

International Telecommunication Union

**ITU-R**  
Radiocommunication Sector of ITU

**Recommendation ITU-R SM.2110-0**  
(09/2017)

**Frequency ranges for operation of  
non-beam wireless power  
transmission systems**

**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 Annex 1 of 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.*

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## RECOMMENDATION ITU-R SM.2110-0

**Frequency ranges for operation of non-beam  
wireless power transmission systems\***

(2017)

**Scope**

This Recommendation provides guidelines for the use of frequency ranges for the operation of non-beam wireless power transmission (WPT), including charging of mobile/portable devices.

**Keywords**

Wireless power transmission, short-range devices, ISM, non-beam

**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
ISO:	International Standard Organization
ISM:	Industrial, Scientific, Medical
GSC:	Global Standards Collaboration
RR:	Radio Regulations
SAE:	Society of Automotive Engineers
WHO:	World Health Organization
WPT:	wireless power transmission
WRC-19:	World Radiocommunication Conference 2019

**Related ITU Recommendations, Reports**

Recommendation ITU-R SM.1056; Recommendation ITU-R SM.1896; Report ITU-R SM.2153;  
Report ITU-R SM.2303.

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 using the electromagnetic field;
- b) that WPT technologies utilize various mechanisms, such as transmission via radio frequency beams, inductive, resonant and capacitive coupling;
- c) that such WPT technologies may be useful in applications of charging of mobile/portable devices and electric vehicles etc.;

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\* The global harmonization of frequencies for WPT for electric vehicles will be addressed under WRC-19 agenda item 9.1, issue 9.1.6 (i.e. Item 1 in the Annex to Resolution **958 (WRC-15)**).

- d) that WPT standards are currently being developed at national, regional, and international levels for the above-mentioned wireless charging of mobile devices and electric vehicles, etc.;
- e) that industrial alliances, consortia, and academia have investigated several frequency bands for WPT technologies, including; 19-21 kHz and 59-61 kHz for the shaped magnetic field in resonance for electric vehicles, 79-90 kHz for magnetic resonant technology for electric vehicles, 100-300 kHz for magnetic resonant and induction technology for mobile devices and 6 765-6 795 kHz for magnetic resonant technology for mobile devices;
- f) that studies have been concluded by one administration on the impact of WPT to radiocommunication services in the bands 79-90 kHz and 6 765-6 795 kHz, another administration undertook studies on the impact of WPT in the band 110-300 kHz and some administrations already authorize use of some of these bands for WPT technologies;
- g) that as the number of WPT devices is growing the use of WPT technologies may have an impact on the operation of radiocommunication services including the standard frequency and time signal service and the radio astronomy service;
- h) that radiation outside the bands used by WPT should be minimized in order to preserve the RF spectrum of radiocommunication services;
- i) that to mitigate the impact of WPT devices on the operation of radiocommunication services some solutions utilize frequency bands designated for Industrial, Scientific, Medical (ISM) applications;
- j) 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, and that ICNIRP 2010 provides guidelines for limiting exposure (up to 10 MHz), and ICNIRP 1998 provides Guidelines for limiting exposure (up to 300 GHz),

*recognizing*

- a) that WPT has no status in the Radio Regulations (RR) and therefore should not cause interference to radiocommunication services including the standard frequency and time signal service and the radio astronomy service;
- b) that both consumers and manufacturers will benefit from common spectrum bands used for WPT technologies;
- c) that for 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;
- d) the band 6 765-6 795 kHz also designated for ISM use under RR No. **5.138** has been found to have advantages for WPT using magnetic resonance technologies in applications of charging of mobile/portable devices;
- e) that some non-ISM bands are taken into consideration for the global or regional harmonized use of specific WPT applications;
- f) that the WPT energy transfer can be treated separately from data communications, especially when the receiving device receives data communications at a different frequency to the energy transfer;
- g) that some Administrations classify the non-beam WPT energy transfer as an ISM application, even for operation outside bands designated for ISM use;
- h) that some Administrations classify non-beam WPT systems as Short-Range Devices, operating in some bands listed in Recommendation ITU-R SM.1896 and Report ITU-R SM.2153;

- i) that in the absence of a load, the WPT shuts off and only periodically polls or searches for the load, with very low duty cycle;
- j) that for WPT (non-beam), the radiated power is much lower than RF power transferred. Most power is transferred to the receiver through mechanisms such as capacitive, resonant and inductive coupling;
- k) that at VLF, LF and MF frequencies the environment is already very noisy relative to the victim's thermal noise floor, due to atmospheric and man-made noise;
- l) that duration or power limits can be placed on WPT,

*noting*

- a) that the International Electrotechnical Commission (IEC) has published a Technical Report IEC/TR 62869 on Wireless Power Transfer for audio, video and multimedia systems and equipment developed by TC 100;
- b) that the IEC 61980 series, International Standard Organization (ISO) 19363, and the Society of Automotive Engineers (SAE) International J2954 are developing international standards intended for global and regional harmonization on electric vehicle WPT systems;
- c) that Resolution Global Standards Collaboration (GSC)-17/34 resolves to facilitate a strong and effective standards collaboration on WPT in terms of protocol, regulatory and interoperability aspects;
- d) that this Recommendation will assist administrations in applying RR No. **15.13** to prevent harmful interference to a radiocommunication service from equipment used for industrial, scientific and medical applications;
- e) 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;
- f) that Report ITU-R SM.2303 discusses WPT using technologies other than radio frequency beam,

*recommends*

that administrations should consider as a guideline the use of the frequency range listed in the following Table for the operation of non-beam WPT systems and should take steps to ensure that radiocommunication services including the standard frequency and time signal service and the radio astronomy service are protected from WPT operations, including consideration of unwanted radio frequency energy (such as radiated electromagnetic disturbances) falling into all bands.

TABLE 1

**Frequency range for operation of non-beam WPT systems**

<b>Frequency range</b>	<b>Suitable non-beam WPT technologies and applications</b>
6 765-6 795 kHz Note: See RR No. <b>5.138</b>	Magnetic resonant technology for mobile/portable devices

NOTE – This Table lists only one frequency range since no global harmonization for other frequency ranges could be reached at the moment of publication. This does not mean that the mentioned frequency range is the most suitable or the only available range for WPT. Other ranges may be added in due time.