



Recommendation ITU-R SA.1882
(02/2011)

**Technical and operational characteristics
of space research service (Earth-to-space)
systems for use in the
22.55-23.15 GHz band**

SA Series
Space applications and meteorology

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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Series of ITU-R Recommendations

(Also available online at <http://www.itu.int/publ/R-REC/en>)

| Series | Title |
|------------|--|
| BO | Satellite delivery |
| BR | Recording for production, archival and play-out; film for television |
| BS | Broadcasting service (sound) |
| BT | Broadcasting service (television) |
| F | Fixed service |
| M | Mobile, radiodetermination, amateur and related satellite services |
| P | Radiowave propagation |
| RA | Radio astronomy |
| RS | Remote sensing systems |
| S | Fixed-satellite service |
| SA | Space applications and meteorology |
| SF | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| SM | Spectrum management |
| SNG | Satellite news gathering |
| TF | Time signals and frequency standards emissions |
| V | Vocabulary and related subjects |

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R SA.1882

**Technical and operational characteristics of space research service
(Earth-to-space) systems for use in the 22.55-23.15 GHz band**

(2011)

Scope

This Recommendation provides system characteristics to be used in sharing studies for the space research service (Earth-to-space) in the band 22.55-23.15 GHz.

The ITU Radiocommunication Assembly,

considering

- a) that there is growing interest in space exploration, particularly around the Moon, from a number of administrations;
- b) that space research service (Earth-to-space) transmissions will include mission data, command and control links for space exploration for lunar exploration missions;
- c) that space research service missions utilizing the 22.55-23.15 GHz band may also operate in low-Earth orbit and in Sun-Earth Lagrangian (L1/L2) orbits;
- d) that in order to carry out sharing studies, technical and operational characteristics of space research service systems for use in 22.55-23.15 GHz are needed,

recommends

1 that the technical and operational system characteristics for the space research service (Earth-to-space) in the 22.55-23.15 GHz band detailed in Annex 1 should be used in sharing studies.

Annex 1**Technical and operational characteristics of space research service
(Earth-to-space) systems for use in the 22.55-23.15 GHz band****Characteristics of the SRS earth station emissions**

The characteristics of the SRS earth station emissions in the 23 GHz band are summarized in Table 1a). The SRS missions supported by these earth stations will be non-deep-space SRS missions. The SRS earth station characteristics are based on supporting three types of space research missions:

- low-Earth orbiting (LEO) missions;
- Lunar missions; and,
- Sun-Earth Lagrangian (L1/L2) missions.

Table 1b) lists the orbital and receiving characteristics of the representative mission satellites.

LEO missions

Before spacecraft travel to lunar destination for exploration, they first must be tested out in Earth orbit, especially in regard to manned exploration. The increase of computing and other technology capacity results in the need for an increased amount of mission data, command and control links to be sent to the spacecraft.

Lunar missions

Missions at the Moon, or in transit to the Moon, will have similar data requirements to those in low-Earth orbit, but transmission will cover a greater distance, resulting in higher power transmissions and different ground station antenna.

L1/L2 missions

Missions at Sun-Earth Lagrangian points, are typically unmanned space observatories. These observatories have longer duration contacts with the ground stations and since they are designed to operate without much interaction from the Earth, do not require as much data to be uplinked, resulting in a lower bandwidth requirement, but a higher gain earth station antenna.

TABLE 1a)

**Technical and operating characteristics of SRS earth stations
to support representative missions**

| Parameter | Values | | |
|--|------------------------|--------------------------------------|---------|
| Operating frequency (GHz) | 23.1 | | |
| Supported mission | LEO | Lunar | L1/L2 |
| SRS earth station latitude (degrees) | 32.5 N | – 35.34 N – 35.41 S – 40.43 N | 35.4 N |
| SRS earth station longitude (degrees) | 106.6 W | – 116.87 W – 148.98 E – 4.25 W | 116.9 W |
| Transmitting antenna diameter (m) | 10 | 18 | 34 |
| Antenna gain (dBi) | 65.3 | 70.4 | 75.9 |
| Off-axis antenna gain envelope | RR Appendix 7, Annex 4 | | |
| Minimum elevation angle for transmission (degrees) | 5 | | |
| Bandwidth (MHz) | 24 | 24 | 3 |
| Power at the antenna input (dBW) | 0.0 | 11.1 | 0.0 |
| Power spectral density at antenna input (dBW/Hz) | –70.8 | –59.7 | –61.4 |
| e.i.r.p. (dBW) | 65.3 | 81.5 | 75.9 |
| e.i.r.p. density (dBW/Hz) | –5.5 | 10.7 | 14.5 |

TABLE 1b)

Mission satellite characteristics

| Parameter | Values | | |
|-------------------------------|---------------|----------|--------------------------------|
| Mission type | LEO | Lunar | L1/L2 |
| Orbital altitude (km) | 700 | 384 400 | 1 500 000 |
| Orbit type | Circular | Circular | Halo |
| Orbital inclination (degrees) | 98.2 | 23.45 | $\approx 0^\circ$ wrt ecliptic |
| Antenna gain (dBi) | 40.3 | 44.7 | 44.7 |
| Noise temperature (K) | 410 | 410 | 410 |
