



**Recommendation ITU-R SM.2151-0**  
(09/2022)

**Guidance on frequency ranges for operation  
of wireless power transmission via radio  
frequency beam for mobile/portable devices  
and sensor networks**

**SM Series**  
**Spectrum management**

## 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.

## Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

### Series of ITU-R Recommendations

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

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

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

Electronic Publication  
Geneva, 2022

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## RECOMMENDATION ITU-R SM.2151-0

**Guidance on frequency ranges for operation of wireless power transmission via radio frequency beam for mobile/portable devices and sensor networks**

(2022)

**Scope**

This Recommendation provides guidance on frequency ranges for the operation of wireless power transmission (WPT) via radio frequency beam (beam WPT), including wireless charging of mobile/portable devices and wireless powered & charging of sensor networks, but not including WPT for electric vehicles.

**Keywords**

Wireless power transmission, radio frequency beam, beam WPT, ISM, short-range devices

**Abbreviations/Glossary**

CISPR	In French “Comité International Spécial des Perturbations Radioélectriques”, International Special Committee on Radio Interference
ICNIRP	International Commission on Non-ionizing Radiation Protection
IEC	International Electrotechnical Commission
ISM	Industrial, scientific and medical
RR	Radio Regulations
WHO	World Health Organization
WPT	Wireless power transmission

**Related ITU Recommendations, Reports**

Recommendation ITU-R SM.1056

Recommendation ITU-R SM.1896

Report ITU-R SM.2153

Report ITU-R SM.2392

Report ITU-R SM.2505

The ITU Radiocommunication Assembly,

*considering*

- a)* that wireless power transmission (WPT) is defined as the transmission of power from a power source to an electrical load wirelessly using an electromagnetic field;
- b)* that WPT technologies utilize various mechanisms, such as transmission via radio frequency radiation in the far field (beam WPT) and near-field inductive, resonant and capacitive coupling (non-beam WPT);
- c)* that beam WPT technologies may be useful in various applications, including wireless charging of mobile/portable devices and wireless powered and charging of sensor networks;

- d) that there is potential customer demand for beam WPT technologies for such applications and associated applications;
- e) that WPT standards are currently being developed at national, regional and international levels;
- f) that some beam WPT utilize frequency bands designated for Industrial, Scientific and Medical (ISM) applications and some systems utilize different frequency ranges;
- g) that issues of non-ionizing radiation exposure are dealt with by international organizations such as the World Health Organization (WHO), the International Commission on Non-ionizing Radiation Protection (ICNIRP), and International Electrotechnical Commission TC106;
- h) that administrations wishing to introduce and bring into use beam WPT applications should consider the exposure limits for non-ionizing electromagnetic fields (see *noting c*),

*recognizing*

- a) that WPT has no status in the RR and that, under Nos. **15.12** and **15.13**, administrations shall take all practicable steps to ensure this equipment does not cause harmful interference to a radiocommunication service, in particular to a radionavigation or any other safety service;
- b) that when considering beam WPT as an ISM application, RR Nos. **5.138**, **5.150** and **15.13** should be taken into consideration;
- c) that both consumers and manufacturers may benefit from harmonized frequency ranges and technical conditions for WPT technologies;
- d) that frequency bands designated for ISM applications have been successfully used in the past for development and proliferation of innovative technologies in accordance with the RR;
- e) that some non-ISM bands are taken into consideration for the global or regional harmonized use of specific WPT applications;
- f) that WPT can be treated separately from data communications, especially when the receiving device receives data communications at a frequency different from that for the energy transmission;
- g) that some administrations classify beam WPT as an ISM application, even for operation outside the bands designated for ISM applications;
- h) that some administrations classify beam WPT as radio applications such as short-range devices, operating in some bands listed in Recommendation ITU-R SM.1896 and Report ITU-R SM.2153;
- i) that in order to address adequate protections for radiocommunication services from any harmful interference, some administrations may classify certain applications of WPT beam operation as a radio service;
- j) that duration or power limits can be placed on WPT,

*noting*

- a) that the International Electrotechnical Commission (IEC) has published Technical Reports IEC/TR 62869 on “Activities and considerations related to wireless power transfer (WPT) for audio, video and multimedia systems and equipment” and IEC/TR 63231 on “Consideration of energy efficiency in wireless power transfer technology” and IEC/TR 63239 on “Radio frequency beam wireless power transfer (WPT) for mobile devices” developed by TC 100;
- b) that this Recommendation will assist administrations in applying Nos. **15.12** and **15.13** not to cause harmful interference to a radiocommunication service from the operation of WPT equipment used for non-ISM and ISM applications, respectively;

- c) that Recommendation ITU-R SM.1056 on the limitation of radiation from ISM equipment recommends that administrations consider the use of the latest edition of CISPR publication 11;
- d) that Report ITU-R SM.2392 discusses applications of wireless power transmission via radio frequency beam;
- e) that Report ITU-R SM.2505 provides impact studies information related to the use of some beam WPT,

*recommends*

**1** that administrations may consider as guidance the use of the frequency ranges, or portions thereof, listed in the Table 1 below, for the operation of beam WPT for mobile/portable devices and charging of sensor networks;

**2** that necessary steps should be taken to ensure that beam WPT does not cause harmful interference to radiocommunication services, so that radiocommunication services remain protected from radio frequency energy emanating from WPT operations falling into all bands.

TABLE 1

**Frequency ranges for operation of beam WPT**

Frequency range	Suitable beam WPT technologies and applications
915-921 MHz	Wireless charging of mobile/portable devices Wireless powered and charging of sensor networks
2 410-2 483.5/2 486 MHz	
5 725-5 875 MHz	
61-61.5 GHz	

NOTE 1 – The frequency ranges listed in this Table indicate those with possible use for beam WPT, noting that some frequency ranges may not be designated for ISM applications, and may not be available for beam WPT applications in some countries, as a result of the different national allocations and regulatory conditions.

NOTE 2 – In some administrations in Regions 1 and 3, the compatibility study of beam WPT is still ongoing and the available frequency ranges for beam WPT are still under consideration.