



Report ITU-R M.2417-1
(11/2022)

**Technical and operational characteristics of
land mobile service applications
in the frequency range 275-450 GHz**

M Series
**Mobile, radiodetermination, amateur
and related satellite services**



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 Reports

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Series	Title
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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

Note: This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.

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in the frequency range 275-450 GHz**

(Question ITU-R 256-1/5)

(2017-2022)

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1 Introduction

Due to the progress of RF integrated devices and circuits having capability to operate above 275 GHz, contiguous frequency bands in the range 275-450 GHz can be used by land-mobile service applications. Applications operating in the frequency band above 275 GHz, such as Kiosk downloading, automatic turnstile downloading, and intra-rack and intra-chip communications, are introduced, and ultra-high-speed data transmission between terminals whose transmission distance is in the order of centimetres becomes feasible.

Radio Regulations (RR) No. **5.565** identifies the specific frequency bands for the radio astronomy service, the earth exploration satellite service (passive) and the space research service (passive) in the frequency range 275-1 000 GHz. Although the use of the frequency range 275-1 000 GHz by the passive services does not preclude the use of this range by active services, administrations wishing to make frequencies in the 275-1 000 GHz range available for active service applications are urged to take all practicable steps to protect these passive services from harmful interference.

Furthermore, RR No. **5.564A** identifies the frequency bands 275-296 GHz, 306-313 GHz, 318-333 GHz and 356-450 GHz for use by administrations for the implementation of land mobile and fixed service applications, where no specific conditions are necessary to protect Earth exploration-satellite service (passive) applications, and indicates that the frequency bands 296-306 GHz, 313-318 GHz and 333-356 GHz may only be used by fixed and land mobile service applications when specific conditions to ensure the protection of Earth exploration-satellite service (passive) applications are determined in accordance with Resolution **731 (Rev.WRC-19)**. This Report is to be complemented by other ITU-R publications that provide the specific conditions to be applied to the land-mobile service applications, to ensure the protection of Earth exploration-satellite service (passive) applications.

The initial spectrum needs for some LMS applications above 275 GHz are shown in Annex 5 to this Report. Further studies are under way to estimate the spectrum needs for emerging LMS applications.

2 Scope

This Report provides the technical and operational characteristics of land mobile service applications in the frequency range 275-450 GHz for sharing and compatibility studies.

3 Related Recommendations and Reports

Spectrum:

Recommendation ITU-R F.699	Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to 86 GHz
Recommendation ITU-R P.676	Attenuation by atmospheric gases
Recommendation ITU-R P.838	Specific attenuation model for rain for use in prediction methods
Recommendation ITU-R P.840	Attenuation due to clouds and fog
Recommendation ITU-R P.1238	Propagation data and prediction methods for the planning of indoor radiocommunication systems and radio local area networks in the frequency range 300 MHz to 450 GHz
Recommendation ITU-R P.2109	Prediction of Building Entry Loss

Report ITU-R F.2416	Technical and operational characteristics and applications of the point-to-point fixed service applications operating in the frequency band 275-450 GHz
Report ITU-R P.2406	Studies for short-path propagation data and models for terrestrial radiocommunication systems in the frequency range 6 GHz to 450 GHz
Report ITU-R SM.2352	Technology trends of active services in the frequency range 275-3 000 GHz
Use cases:	
Recommendation ITU-R M.2003	Multiple Gigabit Wireless Systems in frequencies around 60 GHz
Report ITU-R M.2227	Use of multiple gigabit wireless systems in frequencies around 60 GHz
Report ITU-R M.2441	Emerging usage of the terrestrial component of International Mobile Telecommunication (IMT)
Report ITU-R M.2479	The use of land mobile systems, excluding IMT, for machine-type communications
Report ITU-R SM.2450	Sharing and compatibility studies between land-mobile, fixed and passive services in the frequency range 275-450 GHz

4 List of acronyms and abbreviations

BER	Bit error ratio
CPMS	Close proximity mobile system
LMS	Land mobile service
OFDM	Orthogonal frequency-division multiplexing
PCB	Printed circuit board
RR	Radio Regulations
SC	Single-carrier
VR	Virtual reality

5 Regulatory and propagation information

5.1 Frequency ranges defined in the RR

The Gigahertz frequency ranges from 3 GHz to 3 000 GHz are subdivided into three bands as shown in Table 1. The frequency range covered by this Report belongs to both millimetric and decimillimetric waves.

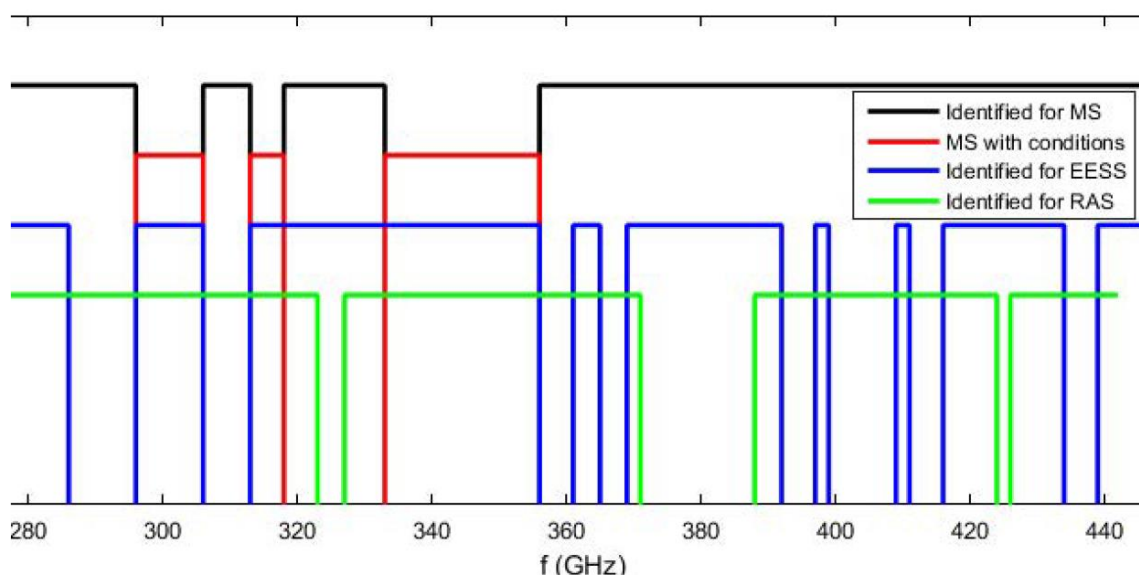
TABLE 1
Frequency bands above 3 GHz

Band number	Symbol	Frequency range (lower limit exclusive, upper limit inclusive)	Corresponding metric subdivision
10	SHF	3 to 30 GHz	Centimetric waves
11	EHF	30 to 300 GHz	Millimetric waves
12	THF ¹	300 to 3 000 GHz	Decimillimetric waves

5.2 Frequency bands identified in the RR

The frequency bands identified in RR No. 5.565 that are also addressed in RR No. 5.564A with either no specific conditions necessary to protect the Earth exploration-satellite service (EESS) (passive) applications, or which may only be used by land mobile service applications when specific conditions are applied to ensure the protection of EESS (passive) applications, are shown in Fig. 1.

FIGURE 1²
Identification of frequency bands in RR Nos. 5.564A and 5.565



5.3 Propagation characteristics

One of the propagation effects in this frequency range is gaseous attenuation, specific gaseous attenuation is shown in Fig. 2 on the height of the ground level (pressure 1 013 hPa, temperature 15 °C, water vapour density 7.5 g/m³). This curve is obtained using the methodology from Recommendation ITU-R P.676-12. The Figure illustrates quite different propagation conditions for different bands identified in this frequency range.

¹ This symbol is introduced for this Report only. THF stands for Tremendous High Frequency.

² This is a conceptual representation and the different services are separated for clarity.