



Recommendation ITU-R SM.2110-1
(10/2019)

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

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.

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Series	Title
BO	Satellite delivery
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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.2110-1

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

(2017-2019)

Scope

This Recommendation provides guidelines for the use of frequency ranges for the operation of non-beam wireless power transmission (WPT) for electric vehicles.

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 Organization for Standardization
ISM	Industrial, scientific, medical
RR	Radio Regulations
SAE	Society of Automotive Engineers
SFTSS	Standard frequency and time signal service
WHO	World Health Organization
WPT	wireless power transmission
WPT-EV	Wireless power transmission for electric vehicles
WRC-19	World Radiocommunication Conference 2019

Related ITU Recommendations, Reports

Recommendation ITU-R SM.1056; Recommendation ITU-R SM.1896; Recommendation ITU-R SM.2129; Report ITU-R SM.2153; Report ITU-R SM.2303; Report ITU-R SM.2451.

* 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)**).

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 beams) and near-field inductive, resonant and capacitive coupling (WPT non-beam);
- c) that such WPT technologies are being considered for applications such as charging of electric vehicles;
- d) that WPT standards are currently being developed at national, regional, and international levels;
- e) that industrial alliances, consortia, and academia have investigated several frequency bands for WPT technologies, including; 19-21 kHz and 55-65 kHz for the shaped magnetic field in resonance for electric vehicles, 79-90 kHz for magnetic resonant technology for electric vehicles;
- f) that for the purpose of WPT studies the standard frequency and time signal and the radio astronomy services are to be treated as radiocommunication service;
- g) that studies have been conducted on the impact of non-beam WPT to radiocommunication services in the bands 19-21 kHz, 55-57 kHz, 63-65 kHz and 79-90 kHz;
- 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 radio communication 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,

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** as the case may be;
- 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 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 short-range devices;
- f) that some non-ISM bands are taken into consideration for the global or regional harmonized use of specific WPT applications;
- g) that the WPT energy transfer 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 does not transmit;

i) that for non-beam WPT-EV, 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;

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 publication 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, is developing IEC Technical Specifications (TS) and IS 61980-2 on communication and control of electric vehicle wireless power transfer systems by 2019 and 2020 respectively, and is developing IEC TS and IS 61980-3 on specific requirements for the magnetic field power transfer systems of electric vehicle wireless power transfer systems by 2019 and 2020 respectively;

b) that the International Organization for Standardization (ISO/TC22/SC37) is developing ISO International Standard (IS) 19363 on electrically propelled road vehicles – magnetic field wireless power transfer by 2019;

c) that the Society of Automotive Engineers (SAE) International J2954 published Recommended Practice (RP) on wireless power transfer for light-duty electric vehicles in 2017 and 2019;

d) 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),

recommends

1 that the use of the frequency range, or portions thereof, listed in Table 1 below should be considered as guidance for the operation of non-beam WPT-EV systems;

2 that the following Note is considered as integral part of this Recommendation.

NOTE – Additional guidance can be found in Table 1 on necessary steps that should be taken to ensure that non-beam WPT-EV applications and equipment minimize the potential for harmful interference to radiocommunication services including the standard frequency and time signal service (SFTSS) and the radio astronomy service, so that these remain protected from radio frequency energy emanating from WPT-EV falling into all bands.

TABLE 1

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

Frequency range	Suitable non-beam WPT-EV
19-21 kHz	Magnetic induction technology or Magnetic resonant technology
55-57 kHz ⁽¹⁾	Magnetic induction technology or Magnetic resonant technology
63-65 kHz ⁽¹⁾	Magnetic induction technology or Magnetic resonant technology
79-90 kHz	Magnetic resonant technology

⁽¹⁾ Not to be used for the fundamental frequency of WPT-EV. Assuming a minimum separation distance of 50 m between WPT-EV and SFTS receivers, the third harmonic must fall within the 64-65 kHz and 55-56 kHz frequency range and the WPT emission be limited to 35 dB μ A/m at 10 m. Where a separation distance of greater than 100 m between WPT-EV and SFTS receivers can be guaranteed, the third harmonic may fall within the 63-65 kHz and 55-57 kHz and the WPT emission be limited to 44 dB μ A/m at 10 m.
