REGULATORY PROCEDURES for Small Satellites

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

**Our membership**

193 MEMBER STATES

+700 INDUSTRY & INTERNATIONAL ORGANIZATIONS

+150 ACADEMIA MEMBERS
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)**.

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- Letters and Notifications
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- 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
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
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.
Legal Framework for Spectrum Access/Use

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
ITU Convention

SECTION 5 – Radiocommunicataion 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
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

Free download
More than 2000 pages
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

**Coordination**
- Between Administrations to ensure interference-free operations conditions

**Monitoring**
- International monitoring system

**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
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
## Table of frequency allocations

### 335.4-410 MHz

<table>
<thead>
<tr>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>335.4-387</strong></td>
<td>FIXED MOBILE</td>
<td>PRIMARY</td>
</tr>
<tr>
<td></td>
<td>5.254</td>
<td></td>
</tr>
<tr>
<td><strong>387-390</strong></td>
<td>FIXED MOBILE</td>
<td>secondary</td>
</tr>
<tr>
<td></td>
<td>Mobile-satellite</td>
<td>space-to-Earth</td>
</tr>
<tr>
<td><strong>390-399.9</strong></td>
<td>FIXED MOBILE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.254</td>
<td></td>
</tr>
<tr>
<td><strong>399.9-400.05</strong></td>
<td>MOBILE-SATELLITE (Earth-to-space)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.209</td>
<td>5.220</td>
</tr>
<tr>
<td><strong>400.05-400.15</strong></td>
<td>STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.261</td>
<td>5.262</td>
</tr>
<tr>
<td><strong>400.15-401</strong></td>
<td>METEOROLOGICAL AIDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOBILE-SATELLITE (space-to-Earth)</td>
<td>5.208A</td>
</tr>
<tr>
<td></td>
<td>MOBILE-SATELLITE (space-to-Earth)</td>
<td>5.263</td>
</tr>
<tr>
<td></td>
<td>SPACE RESEARCH (space-to-Earth)</td>
<td>5.263</td>
</tr>
<tr>
<td></td>
<td>Space operation (space-to-Earth)</td>
<td>5.262</td>
</tr>
</tbody>
</table>
“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.

Please refer to the latest relevant RoP
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.
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.

Source: Rasmus G. Sæderup/AAU Student Space (University of Aalborg, Denmark)
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
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

Submit API Info

BR Publish API/A special section

BR publish API/B special section

Submit notification and Bring into use assignments

3 months for treatment by BR

4 months for comments from other administrations

Minimum 6 months

MAXIMUM 7 YEARS!

In total, ≈ 9 MONTHS to 7 YEARS!
ITU process for satellite network subject to coordination (from 1.1.2017)

Submit Request for coordination

BR Publish API/C special section

BR Publish CR/C special section

BR publish CR/D, CR/E special sections

Submit notification, due diligence and Bring into use assignments

≈ 1 week by Bureau

4 months for treatment by Bureau

4 months for comments from other administrations

MAXIMUM 7 YEARS!
• **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
Publication of API for satellite networks not subject to coordination
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)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Space Station Class of Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Space research (active sensor) space station</td>
</tr>
<tr>
<td>E2</td>
<td>Space research (passive sensor) space station</td>
</tr>
<tr>
<td>E3</td>
<td>Space station in the Earth exploration-satellite service (active sensor)</td>
</tr>
<tr>
<td>E4</td>
<td>Space station in the Earth exploration-satellite (passive sensor)</td>
</tr>
<tr>
<td>Items in Appendix</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>C.1</td>
<td>FREQUENCY RANGE</td>
</tr>
<tr>
<td>C.1.a</td>
<td>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</td>
</tr>
<tr>
<td>C.1.b</td>
<td>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</td>
</tr>
<tr>
<td>C.2</td>
<td>ASSIGNED FREQUENCY (FREQUENCIES)</td>
</tr>
<tr>
<td>C.2.a.1</td>
<td>the assigned frequency (frequencies), as defined in No. 1.148</td>
</tr>
<tr>
<td></td>
<td>- in kHz up to 28 000 kHz inclusive</td>
</tr>
<tr>
<td></td>
<td>- in MHz above 28 000 kHz to 10 500 MHz inclusive</td>
</tr>
<tr>
<td></td>
<td>- in GHz above 10 500 MHz</td>
</tr>
<tr>
<td></td>
<td>If the basic characteristics are identical, with the exception of the assigned frequency, a list of frequency assignments may be provided</td>
</tr>
<tr>
<td></td>
<td>In the case of advance publication, required only for active sensors</td>
</tr>
<tr>
<td></td>
<td>In the case of geostationary and non geo-stationary satellite networks, required for all space applications except passive sensors</td>
</tr>
<tr>
<td></td>
<td>In the case of Appendix 30B, required only for notification under Article 8</td>
</tr>
<tr>
<td>C.2.a.2</td>
<td>the channel number</td>
</tr>
<tr>
<td>C.2.b</td>
<td>the centre of the frequency band observed</td>
</tr>
<tr>
<td></td>
<td>- in kHz up to 28 000 kHz inclusive</td>
</tr>
<tr>
<td></td>
<td>- in MHz above 28 000 kHz to 10 500 MHz inclusive</td>
</tr>
<tr>
<td></td>
<td>- in GHz above 10 500 MHz</td>
</tr>
<tr>
<td>Items in Appendix</td>
<td>Radio astronomy</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>C.1</td>
<td></td>
</tr>
<tr>
<td>C.1.a</td>
<td></td>
</tr>
<tr>
<td>C.1.b</td>
<td></td>
</tr>
<tr>
<td>C.2</td>
<td></td>
</tr>
<tr>
<td>C.2.a.1</td>
<td></td>
</tr>
<tr>
<td>C.2.a.2</td>
<td></td>
</tr>
<tr>
<td>C.2.b</td>
<td></td>
</tr>
</tbody>
</table>
## Eg. Antenna patterns

Kindly submit the appropriate diagrams, or indicate the antenna pattern IDs by selecting from the [Antenna Pattern Library](https://www.itu.int/en/ITU-R/software/Pages/ant-pattern.aspx) available at the webpage:

### Eg. Earth Station Antenna Patterns

<table>
<thead>
<tr>
<th>Antenna Pattern ID</th>
<th>Description</th>
<th>Receiving</th>
<th>Transmitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP7 APERR_012V01</td>
<td>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.</td>
<td>32</td>
<td>75</td>
</tr>
<tr>
<td>Non-directional APEND_099V01</td>
<td>Non-directional earth station antenna pattern.</td>
<td>607</td>
<td>608</td>
</tr>
</tbody>
</table>

### Eg. Space Station Antenna Patterns

<table>
<thead>
<tr>
<th>Antenna Pattern ID</th>
<th>Description</th>
<th>Receiving</th>
<th>Transmitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-directional APSND_499V01</td>
<td>Non-directional space station antenna pattern.</td>
<td>610</td>
<td>609</td>
</tr>
</tbody>
</table>

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

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

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**

<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Service</th>
<th>Type of allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>401-403 MHz</td>
<td>EESS (E-S)</td>
<td>Primary</td>
</tr>
<tr>
<td>401-402 MHz</td>
<td>SOS (S-E)</td>
<td>Primary</td>
</tr>
<tr>
<td>1427 – 1429 MHz</td>
<td>SOS (E-S)</td>
<td>Primary</td>
</tr>
<tr>
<td>2025 – 2110 MHz</td>
<td>EESS (E-S, S-S)</td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td>SOS (S-E, S-S)</td>
<td></td>
</tr>
<tr>
<td>2200 – 2290 MHz</td>
<td>EESS(S-E, S-S)</td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td>SOS( S-E, S-S)</td>
<td></td>
</tr>
<tr>
<td>7190 – 7250 MHz</td>
<td>EESS (E-S)</td>
<td>Primary</td>
</tr>
<tr>
<td>8025 – 8400</td>
<td>EESS (S-E)</td>
<td>Primary</td>
</tr>
<tr>
<td>13.75 – 14 GHz</td>
<td>EESS</td>
<td>Secondary</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Service</th>
<th>Type of allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>460-470 MHz</td>
<td>EESS (S-E)</td>
<td>Secondary</td>
</tr>
<tr>
<td>1690 – 1710 MHz</td>
<td>EESS (S-E)</td>
<td>Secondary</td>
</tr>
<tr>
<td>2200 – 2290 MHz</td>
<td>EESS (S-E)</td>
<td>Primary</td>
</tr>
<tr>
<td>8025 - 8400 MHz</td>
<td>EESS (S-E)</td>
<td>Primary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Service</th>
<th>Type of allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400– 1427 MHz</td>
<td>EESS (passive)</td>
<td>Primary</td>
</tr>
<tr>
<td>2677 – 2690 MHz</td>
<td>EESS (passive)</td>
<td>Secondary</td>
</tr>
<tr>
<td>2690 – 2700 MHz</td>
<td>EESS (passive)</td>
<td>Primary</td>
</tr>
<tr>
<td>15.35 – 15.4 GHz</td>
<td>EESS (passive)</td>
<td>Primary</td>
</tr>
<tr>
<td>18.6 – 18.8 GHz</td>
<td>EESS (passive)</td>
<td>Primary</td>
</tr>
<tr>
<td>21.2 – 21.4 GHz</td>
<td>EESS (passive)</td>
<td>Primary</td>
</tr>
</tbody>
</table>

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

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

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

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

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

<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Direction</th>
<th>Service and Type of allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>401 – 403 MHz</td>
<td>E-S</td>
<td>EESS and MetSat Primary</td>
</tr>
<tr>
<td>2025 – 2110 MHz</td>
<td>E-S, S-S</td>
<td>EESS Primary</td>
</tr>
<tr>
<td>2200 – 2290 MHz</td>
<td>S-E, S-S</td>
<td>EESS Primary</td>
</tr>
<tr>
<td>8025 – 8400 MHz</td>
<td>S-E</td>
<td>EESS Primary</td>
</tr>
<tr>
<td>8175 – 8215 MHz</td>
<td>E-S</td>
<td>MetSat Primary</td>
</tr>
<tr>
<td>25.5 – 27 GHz</td>
<td>E-S and S-S in 25.25 – 27.5 GHz</td>
<td>EESS Primary</td>
</tr>
<tr>
<td>28.5 – 30 GHz</td>
<td>E-S</td>
<td>EESS secondary</td>
</tr>
<tr>
<td>37.5 – 40 GHz</td>
<td>S-E</td>
<td>EESS secondary</td>
</tr>
<tr>
<td>40 – 40.5 GHz</td>
<td>E-S</td>
<td>EESS Primary</td>
</tr>
</tbody>
</table>

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.
## Space Research Service

– example of frequency allocations

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

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

<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Service</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.01 – 37.5 MHz</td>
<td>Space Operation Service</td>
<td>S-E, E-S</td>
</tr>
<tr>
<td>174 – 184 MHz</td>
<td>Space Operation Service</td>
<td>S-E</td>
</tr>
<tr>
<td>267 – 273 MHz</td>
<td>Space Operation Service</td>
<td>S-E</td>
</tr>
<tr>
<td>470 – 485 MHz</td>
<td>Space Operation Service</td>
<td>S-E</td>
</tr>
<tr>
<td>1525 – 1535 MHz</td>
<td>Space Operation Service</td>
<td>S-E</td>
</tr>
<tr>
<td>1750 – 1850 MHz</td>
<td>Space Operation Service</td>
<td>E-S</td>
</tr>
<tr>
<td>2025-2100 MHz</td>
<td>Space Operation Service</td>
<td>S-E, E-S</td>
</tr>
<tr>
<td>2200-2290 MHz</td>
<td>Space Operation Service</td>
<td>S-E, E-S</td>
</tr>
<tr>
<td>7100-7155MHz</td>
<td>Space Operation Service</td>
<td>E-S</td>
</tr>
<tr>
<td>7290-7235MHz</td>
<td>Space Operation Service</td>
<td>E-S</td>
</tr>
</tbody>
</table>

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

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

[Image of a software interface with a red circle highlighting 'Clone API as a Notification' and a red arrow pointing to it. The selected API is 'CUBESAT-1' with date '01.08.2018'.]
SpaceCap for Notification

NonGeoStationary Satellite Network
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

Resolution ITU-R 68

- 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.
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.
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

Calendar of ITU Events: https://www.itu.int/en/events/Pages/Calendar-Events.aspx?sector=ITU-R
Free online ITU-R help & documents

- **Small Satellite Support**
  - [https://www.itu.int/en/ITU-R/space/Pages/supportsmallsat.aspx](https://www.itu.int/en/ITU-R/space/Pages/supportsmallsat.aspx)

- **BR space website**

- **SNL online** *(basic reference info concerning space stations)*
  - [https://www.itu.int/ITU-R/go/space/snl/en](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/](https://www.itu.int/sns/)
Free online ITU-R documents & events

- **ITU Radio Regulations @ 2016**
  [https://www.itu.int/pub/R-REG-RR/](https://www.itu.int/pub/R-REG-RR/)

- **ITU RoP**
  [https://www.itu.int/pub/R-REG-ROP/en](https://www.itu.int/pub/R-REG-ROP/en)

- **ITU-R Preface**

- **ITU-R Recommendations**
  [https://www.itu.int/publ/R-REC/](https://www.itu.int/publ/R-REC/)

- **ITU-R Reports**
  [https://www.itu.int/pub/R-REP/](https://www.itu.int/pub/R-REP/)

- **WRC-19**

- **CPM19-2**
Free online ITU-R Publications


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

• Handbook for amateur and amateur-satellite services

• Handbook for earth exploration satellite service

• Handbook for meteorological-satellite service

• Handbook for space research service
Questions?

EMAIL: Xiuqi.Wang@ITU.INT