

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R RS.2064-0 (12/2014)

Typical technical and operating characteristics and frequency bands used by space research service (passive) planetary observation systems

RS Series
Remote sensing systems



Foreword

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P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
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SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
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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 RS.2064-0

Typical technical and operating characteristics and frequency bands used by space research service (passive) planetary observation systems

(Question ITU-R 221/7)

(2014)

Scope

This Recommendation provides typical technical and operational characteristics of space research service (passive) systems and frequency bands used by space research service (passive) planetary observation systems.

The ITU Radiocommunication Assembly,

considering

- a) that one application of the space research service (SRS) (passive) is for spacecraft to measure physical phenomena of extraterrestrial bodies;
- b) that SRS (passive) observation systems may receive emissions from transmitters operating in active radiocommunication services;
- c) that there are exclusive SRS (passive) allocations in which all emissions are prohibited by RR No. 5.340;
- d) that certain frequency bands are allocated to the SRS (passive) on a co-primary basis with active services;
- e) that studies considering protection for SRS (passive) systems may take place within ITU-R;
- f) that in order to perform compatibility and sharing studies concerning SRS (passive) systems, the technical and operational characteristics of these systems must be known;
- g) that the sensing of different physical properties requires the use of different frequencies;
- h) that simultaneous measurements at a number of frequencies are often needed to distinguish between the various physical properties being measured,

recommends

- 1 that the technical and operational parameters presented in Annex 1 of this Recommendation should be taken into account in studies considering SRS (passive) systems operating in bands allocated to the SRS (passive);
- 2 that the frequency bands used for SRS (passive) sensing should be in accordance with Annex 2.

Annex 1

Typical technical and operating characteristics used by space research service (passive) observation systems

1 Introduction

The purpose of this Recommendation is to present typical technical and operating characteristics and preferred frequency bands of space research service (SRS) (passive) observation systems.

The “*decides*” of Question ITU-R 221/7 – Preferred frequency bands and protection criteria for space research service observations (passive), includes the studying of: 1) typical technical and operating characteristics of SRS (passive) observation systems; 2) preferred frequency bands for SRS (passive) observations; and 3) protection criteria for SRS (passive) observations.

This Recommendation focuses on the first two study objectives mentioned above. Annex 1 presents typical technical and operating characteristics of the spaceborne passive sensors in the SRS (passive) which have been flown or are planned to be used, and Annex 2 lists the preferred frequency bands along with missions associated with those frequency bands.

2 Specific missions with SRS (passive) systems

The following sections describe various space research missions that have used or are using passive sensors (i.e., microwave radiometers).

2.1 Mariner 2 microwave radiometer at Venus

Mariner 2 was a Venus flyby mission in December 1962 where a microwave radiometer was used to determine the absolute temperature of the Venus surface and atmosphere. Mariner 2 approached Venus from 30 degrees above the dark side of the planet, and passed below the planet at its closest distance of 34 773 km on 14 December 1962. Simultaneous measurements were made in two frequency bands at 15.8 GHz and 22.2 GHz with predetection bandwidths of 1.6 GHz and 1.5 GHz (Table 1). The microwave radiometer used a 48.5 cm diameter parabolic antenna with two reference horns looking 60 degrees away at space. The 3 dB beamwidths were 2.64 degrees and 2.2 degrees for the two frequencies, respectively. The microwave radiometer was of the crystal video type operating in the standard Dicke mode of chopping between the main antenna pointed at the target and a reference horn pointed at cold space. The planetary emissions were characterized by limb-darkening and confirmed the high temperature of Venus. The dual-channel microwave radiometer obtained three scans across the planet Venus. The peak temperature values supported a hot-surface model for the planet. The model best to match the limb-darkening ratios and temperature values measured at both frequencies pointed to a specular surface and an isothermal cloud-type layer at a temperature near 350 K. The magnitude of the relative dielectric coefficient of the surface varied between 3 and 4. Scientific discoveries made by Mariner 2 included a slow retrograde rotation rate for Venus, hot surface temperatures and high surface pressures, a predominantly carbon dioxide atmosphere, continuous cloud cover with a top altitude of about 60 km, and no detectable magnetic field.