



Recommendation ITU-R RS.515-5
(08/2012)

**Frequency bands and bandwidths used for
satellite passive remote sensing**

RS Series
Remote sensing systems



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Foreword

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SM	Spectrum management
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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.515-5*

Frequency bands and bandwidths used for satellite passive remote sensing

(1978-1990-1994-1997-2003-2012)

Scope

This Recommendation provides information on the frequency bands and bandwidths used for satellite passive remote sensing of the Earth and its atmosphere for microwave passive sensors.

The ITU Radiocommunication Assembly,

considering

- a) that environmental data relating to the Earth is of increasing importance;
- b) that passive microwave sensors are used in remote sensing by Earth exploration and meteorological satellites in certain frequency bands allocated for such use in the Radio Regulations (RR);
- c) that some of these bands are also allocated to other radiocommunication services;
- d) that protection from interference on certain frequencies is essential for passive sensing measurements and applications;
- e) that for measurements of known spectral lines, certain bands at specific frequencies are of particular importance;
- f) that, for other types of passive sensor measurements, a certain number of frequency bands are in use, the exact positions of which in the spectrum are not of critical importance as long as the centre frequencies are more or less uniformly distributed in the spectrum;
- g) that due to the continuous technological and scientific development in the bands from 275 GHz to 3 000 GHz, the requirements for passive sensing must be periodically reviewed;
- h) that three main categories of passive sensors can be identified for the use of the bands from 275 GHz to 3 000 GHz:
 - 1) three-dimensional vertical atmosphere sounders requiring very high data reliability and medium resolution over multiple channels;
 - 2) imaging radiometers requiring high data reliability, medium resolution, integration over relatively large bandwidth single channels; and
 - 3) atmospheric limb sounders requiring medium data reliability at very high resolution over many small bandwidth channels;
- j) that any performance requirement has to be based on known scientific requirements for the measurement; the data resolution and availability levels must therefore be scientifically meaningful with respect to the applications for which they are used (e.g. forecasting, surface observations and climate monitoring),

* Radiocommunication Study Group 7 made editorial amendments to this Recommendation in 2010 in accordance with Resolution ITU-R 1.

noting

- a) that, due to the large number of spectral lines of interest for Earth observations within the 1 000-3 000 GHz region, it would be impractical to define individual bands suitable for passive remote sensing for this range;
- b) that the atmosphere in the 1 000-3 000 GHz range is so opaque to any emission that only limb-sounding observations from the top of the atmosphere are practical;
- c) that, due to the opaqueness of the atmosphere in the 1 000-3 000 GHz range, adequate protection for passive remote sensing operations is essentially guaranteed and frequency sharing is feasible with any terrestrial radiocommunication service,

recommends

1 that, based on Annexes 1 and 2, the frequency bands and the associated bandwidths for passive sensing of properties of the Earth's land, oceans and atmosphere in bands below 275 GHz shown in Table 1 and in bands between 275 and 1 000 GHz shown in Table 2 should be used for satellite passive remote sensing;

2 that the co-frequency use of the frequency range 1 000-3 000 GHz by passive microwave remote sensing systems and systems of any terrestrial radiocommunication service should be feasible.

TABLE 1

Frequency bands for satellite passive remote sensing below 275 GHz

Frequency band(s) (GHz)	Total bandwidth required (MHz)	Spectral line(s) or centre frequency (GHz)	Measurement (meteorology-climatology, chemistry) (see Table 3)	Typical scan mode N, C, L ⁽¹⁾
1.37-1.427	57	1.4	Soil moisture, ocean salinity, sea surface temperature, vegetation index	N, C
2.64-2.7	60	2.67	Ocean salinity, soil moisture, vegetation index	N
4.2-4.4	200	4.3	Sea surface temperature	N, C
6.425-7.25	350 ⁽⁴⁾	6.85	Sea surface temperature	N, C
10.6-10.7	100	10.65	Rain rate, snow water content, ice morphology, sea state, ocean wind speed	N, C
15.2-15.4	200	15.3	Water vapour, rain rate	N, C
18.6-18.8	200	18.7	Rain rates, sea state, sea ice, water vapour, ocean wind speed, soil emissivity and humidity	N, C
21.2-21.4	200	21.3	Water vapour, liquid water	N
22.21-22.5	290	22.235	Water vapour, liquid water	N
23.6-24	400	23.8	Water vapour, liquid water, associated channel for atmospheric sounding	N, C

TABLE 1 (*continued*)

Frequency band(s) (GHz)	Total bandwidth required (MHz)	Spectral line(s) or centre frequency (GHz)	Measurement (meteorology-climatology, chemistry) (see Table 3)	Typical scan mode N, C, L ⁽¹⁾
31.3-31.8	500	31.4	Sea ice, water vapour, oil spills, clouds, liquid water, surface temperature, reference window for 50-60 GHz range	N, C
36-37	1 000	36.5	Rain rates, snow, sea ice, clouds	N, C
50.2-50.4	200	50.3	Reference window for atmospheric temperature profiling (surface temperature)	N, C
52.6-59.3	6 700 ⁽²⁾	Several between 52.6-59.3	Atmospheric temperature profiling (O ₂ absorption lines)	N, C
86-92	6 000	89	Clouds, oil spills, ice, snow, rain, reference window for temperature soundings near 118 GHz	N, C
100-102	2 000	100.49	N ₂ O, NO	L
109.5-111.8	2 300	110.8	O ₃	L
114.25-116	1 750	115.27	CO	L
115.25-122.25	7 000 ⁽²⁾	118.75	Atmospheric temperature profiling (O ₂ absorption line)	N, L
148.5-151.5	3 000	150.74	N ₂ O, Earth surface temperature, cloud parameters, reference window for temperature soundings	N, L
155.5-158.5 ⁽³⁾	3 000	157	Earth and cloud parameters	N, C
164-167	3 000 ⁽²⁾	164.38, 167.2	N ₂ O, cloud water and ice, rain, CO, ClO	N, C, L
174.8-191.8	17 000 ⁽²⁾	175.86, 177.26, 183.31, 184.75	N ₂ O, Water vapour profiling, O ₃	N, C, L
200-209	9 000 ⁽²⁾	200.98, 203.4, 204.35, 206.13, 208.64	N ₂ O, ClO, water vapour, O ₃	L
226-231.5	5 500	226.09, 230.54, 231.28	Clouds, humidity, N ₂ O (226.09 GHz), CO (230.54 GHz), O ₃ (231.28 GHz), reference window	N, L