

Recommendation ITU-R SM.2110-2

(09/2025)

SM Series: Spectrum management

**Guidance on frequency ranges for
operation of non-beam wireless power
transmission for electric vehicles**

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 Recommendations

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

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
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
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	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.2110-2

**Guidance on frequency ranges for operation of non-beam
wireless power transmission for electric vehicles**

(Question ITU-R 210-4/1)

(2017-2019-2025)

Scope

This Recommendation provides guidance on frequency ranges for the operation of non-beam wireless power transmission (non-beam WPT) for electric vehicles (EV) and the protection of radiocommunication services.

Keywords

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

Abbreviations/Glossary

CISPR	In French “Comité International Spécial des Perturbations Radioélectriques”, International Special Committee on Radio Interference
ICES	International Committee on Electromagnetic Safety
ICNIRP	International Commission on Non-ionizing Radiation Protection
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ISM	Industrial Scientific Medical
RR	Radio Regulations
SAE	Society of Automotive Engineers
SFTS	Standard Frequency and Time Signal service (RR No. 1.53)
WHO	World Health Organization
WPT	Wireless power transmission
WPT-EV	Wireless power transmission for electric vehicles

Related ITU Recommendations, Reports

- Recommendation ITU-R SM.1056 – Limitation of radiation from industrial, scientific and medical (ISM) equipment
- Recommendation ITU-R SM.1896 – Frequency ranges for global or regional harmonization of short-range devices
- Recommendation ITU-R SM.2129 – Guidance on frequency ranges for the operation of non-beam wireless power transmission for mobile and portable devices
- Report ITU-R SM.2153 – Technical and operating parameters and spectrum use for short-range radiocommunication devices
- Report ITU-R SM.2303 – Wireless power transmission using technologies other than radio frequency beam
- Report ITU-R SM.2451 – Assessment of impact on radiocommunication services from wireless power transmission for electric vehicle operating below 30 MHz

Report ITU-R TF.2487 – Protection criteria for systems in the standard frequency and time signal services

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 the electromagnetic field;
- b) that WPT technologies utilize various mechanisms, such as transmission via radio frequency radiated transmissions in the far-field (WPT beam) and near-field inductive, resonant and capacitive coupling (non-beam WPT);
- c) that WPT technologies are being considered for applications such as charging of electric vehicles;
- d) that WPT regulations and standards are currently being developed at national, regional, and international levels;
- e) that industrial alliances, consortia, and academia have investigated several fundamental frequency bands for WPT technologies, including; 19-21 kHz and 79-90 kHz for electric vehicles;
- f) that studies have been conducted on the impact of non-beam WPT to radiocommunication services and are contained in Report ITU-R SM.2451;
- g) that for the purpose of WPT studies the radio astronomy service is to be treated as a radiocommunication service;
- h) that as more WPT devices proliferate globally, the use of WPT technologies may have an impact on radiocommunication services including the standard frequency and time signal service and the radio astronomy service, WPT must not cause harmful interference to radiocommunication services;
- i) that to mitigate the impact of WPT devices on the operation of radiocommunication services some solutions utilize frequency bands already designated for industrial, scientific and medical (ISM) applications,

recognizing

- a) that WPT is not a radiocommunication service and has no status in the Radio Regulations (RR), but may be regarded as subject to RR Nos. **15.12** or **15.13**;
- b) that the criteria to protect various radiocommunication services from harmful interference are specified in existing ITU-R Recommendations;
- c) that both consumers and manufacturers may benefit from harmonized frequency ranges and technical conditions for WPT technologies;
- d) that some Administrations classify the non-beam WPT energy transfer as an ISM application, even for operation outside bands designated for ISM use;
- e) that some Administrations classify non-beam WPT systems as radio application such as a short-range radio device;
- f) that some non-ISM bands are taken into consideration for the global or regional harmonized use of specific WPT applications;
- g) that the energy transfer of non-beam WPT systems can be treated separately from data communications, especially when the receiving device receives data communications at a frequency different from that for the energy transfer;
- h) that in the absence of a load, the WPT-EV shuts off and does not radiate;

i) that for non-beam WPT-EV, the radiated RF power external to the WPT-EV system is much lower than RF power transferred to the vehicle. Most power is transferred to the receiver through mechanisms such as capacitive, resonant and inductive coupling;

j) 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 11. These limits do not necessarily protect radiocommunication services,

noting

a) that the IEC TC 69 published IEC International Standard (IS) 61980-1 on “general requirement of electric vehicle wireless power transfer systems”, IEC IS 61980-2 on “specific requirements for communication between electric road vehicle (EV) and infrastructure”, and IEC IS 61980-3 on “specific requirements for the magnetic field power transfer systems of WPT-EV”;

b) that the International Organization for Standardization (ISO/TC22/SC37) published ISO International Standard (IS) 5474-4 on “electrically propelled road vehicles – functional and safety requirements for power transfer between vehicle and external electric circuit part 4: magnetic field wireless power transfer”;

c) that SAE International published the Standard J2954 on “wireless power transfer for light-duty plug-in/electric vehicles and alignment methodology”;

d) that issues of non-ionizing radiation exposure are dealt with by international organizations such as the WHO, ICNIRP and IEEE;

e) and that “ICNIRP Guidelines” (2010) addresses limiting exposure to time-varying electric and magnetic fields from 1 Hz to 100 kHz and IEEE C95.1 provides a standard for limiting exposure in the frequency range 0 Hz to 300 GHz,

recommends

that the frequency ranges (or portions thereof) listed in Table 1 below, as well as Note of Table 1 should be considered as guidance for the operation of non-beam WPT-EV systems and the protection of radiocommunication services taking into account *considering f) and h)*.

TABLE 1

Frequency ranges for operation of non-beam WPT systems for electric vehicles

Frequency range ⁽¹⁾	Suitable non-beam WPT-EV technologies
19-21 kHz	Magnetic induction or Magnetic resonance
79-90 kHz	Magnetic resonance

⁽¹⁾ For protection of SFTS operation at 60 kHz all forms of energy emissions from WPT-EV in the 60 kHz $\pm$ 4 kHz range (56-64 kHz) should be avoided.

In cases where any form of WPT-EV energy emission occurs in the proximity of 60 kHz SFTS receivers, and assuming a minimum separation distance of 50 m, any form of WPT-EV energy emission falling within the 64-65 kHz and 55-56 kHz frequency ranges should not exceed a total of 35 dB μ A/m at 10 m. Where the separation distance is guaranteed to be greater than 100 m between WPT-EV and SFTS receivers, any form of WPT-EV energy emission falling within the 63-65 kHz and 55-57 kHz ranges, should not exceed a total of 44 dB μ A/m at 10 m.