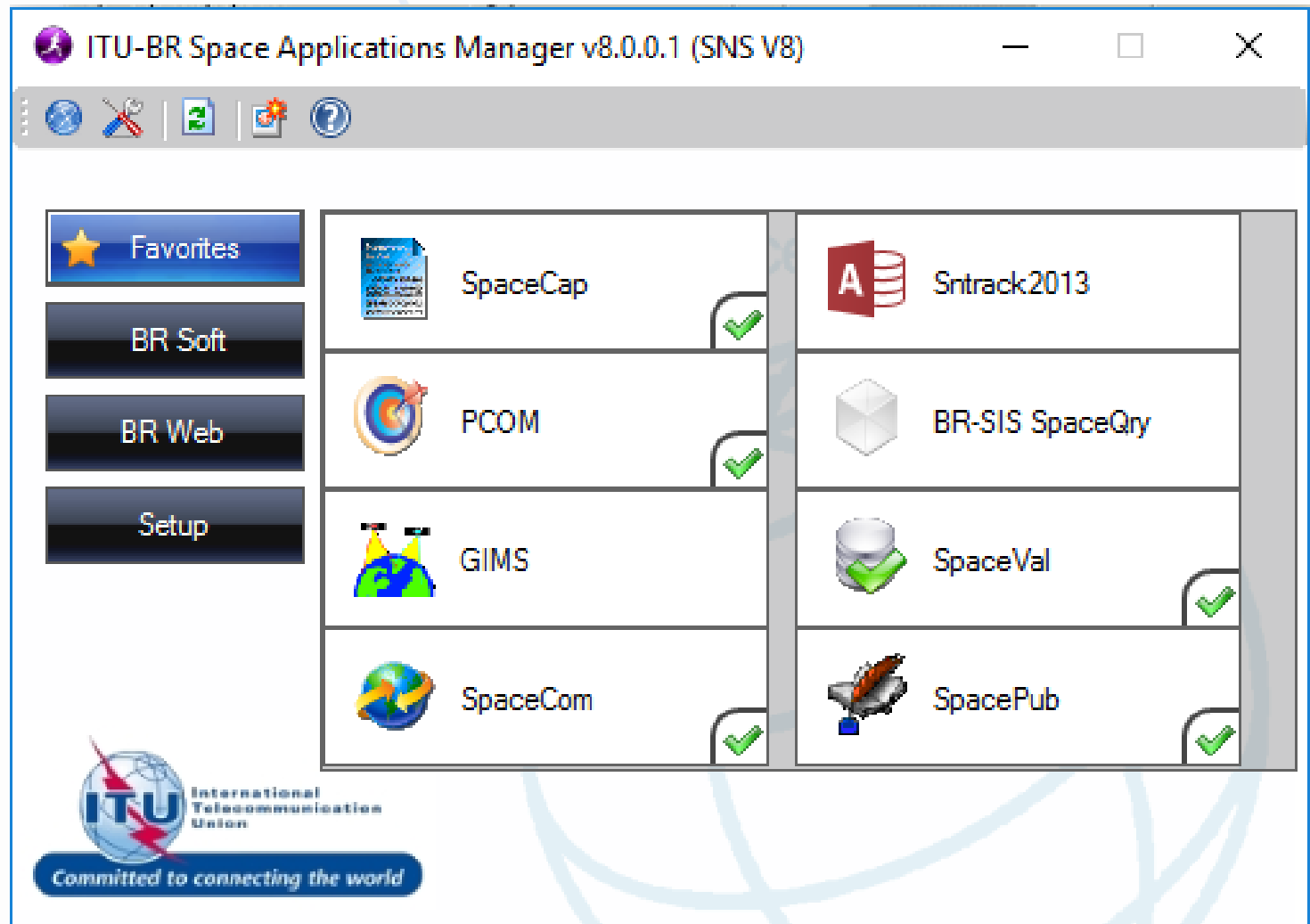
- According to **No.9.2**, amendments to the information for NGSO filing that requires a **new API** are:
 - **Additional frequency band**
 - **Modification of the direction of transmission**
 - **Modification of reference body**
- However, it is a good practice to submit a modification to the API any change in characteristics including orbital characteristics, service area (adding earth stations) etc.
- This will allow other administrations/operators the chance to submit comments before the modifications are notified for recording in the Master Register.
- If during the **notification**, there are **other changes** in characteristics from the information published in API/A, other administrations can submit comments following the **Part I-S (No.11.28.1)**.

How to capture? --- BRsoft



- The **latest version** of BR software for capture and validation of space notices are available from the ITU website
(<http://www.itu.int/ITU-R/go/space-software/en>)
- They are also available with the **BR IFIC DVD**
- For convenience of workshop participants, the latest version has been included **in the USB key**.
- **Administrator privilege** is required to install these software.
- Can **add descriptions** in PDF or Word format to supplement the information

How to capture? --- BRsoft



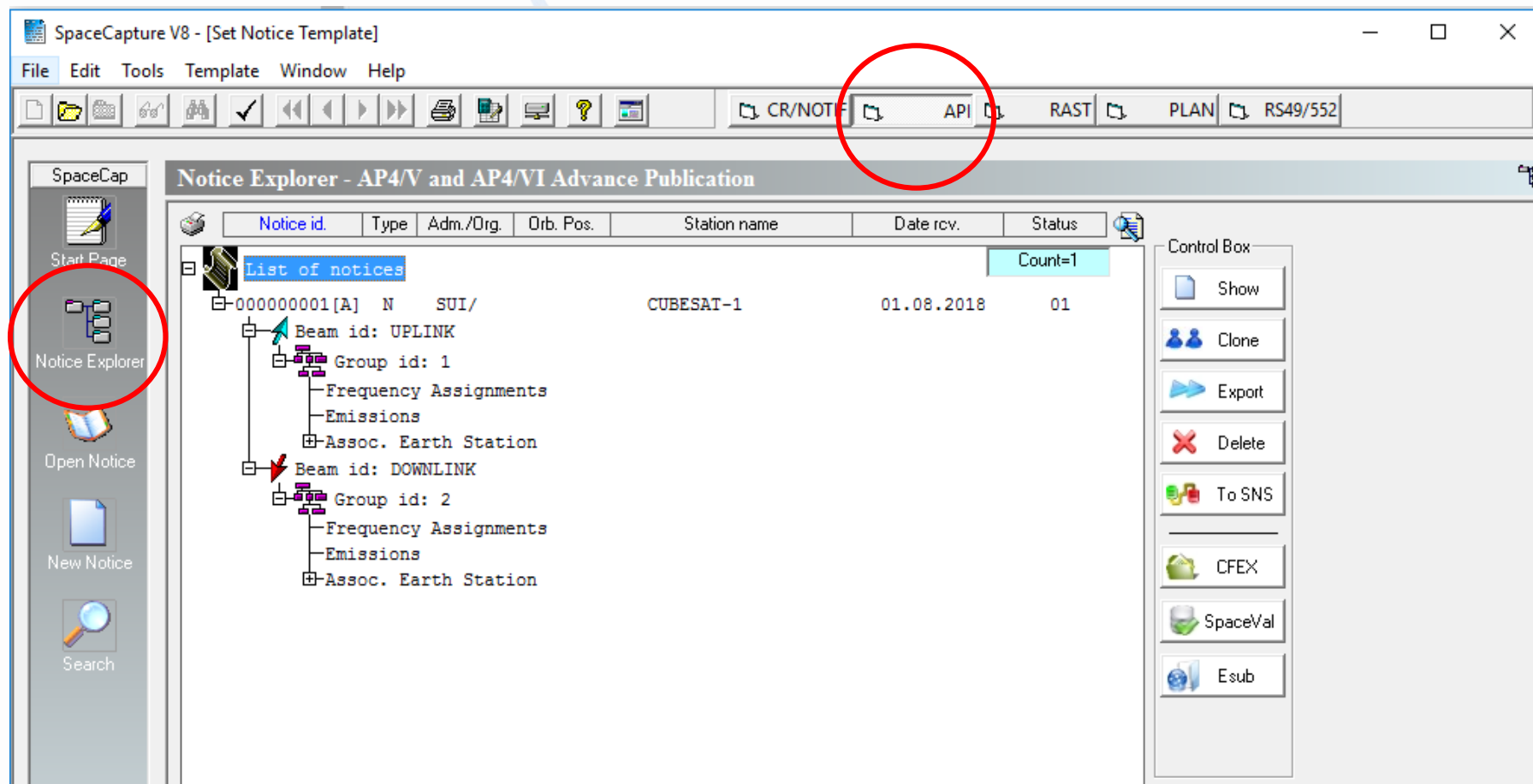
How to capture? --- BRsoft



For API, Coordination and Notification

BR space software	Description
SpaceCap	PC-based software for electronic capture of AP4 forms of notices for API, CRC or Notification
SpaceVal	PC-based software for validating electronic notices captured by the SpaceCap software
BRSIS SpaceQry	PC-based software package which allows the query/access to the Bureau's Space Radiocommunication Stations database
SpacePub	PC-based software utility for printing satellite networks / earth stations data

SpaceCap for API



The screenshot displays the SpaceCapture V8 software interface. The title bar reads "SpaceCapture V8 - [Set Notice Template]". The menu bar includes "File", "Edit", "Tools", "Template", "Window", and "Help". The toolbar contains various icons for file operations and navigation. A red circle highlights the "API" button in the toolbar. Below the toolbar, the "Notice Explorer - AP4/V and AP4/VI Advance Publication" window is open. It features a tree view on the left with "List of notices" selected. The main pane shows a table of notices with columns: "Notice.id.", "Type", "Adm./Org.", "Orb. Pos.", "Station name", "Date rcv.", and "Status". A single notice is listed with ID "000000001[A]", Type "N", Org. "SUI/", Station name "CUBESAT-1", Date rcv. "01.08.2018", and Status "01". The notice is expanded, showing a hierarchical structure: "Beam id: UPLINK" (Group id: 1) and "Beam id: DOWNLINK" (Group id: 2). Each beam group contains "Frequency Assignments", "Emissions", and "Assoc. Earth Station". A "Control Box" on the right contains buttons for "Show", "Clone", "Export", "Delete", "To SNS", "CFEX", "SpaceVal", and "Esub". The left sidebar of the Notice Explorer contains buttons for "Start Page", "Notice Explorer" (highlighted with a red circle), "Open Notice", "New Notice", and "Search".

Notice.id.	Type	Adm./Org.	Orb. Pos.	Station name	Date rcv.	Status
000000001[A]	N	SUI/		CUBESAT-1	01.08.2018	01

SpaceCap for API

SpaceCapture V8

File Edit Tools View Window Help

CR/NOTF API RAST PLAN

Forms of Notice Advance Publication

Notice Beam Remarks

Notice Id: 1 Advance Publication 31.10.2013 Status: 01

Date: DD.MM.YY 01.08.2018 Administration Serial Nbr

A1f1. Notifying Administration SUI A1f2. Notice submitted on behalf of these administrations.

A1f3. Intergovernmental Satellite System

Notice intended for: Add Mod Sup

BR Identification No. of the Satellite Network to be Modified

☐ GeoStationary Satellite Network ☒ Non GeoStationary Satellite Network

A1a. Identity of the Satellite Network CUBESAT-1

A4. Orbital Information

A4b1. Number of Orbital Planes 1 A4b2. Reference body (T) Earth

A4b3a. Nbr of Satellites to NH A4b3b. Nbr of Satellites to SH

A4b4. Orbital Plane Information

Section II Article 9

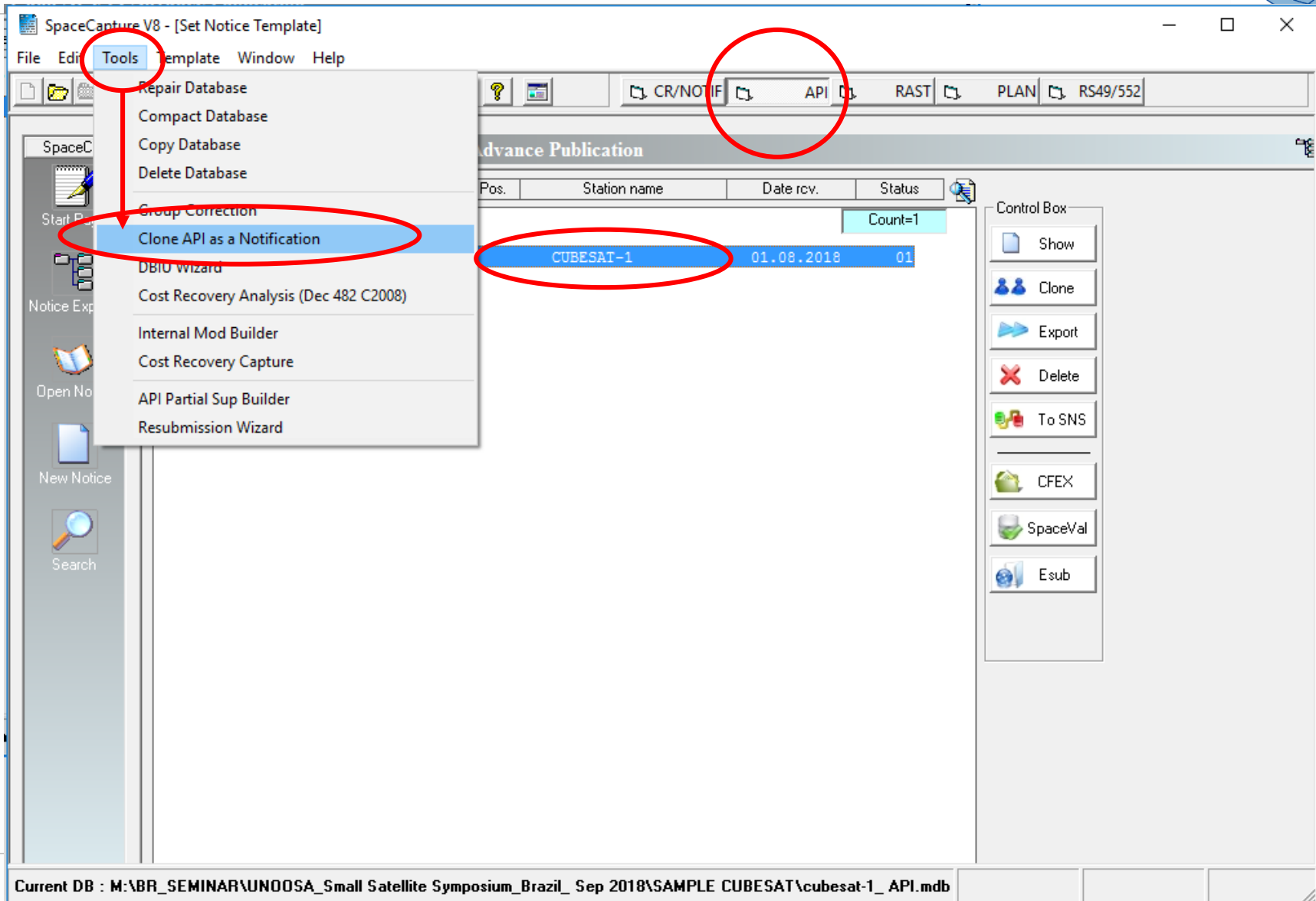
☐ Subject to coordination ☒ Not Subject to coordination ☐ Both

List of Available Beams

Beam UPLINK Beam DOWNLINK

More...

SpaceCap for Notification



The screenshot shows the SpaceCapture V8 - [Set Notice Template] window. The 'Tools' menu is open, highlighting 'Clone API as a Notification'. The 'API' tab is selected in the top toolbar. A table displays satellite data with 'CUBESAT-1' highlighted. The status bar at the bottom shows the current database path.

Tools Menu:

- Repair Database
- Compact Database
- Copy Database
- Delete Database
- Group Correction
- Clone API as a Notification**
- DBIU Wizard
- Cost Recovery Analysis (Dec 482 C2008)
- Internal Mod Builder
- Cost Recovery Capture
- API Partial Sup Builder
- Resubmission Wizard

Table Data:

Pos.	Station name	Date rcv.	Status
	CUBESAT-1	01.08.2018	01

Control Box:

- Show
- Clone
- Export
- Delete
- To SNS
- CFEX
- SpaceVal
- Esub

Status Bar: Current DB : M:\BR_SEMINAR\UNOOSA_Small Satellite Symposium_Brazil_ Sep 2018\SAMPLE CUBESAT\cubesat-1_ API.mdb

SpaceCap for Notification

SpaceCapture V8

File Edit Tools View Window Help

CR/NOTIF API RAST PLAN RS49/552

NonGeoStationary Notice:1

Notice Station Beam Attachments

Notice Id: 1 AP4/II and AP4/III (Appendix 4 - Annex 2A) 17.05.2018 Status 01

Notice submitted under:

☐ No. 9.6 Coordination ☒ **No. 11.2 Notification** ☐ First Notification ☐ Resubmission

☐ No. 9.11A Applies ☐ Bands 21.4 to 22 GHz Special Procedure

☐ No. 9.7A Specific Receive GSO FSS Earth stn Coordination

☐ No. 9.17 Earth Station Coordination amongst Administrations

Date: DD.MM.YY 28.08.2018 Administration Serial Nbr

A1f1. Notifying Administration SUI A1f2. Notice submitted on behalf of these administrations. + x

A1f3. Intergovernmental Satellite System

Notice intended for:

☒ Addition ☐ Modification ☐ Suppression

BR Identification No. of Station to be modified/suppressed

Type of Satellite Network or Earth Station:

☐ GeoStationary Satellite Network ☐ Specific Earth Station

☒ **NonGeoStationary Satellite Network** ☐ Typical Earth Station

More...

Before you submit....

- Run **Spaceval** to ensure that there are **no fatal errors**
- If there are fatal errors, try to correct them before submission
- If you are unable to get rid of the fatal errors, you can **describe** them in the cover letter of your submission, the Bureau will provide assistance to address the errors
- Make sure that all required antenna patterns are provided, either by pattern id, formula or diagrams
- Do not forget to add **notes/attachments** when necessary
- Change extension of **.mdb** to **.itu** if submitting by email
- *Satellite filings* **must be submitted by the Administration**

e-Submission system online

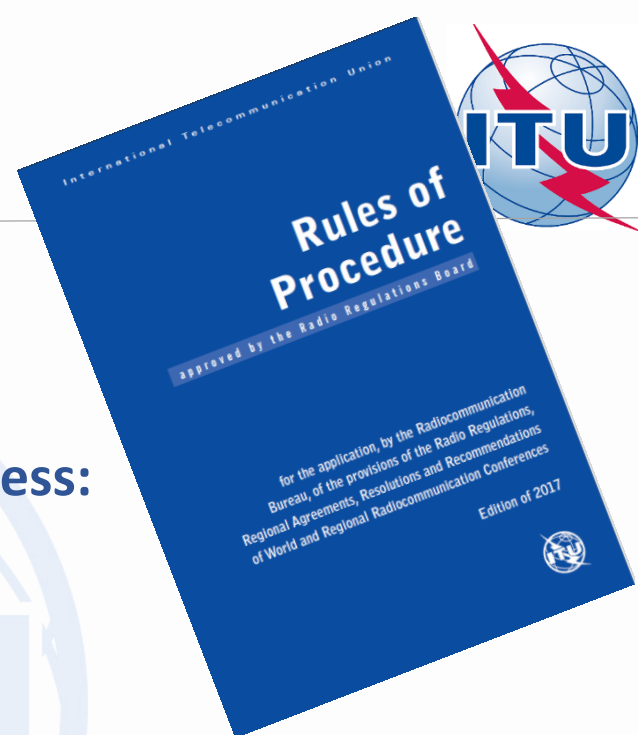


Effective: 01.08.2018

- Upload the electronic notice via the Bureau's new online submission system **"e-submission of satellite network filings"** (<https://www.itu.int/itu-r/go/space-submission>) in accordance with the revised Rules of Procedure on Receivability
- Notices submitted using "e-Submission of satellite network filings" for space services shall **be recorded as received on the actual date of receipt**, irrespective of whether or not that is a working day at the ITU/BR's offices in Geneva
- Notices submitted using "e-Submission of satellite network filings" for space services **do not require any separate confirmation by telefax or mail.**

(see BR circular letter **CR/434** dated **1 August 2018** for more details)

Other things to note



- Email: BRMAIL@ITU.INT
- Fax: +41 22 730 5785 (several lines)
- All mail must be sent to the following address:
Radiocommunication Bureau, ITU
Place des Nations, CH-1211 Geneva 20
Switzerland
- If a notice does not contain all of the mandatory information as defined in the **AP4** of the RR, further processing of the notice will remain in abeyance and a date of receipt will not be established until the missing information is received
- If all mandatory data have been submitted and further **clarification** is required concerning the correctness of the mandatory data, the Bureau shall request the ADM to provide the clarification within **30 days**
- If the information is received within the **30 days** period, the **original date of receipt** is retained, otherwise, a **new date of receipt** will be established

Cost recovery

- Cost recovery framework is defined in the Council Decision 482
- Filings for **amateur-satellite service** is exempt from cost recovery fee
- All other services are subject to cost recovery fee
- For satellite networks not subject to coordination
 - **API** – flat fee of 570 CHF
 - **Notification** – flat fee of 7030 CHF
- Modification charged with flat fee just like a new filing
- **Notification of Earth stations** are not chargeable
- Each Administration has **one free filing per year**
- In the event of **non-payment by the due date**, the filing will be cancelled (**RR9.2B.1** and **A.11.6**). However the invoice continue to be payable for the Administration
 - Note also ROP relating to late payment
- <http://www.itu.int/ITU-R/go/space-cost-recovery/en>



Resolution ITU-R 68

ADM obligations

➤ *invites administrations*

- to inform their national entities involved in the development, manufacturing, operation and launch of small satellites, in particular of those satellites whose mass is less than 100 kg (such as nanosatellites and picosatellites), about the applicable ITU and national regulatory provisions for the coordination, notification and use of orbital resources (i.e. orbits and frequencies);
- to encourage their national entities aiming to launch and deploy in outer space the satellites mentioned above to initiate the relevant ITU registration procedures as soon as possible before the launch of the satellite

ADM obligations

- **WRC-15 Agenda Item 9.1.8 –
*Regulatory aspects for nano- and picosatellites***
 - WRC-12 adopted Resolution 757 (WRC-12) *Regulatory aspects for nanosatellites and picosatellites*.
 - This issue was studied in ITU-R WP-7B between 2012-2015, which came up with two reports:
 - **ITU-R Report ITU-R SA.2312** - *Characteristics, definitions and spectrum requirements of nanosatellites and picosatellites, as well as systems composed of such satellites; and*
 - **ITU-R Report ITU-R SA.2348** - *Current practice and procedures for notifying space networks currently applicable to nanosatellites and picosatellites;*
 - Conclusion was that there was no need for special regulatory arrangements for nano and picosatellites
- **WRC-15 Decision – *Suppression of Resolution 757***

Resolution 659 (WRC-15)



- ***Studies to accommodate requirements in the space operation service for non-geostationary satellites with short duration missions***
 - assess the suitability of using existing allocations for the space operations service below 1 GHz to accommodate the telemetry, tracking and command (TT&C) requirements for non-geostationary satellites with short duration missions, and if those allocations are determined to be unsuitable
 - consider possible new allocations or an upgrade of the existing allocations to the SOS within the frequency ranges 150.05-174 MHz and 400.15-420 MHz while protecting the incumbent services, both in-band as well as in adjacent bands.
- **This study is being carried out in ITU-R WP-7B**
(<http://www.itu.int/en/ITU-R/study-groups/rsg7/rwp7b/Pages/default.aspx>) ,
and the results of the studies will be submitted for consideration by WRC-19 under Agenda item 1.7.

WRC-19 Agenda item 1.7

- to study the spectrum needs for telemetry, tracking and command in the **space operation service** for non -GSO satellites with **short duration missions**, to assess the suitability of **existing allocations** to the space operation service and, if necessary, to consider **new allocations**, in accordance with **Resolution 659** (WRC - 15)
- **Draft CPM report from WP7B**
 - **Method A** proposes no change to the Radio Regulations;
 - **Method B1** proposes a new SOS (Earth-to-space) allocation for NGSO SD systems in the frequency range **403-404 MHz**;
 - **Method B2** proposes a new SOS (Earth-to-space) allocation for NGSO SD systems in the frequency range **404-405 MHz**;
 - **Method C** proposes to use the SOS allocation in the frequency band **137-138 MHz** for downlink and the band **148-149.9 MHz** for uplink and to provide appropriate **associated regulatory provisions** in the Radio Regulations for telecommand links of NGSO SD missions.

WRC-19 Agenda item **7** issue **M**

- Simplified regulatory regime for non-GSO satellite systems with **short duration missions**
- Draft **CPM-19-2** text
 - *Proposed a **simplified regime** through a Resolution*
 - *Period of validity: maximum of **3 years***
with no possibility for extension
 - *Further proposals expected at **CPM-19-2***

2019-02-18	2019-02-28	ITU-R	CPM19-2	Second Session of the Conference Preparatory Meeting for WRC-19	Switzerland [Geneva]
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Free online ITU-R help & documents



➤ **Small Satellite Support**

- <https://www.itu.int/en/ITU-R/space/Pages/supportsmallsat.aspx>

➤ **BR space website**

- <https://www.itu.int/en/ITU-R/space>

➤ **SNL online** (*basic reference info concerning space stations*)

- <https://www.itu.int/ITU-R/go/space/snl/en>

➤ **SNS online**

- *TIES account required, need to be an ITU member (member state, ITU-R sector member, associate or academia)*

- <https://www.itu.int/sns/>

Free online ITU-R documents & events



➤ **ITU Radio Regulations @ 2016**

<https://www.itu.int/pub/R-REG-RR/>

➤ **ITU RoP** <https://www.itu.int/pub/R-REG-ROP/en>

➤ **ITU-R Preface** <https://www.itu.int/ITU-R/go/space-preface/en>

➤ **ITU-R Recommendations**

<https://www.itu.int/publ/R-REC/>

➤ **ITU-R Reports** <https://www.itu.int/pub/R-REP/>

➤ **WRC-19**

<https://www.itu.int/en/ITU-R/conferences/wrc/2019/>

➤ **CPM19-2**

<https://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/cpm-19.aspx#>

Free online ITU-R Publications



<https://www.itu.int/en/publications/ITU-R/Pages/default.aspx>

- **Handbook for Small Satellites** (Developed in partnership between UNOOSA and ITU BR)

<https://www.itu.int/en/ITU-R/space/Documents/Handout-on-Small-SatellitesE.pdf>

- **Handbook for amateur and amateur-satellite services**

<https://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-HDB-52-2014&media=electronic>

- **Handbook for earth exploration satellite service**

<https://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-HDB-56-2011&media=electronic>

- **Handbook for meteorological-satellite service**

<https://www.itu.int/en/publications/ITU-R/Pages/publications.aspx?lang=en&media=electronic&parent=R-HDB-45-2017>

- **Handbook for space research service**

<https://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-HDB-43-2013&media=electronic>