IARU and Wireless Power Transmission for Electric Vehicles

What is Wireless Power Transmission for Electric Vehicles (WPT-EV)?

Wireless Power Transmission for Electric Vehicles WPT-EV is a new technology which will form part of the infrastructure options for electric vehicle charging. WPT-EV will use high power levels of radio frequency energy (typically up to 22 kW) coupled from a primary charging coil located on the ground under the vehicle, to a secondary coil mounted on the underside of the vehicle. Energy is transferred across the air-gap between these two coils to charge the vehicle battery pack. The operating frequency will be typically 79-90 kHz.

There is an intense focus on developing technical and operational standards for WPT- EV. Early results of the studies in Europe have resulted in the publication of CEPT ECC Report 289 "Wireless Power Transmission (WPT) systems for electrical vehicles (EV) operating within 79-90 kHz band" [1]. IARU has made significant input to the Report, as have other users of the radio spectrum. The general message is clear: radio communications services – not just the amateur service see a major threat to their continued operation because of the high levels of spurious emissions expected from WPT-EV. In short, the picture is not a pretty one.

Why is WPT-EV a problem for radio services?

The operating frequency of WPT-EV is not the prime concern for IARU nor for most other radio services. But the radio frequency energy emitted is rich in harmonics (and perhaps noise-like products), which represents a real threat to many radio services operating at other frequencies. Developers of these WPT-EV systems have generally been reluctant to share the results of the measurements they have conducted on harmonic emissions, but what little has emerged suggests that the levels are high.

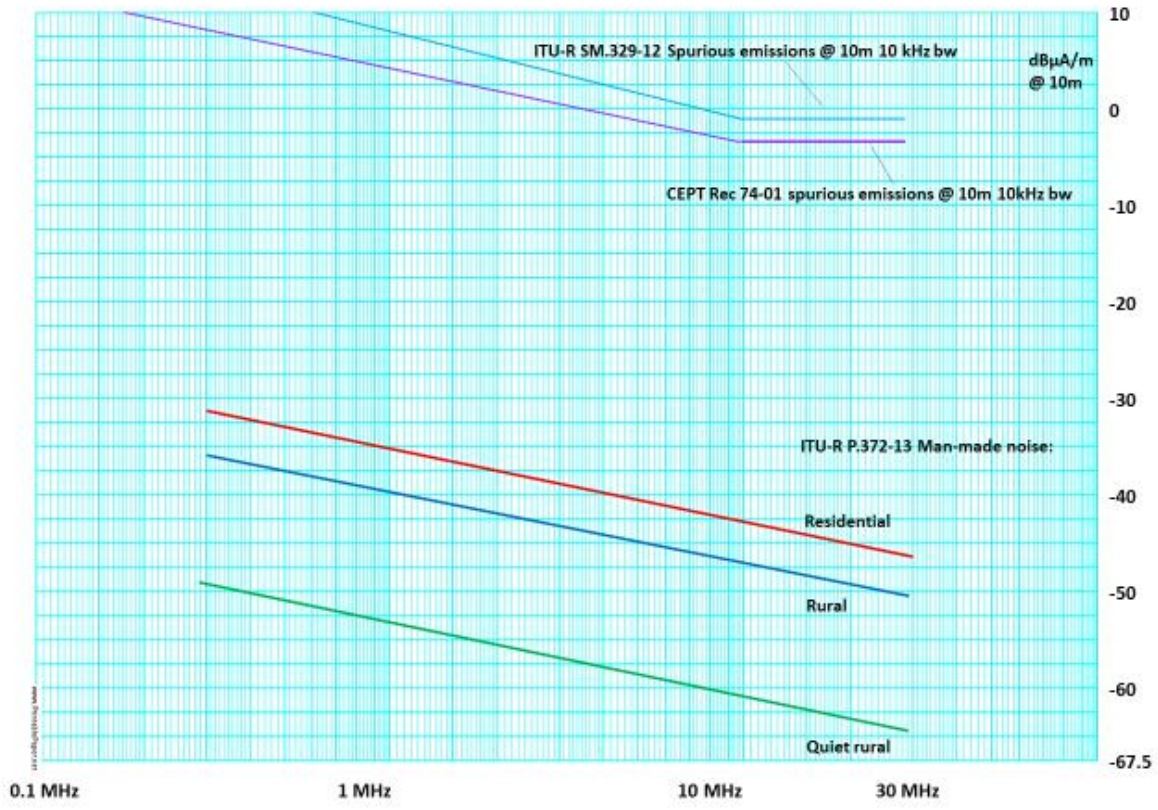
Because many of the systems adjust their operating frequency to optimise the coupling efficiency, and to cater for inter-operability between vehicle types, WPT-EV operating frequencies could lie anywhere in the 79-90 kHz range. It is therefore self-evident that once multiplied up into the HF radio spectrum, these harmonics can lie anywhere across the entire spectrum. Furthermore, the projected density of WPT-EV installations suggests that many domestic households will be impacted by the harmonics from several systems.

More generally, lower power WPT systems are being developed to charge just about any device using a battery, from mobile phones to hand power tools. The technology will also come into the kitchen with kettles, food mixers etc being directly powered or charged by WPT.

[1] https://www.ecodocdb.dk/download/2fed7e3c-7543/ECC%20Report%20289.pdf

In all cases, the product developers are arguing that the relevant CEPT spurious emission limits are those set out in ERC Rec 74-01 (Table 2.1.3) [2] The wording in this recommendation makes clear that it cannot automatically be read across to new classes of device, and IARU has argued that it is an inappropriate limit for spurious emissions. A simple graph shows why.

The following chart shows the spurious limits as defined variously in CEPT and ITU (emission at 10m distance) and compares it with the man-made background noise levels defined in ITU Report P. 372-14 [3]



It is clear that the emissions at 10m distance exceed the median man-made noise figures by 30-45 dB.

Separately in CISPR, WPT developers have been arguing for emission limits which again would cause serious degradation of the radio spectrum.

[2] https://www.ecodocdb.dk/download/3af8bcdd-43ae/ERCREC7401.pdf
[3] https://www.itu.int/rec/R-REC-P.372-14-201908-I/en

So what has IARU done about this?

Firstly it has involved itself in discussions in CEPT, CISPR and ITU and presented studies which clearly show the threat to radio communications services. IARU was the only voice representing the amateur service. Broadcasters and the land fixed and mobile services also share our concerns and made input, as did some of the more enlightened administrations around Europe. But the level of engagement of WPT-EV developers in discussions about mitigation actions to prevent widespread harmful interference to radio services in residential areas has been minimal.

Meanwhile, standards development organisations (CISPR and ETSI) have been extrapolating existing limits for emissions to cater for those expected from WPT-EV. The existing limits included a discounting factor for a number of probability issues, all of which apply to a lower degree, or not at all, to WPT-EV. This suggests that the limits should be tightened but there is resistance to this from the industry.

There have been comments from the WPT industry that WPT will not cause problems because the noise levels are already well above the ITU-R P.372 levels. Evidence from comprehensive measurements in Germany shows that this is far from correct and that the P.372 median lines are to a large extent still relevant.

We are able to provide detailed supporting evidence of our concerns although these have already been published in CEPT Report 289 (https://www.ecodocdb.dk/download/2fed7e3c-7543/ECC%20Report%20289.pdf) and will be included in a new report on generic WPT due early next year.

What can national amateur radio societies do to help?

National amateur radio societies should make sure that their national spectrum administration authorities are made aware of the real and present threat from WPT-EV. IARU hopes that national administrations will properly take into account the requirements of radiocommunications services when considering the permissible levels of spurious and unwanted emissions from WPT systems. The deployment of such systems into residential areas means that there is a likelihood of serious impact on radiocommunications services from these devices, causing levels of interference hitherto not experienced because of their power levels, duty cycles and the harmonic content of their emissions.

Radiocommunications services are entitled to sensible levels of protection from harmful interference caused by non-radio devices under ITU Radio Regulations[4]. Harmful interference is also defined in the radio regulations[5]

WPT-EV has not shown itself to be a benign technology for radiocommunications services. Radiocommunications services are asking for the risks to be properly assessed before the technology is authorised for deployment.

[4] ITU Radio Regulations 15.12 and 15.13
[5] ITU Radio Regulations 1.169