

**Office of Engineering and Technology (“OET”)
Laboratory Division
Draft Laboratory Division Publications Report (“Draft KDB”)
Wireless Power Transfer (“WPT”)
680106 D01 RF Exposure Wireless Charging Apps v04**

COMMENTS OF METAPOWER, LLC

MetaPower, LLC (“MetaPower”), a wholly-owned operating subsidiary of The Invention Science Fund II, LLC, an Intellectual Ventures managed fund, hereby submits its Comments in response to the Draft KDB, dated February 18, 2022, in the above-referenced proceeding. In particular, MetaPower’s comments address Draft KDB Section 5.2, “Part 18 Wireless Power Transfer Devices Beyond 1 Meter Distances.”

MetaPower applauds OET for seeking to provide guidance regarding applications for equipment authorization to operate WPT devices beyond one meter (“at a distance” or “AAD”). At present, there is no guidance on WPT AAD devices, and no path for approval of WPT AAD devices. The inability to obtain equipment authorization for WPT AAD devices threatens to impede the development and deployment of such critical devices, and U.S. leadership in this important new technology.

In its Comments, MetaPower provides suggested edits and explanations thereof to the Draft KDB. MetaPower emphasizes that the guidance provided in the WPT KDB must (1) recognize the significant difference in use cases between consumer and industrial devices, and (2) provide sufficient flexibility so as not to preclude U.S. leadership in the development of new and innovative devices in this rapidly emerging new technology.

I. BACKGROUND

MetaPower, a startup based in the Seattle area, is developing WPT remote-charging solutions using cutting-edge beam-forming technology. MetaPower’s software-defined antennas generate reconfigurable beams that can focus power on the receiver. MetaPower plans to market

devices operating in the ISM bands that can charge industrial IoT devices at a distance of up to 50 meters. The ability to deliver steerable, wireless power will revolutionize applications in which a device's performance or operation time are constrained by a limited on-board energy source, or where a wired connection is costly and/or impractical. MetaPower's technology will provide a substantial improvement in many areas, including industrial IoT and robotics.

MetaPower's target market is the provision of WPT devices for deployment at large industrial facilities, both inside commercial buildings and outside in restricted areas. These facilities typically have limited personnel present (many are completely unmanned or unmanned for a period of time during the day). Industrial use cases include, but are hardly limited to, the following:

- Energy – large oil and gas companies operate thousands of well sites, including off-shore oil drilling platforms, with tens of thousands of batteries in remote areas with battery-based sensors. The capacity limitation of the batteries limit their ability to optimize processes locally and ongoing replacement is a huge cost burden as it requires personnel to roll trucks to the remote sites.
- Manufacturing – industrial conveyor systems have battery powered sensors that provide limited data and require shutdown for replacement and system re-calibration. This costs some suppliers hundreds of thousands of dollars in downtime per year. WPT systems can continuously power these sensors without battery chemistry or downtime.
- Water treatment – large water treatment facilities require valve cycling as well as position and flow information for optimal system operation. Installing copper throughout the facility, sometimes at great distances, can be very expensive. Battery based flow sensors require routine maintenance and replacement. WPT systems can remove the battery sensor limitations and significantly reduce the cost and complexity of power distribution in the facility.

II. Industrial WPT Devices

It is essential that the final KDB provide guidance for WPT AAD devices used in industrial settings. Such guidance must recognize the significant difference in use cases between consumer and industrial devices.

At the outset, MetaPower observes that it is unclear whether the draft KDB even addresses industrial use cases. For this reason, MetaPower urges OET to modify the title of the Draft KDB from “RF Exposure for Low Power Consumer Wireless Power Transfer Applications” to “RF Exposure from Wireless Power Transfer Applications.”¹ It should be made clear that the KDB applies to both consumer and industrial devices. Further, the KDB should not be limited to low power devices. Many low power consumer WPT devices can already be authorized under Part 15 of the Rules. The draft KDB is designed to provide guidance for higher power WPT devices seeking approval under Part 18 of the FCC’s Rules. Part 18 does not set power limits on Industrial, Scientific and Medical (“ISM”) devices.

III. Proposed Modifications to the Draft KDB

In light of the discussion above, MetaPower now makes specific proposals for modifying Sections 5.2(e), (f), (g) and (h) of the Draft KDB, with an explanation for all proposed changes.²

A. RF Level – Subsection 5.2(e)

Revised Wording

*(e) The applicant must demonstrate that the maximum RF field at or beyond one meter is at or below the maximum level that would be present within 1 meter when all devices being charged are within 1 meter of the transmitter.*³

¹ MetaPower also recommends that OET tweak the wording in the cover document to add “radiative” power transfer techniques. At present, in two places the cover document refers only to “inductive” charging. Most, if not all, of the WPT AAD devices use radiative power.

² MetaPower notes that in the final KDB, the subsections could be re-labeled as 5.2(a), (b), (c), and (d).

³ MetaPower understands the GuRu Wireless is proposing the same changes to the text of Section 5.2(e).

Explanation

Operation of WPT AAD devices, like all radiofrequency (“RF”) devices regulated by the Commission, must ensure that persons are not subject to excessive exposure to RF energy. The Commission already has in place long-standing rules regarding Maximum Permissible Exposure (“MPE”),⁴ and these rules have a built-in *de facto* distinction between consumer and industrial applications. The existing MPE rules should be applied, as appropriate, to WPT devices: a general population/uncontrolled exposure limit of 1 mW/cm² averaged over 30 minutes and an occupational/controlled exposure limit of 5 mW/cm² averaged over 6 minutes.⁵

An applicant for equipment certification that can demonstrate compliance with the applicable MPE level would be exempt from any further showing or mitigation measures. An applicant that cannot demonstrate compliance with the applicable MPE level would be required to put in place appropriate mitigation measures, including the following:⁶

- Workplace training
- Appropriate warnings in instruction manuals
- Warning signs
- Indicative or restrictive barriers around restricted areas or exclusion zones
- Labels
- The ability of the device to reduce power if human presence is detected.

MetaPower further notes that certain industrial WPT AAD use cases will not be accessible to the public or workers. OET Bulletin 65 makes clear that the MPE standards apply only in areas accessible to the public or workers. Specifically, OET Bulletin 65 states, in relevant part, as follows:

⁴ See OET Bulletin 65, Edition 97-01, August 1997 (“OET Bulletin 65”); *see also* the Second Report and Order section of FCC 19-126, ET Docket No. 19-226.

⁵ Section 1.1310(e)(1), Table 1 and OET Bulletin 65 at Appendix A, Table 1.

⁶ See Second Report and Order at ¶¶ 80 – 106 for an extensive discussion of mitigation measures.

In general, in order for a transmitting facility or operation to be out of compliance with the FCC's RF guidelines an area or areas where levels exceed the MPE limits must, first of all, be in some way *accessible* to the public or to workers. *** **The FCC guidelines specify exposure limits not emission limits, and that distinction must be emphasized.** This is why accessibility is key to determining compliance. *** When accessibility to an area where excessive levels is appropriately restricted, the facility or operation can certify that it complies with the FCC requirements.”⁷

Many applications of industrial WPT will be in areas not accessible to anyone. For example, WPT systems may be deployed in facilities, such as off-shore oil drilling platforms (outdoor use) or autonomous factories (indoor use), where there are no workers, or where the device will only be used at times of day (*e.g.*, the middle of the night) when no workers are present in the facility.

MetaPower strongly recommends that the last sentence of Section 5.2(e) be deleted because it does not add to the underlying purpose of Section 5.2(e), but instead risks the creation of substantial confusion. RF emissions are invariably affected by the placement of the target device. At different distances, whether the target device is fixed or mobile, there will be a variation in RF levels. The underlying goal of OET should be to ensure that at different distances the maximum RF level does not exceed the maximum RF level within one meter.

MetaPower also recommends deleting the words “in all locations anywhere.” Read literally, such guidance would require an applicant to submit an infinite number of calculations or measurements. As a practical matter, as part of the PAG process, OET should work with applicants to determine appropriate representative locations at which calculations or measurements will be required.

⁷ OET Bulletin 65 at 52 (*italics in original; bold type-face added*).

B. Indoor and Outdoor Usage – Section 5.2(f)

Revised Wording

(f) The devices may operate indoors (i.e., the interior of a fully enclosed, weatherproof structure) and outdoors in controlled environments not accessible to the general public.

Explanation

MetaPower urges OET to permit the certification of industrial WPT AAD devices for outdoor use, so long as such use is in a controlled environment not accessible to the general public. Applicants would have to demonstrate that such usage complies with the Commission's RF safety requirements, as discussed above. In addition, applicants would have to demonstrate that such usage complies with the Commission's rules designed to prevent harmful interference, as discussed below.

There is enormous demand for industrial WPT AAD devices for outdoor use. Permitting indoor use while precluding outdoor use of WPT AAD devices would draw an artificial, and even arbitrary, distinction between such use cases, and would stop in its tracks the work of U.S. companies seeking to develop and deploy world-class industrial WPT AAD systems. For example, pursuant to the Draft KDB, a WPT AAD device operating ubiquitously and at a very high power would be permissible in a large indoor stadium (with tens of thousands of persons) but not permitted, even at low power levels, to operate on an unattended off-shore oil platform.⁸

⁸ MetaPower recognizes that at very low power levels, WPT devices can be approved pursuant to the Part 15 rules. In its examples above, MetaPower assumes power levels above the levels permitted by Part 15.

C. Field Strength Limits and Out-of-Band Emissions (“OOBE”)

Revised Wording

(g) Indoor operations must be configured (e.g., through proper positioning of transmitter and/or attenuating material structures) such that when measured outdoors, the maximum fundamental and unwanted radiated emissions of the Part 18 device on any non-ISM frequency meet the limits in Part 15 of the Commission’s rules. The distance specified in Part 15 (§ 15.209(a)) for evaluating field strength is to be measured from the outer surface of the structure delimiting the indoor operations. Outdoor operations must be configured (e.g., through proper positioning of transmitters) such that when measured at the outer boundaries of the industrial facility, the maximum fundamental and unwanted radiated emissions of the Part 18 device on any non-ISM frequency meet the limits in Part 15 of the Commission’s rules. The distance specified in Part 15 (§ 15.209(a)) for evaluating field strength is to be measured at the outer boundary of the industrial facility for outdoor operations

Explanation

MetaPower simply proposes that the same field strength limits and OOBE limits be applied to both outdoor and indoor WPT AAD devices.

D. Professional Installation – Section 5.2(h)

Revised Wording

(h) Industrial devices, whether indoors or outdoors, shall be professionally installed (i.e., by persons who have the necessary training and qualifications to follow manufacturer-provided guidance and conduct necessary measurements and calculations to verify that the conditions stated above, have been met).

Explanation

In the normal course of business, industrial WPT AAD devices would be professionally installed, and consumer devices would not be professionally installed. MetaPower has no objection to a professional installation requirement for industrial WPT AAD devices, whether indoors or outdoors. Although MetaPower is not developing consumer devices, MetaPower submits that it is not feasible, or necessary, to require professional installation of consumer WPT AAD devices.

IV. CONCLUSION

For the reasons set forth above, MetaPower recommends that the Commission adopt a final KDB for WPT AAD devices consistent with the proposals in these Comments.

Respectfully submitted,

MetaPower, LLC

By: /s/ Robert S. Koppel

Robert S. Koppel

LUKAS, LAFURIA, GUTIERREZ & SACHS, LLP

8300 Greensboro Drive, Suite 1200

McLean, Virginia 22102

bkoppel@fcclaw.com

(703) 584-8669

Counsel to MetaPower, LLC

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