RADIO FREQUENCY SPECTRUM ISSUES RELATING TO SMALL SATELLITES

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What is a Small Satellite?

≤1kg?
10kg?
100 kg?

Do small satellites have unique spectrum requirements?
What is a Small Satellite?

There is no universally accepted definition
### ITU-R Report SA.2312

**Denomination** | **Mass (kg)** | **Max. bus power (W)** | **Max. dimensions (m)** | **Development time (years)** | **Orbit** | **Mission duration (years)**
--- | --- | --- | --- | --- | --- | ---
Minisatellite | 100-500 | 1000 | 3-10 | 3-10 | GEO, MEO, LEO, HEO | 5-10
Microsatellite | 100-500 | 150 | 1-5 | 2-5 | LEO, HEO | 2-6
Nanosatellite | 10-100 | 20 | 0.1-1 | 1-3 | LEO, HEO | 1-3
Picosatellite | 1-10 | 5 | 0.05-0.1 | 1 | HEO | 1
Femtosatellite | 0.1-1 | 1 | 0.01-0.1 | 1 | | < 1

Building a better life for all through an enabling and sustainable world class information and communication technologies environment.
The genesis of small satellites with short-duration missions was in the amateur satellite service. Today these satellites are being used for a wide variety of missions and applications, including:

- remote sensing;
- space weather research;
- astronomy;
- communications;
- technology demonstration; and
- education

Some are even used in commercial applications. Small satellites with short-duration missions may operate under various radiocommunication services.
International Regulatory Framework

ITU Radio Regulations
- International Treaty
- Seeks to ensure interference-free operation
- Principles for use of spectrum & satellite orbits
- Allocation of frequency bands
- Regulatory Procedures (notification, co-ordination, recording)

5 United Nations Treaties
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**ITU Defined Satellite Services**

- fixed-satellite service
- inter-satellite service
- space operation service
- mobile-satellite service
- broadcasting-satellite service
- radiodetermination-satellite service
- radionavigation-satellite service
- radiolocation-satellite service
- Earth exploration-satellite service
- meteorological-satellite service
- standard frequency and time signal-satellite service
- space research service
- amateur-satellite service
Satellite Services Used Most Frequently by Small Satellites

- Amateur-satellite
- Space research
- Space telecommand
- Earth exploration
- Space tracking
- Meteorological-satellite
- Space telemetry
- Inter-satellite service
- Space operations
- Mobile-satellite
TT&C functions should be provided within the service in which the space station is operating.

Non-amateur satellites have been using frequencies TT&C in frequency bands which are allocated to the amateur-satellite service.

ITU-R WP 7B is considering allocations for TT&C.
Frequencies Used Most Frequently by Small Satellites

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>401-403 MHz</td>
<td>EESS SOS</td>
</tr>
<tr>
<td>449.75-450.25 MHz</td>
<td>SOS SRS</td>
</tr>
<tr>
<td>1 215-1 300 MHz</td>
<td>EESS SRS</td>
</tr>
<tr>
<td>1 427 – 1 429 MHz</td>
<td>SOS</td>
</tr>
<tr>
<td>2 025 – 2 110 MHz</td>
<td>EESS SOS SRS</td>
</tr>
<tr>
<td>2 200 – 2 300 MHz</td>
<td>EESS SOS SRS</td>
</tr>
<tr>
<td>8 025 – 8 500 MHz</td>
<td>EESS</td>
</tr>
<tr>
<td>8 400 – 8 500 MHz</td>
<td>SRS</td>
</tr>
<tr>
<td>8 550 – 8 650 MHz</td>
<td>EESS SRS</td>
</tr>
<tr>
<td>9 300 – 9 900 MHz</td>
<td>EESS SRS</td>
</tr>
<tr>
<td>10.6 – 10.7 GHz</td>
<td>EESS SRS</td>
</tr>
<tr>
<td>13.25 – 13.75 GHz</td>
<td>EESS SRS</td>
</tr>
<tr>
<td>22.21 – 22.5 GHz</td>
<td>EESS SRS</td>
</tr>
<tr>
<td>22.55 - 23.15 GHz</td>
<td>ISS SRS</td>
</tr>
<tr>
<td>23.6 – 24 GHz</td>
<td>EESS SRS</td>
</tr>
</tbody>
</table>
International Regulatory Framework

ITU Radio Regulations Art 9
- Procedure for effecting coordination with or obtaining agreement of other administrations
- Advance publication of information on satellite networks or satellite systems that are not subject to coordination
- Section II – Procedure for effecting coordination
The majority of non-GSO small satellites operate in frequency bands not subject to ITU RR Article 9 Co-ordination Procedures.

- Shortest regulatory limit for satellites not subject to Art 9 is approximately 9 months.
- Small satellites typically have a 1-2 year development time & 2-3 year operational lifetime.
- Small satellite community is interested in a relaxation of the ITU RR and easy deployment of small satellites.
- South Africa has submitted a contribution to ITU-R WP 4A in this regard.
Annex 20 to Working Party 4A Chairman’s Report

WORKING DOCUMENT

SIMPLIFIED REGULATORY REGIME FOR NON-GSO SATELLITES WITH SHORT DURATION MISSIONS
Thank You