



New KDB 680106 on Part 18 Wireless Power Transfer Devices

Alfonso G. Tarditi

Laboratory Division
Office of Engineering and Technology
Federal Communications Commission

Note: The views expressed in this presentation are those of the authors and may not necessarily represent the views of the Federal Communications Commission.



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Introduction

New Published Guidance in KDB 680106v04

- Updated procedures for equipment authorization of Wireless Power Transfer (WPT) devices.
- Accounted for **comments received** on previously released draft.
- New provisions provide a **uniform approach** to evaluating authorizations both via Certification and Supplier's Declaration of Conformity (SDoC).
- Discussed **case-by-case scenarios** for when **professional installation**, or post-installation verification, may be necessary
- Included consideration of designs that refer to **EIRP** (as opposed to conducted power) for demonstrating compliance to **Part 18.305 EMC** requirements for EMC field strength limits.
- All **ECR** Inquiry Procedures of KDB Pub. 951290



Highlights from KDB Publication 680106-v04 (I)

- Outlined procedure for establishing whether a WPT device can be authorized for the [§2.1091-Mobile](#) or [§2.1093-Portable](#) category, an often-debated topic.
- This applies to situations where that [determination may not be simple](#) or is based on subjective statements.
- Applicable to Equipment Authorizations done [both under SDoC and Certification](#) procedures
- The procedure leverages is based on a [ECR/RFXd Inquiry](#) (per KDB Publication [951290 D01 Equipment Compliance Review](#)) and is uniformly applicable to any other RF device.



Highlights from KDB Publication 680106-v04 (II)

- Confirming [April 2022 TCB Workshop – 4.1](#) procedure for Equipment Authorization of § 2.1093-Portable devices operating [below 4 MHz](#), a frequency range not suitable for SAR evaluation
- Procedure applicable to Equipment Authorization of [all § 2.1093-Portable RF devices](#), thus including, but not limited to, Part 18 and WPT devices.
- Accordingly, for Equipment Authorization of devices operating between 100 kHz and 4 MHz, the use of [MPE limits in §1.1310](#) (with the 300 kHz limit applicable all the way down to 100 kHz) for both E- and H-field strength is allowed [in lieu of SAR](#).
- When applicable, for all the WPT compliance testing, adherence to the [ANSI C63.30-2021](#) Standard (*American National Standard for Methods of Measurement of Radio-Frequency Emissions from Wireless Power Transfer Equipment*) is encouraged.



Highlights from KDB Publication 680106-v04 (III)

- Prescriptions for testing WPT devices that are designed to **operate** in contact or “close proximity” **with other RF transmitters** (e.g., a WPT battery pack that charges a cell phone).
- This guidance shall be applied **to the general case** where a transmitter operates, near, or in the presence of, other conductive structures that may affect its emissions.
- In general (not only for WPT), for RF device compliance testing for Equipment Authorization **does not require** to consider RF emissions from other related but **independently authorized transmitters** operating at the same time
- No need to consider **cumulative emission** effects from client-server or “co-located”, but only impact of **passive structures** related to typical operational conditions.



Highlights from KDB Publication 680106-v04 (IV)

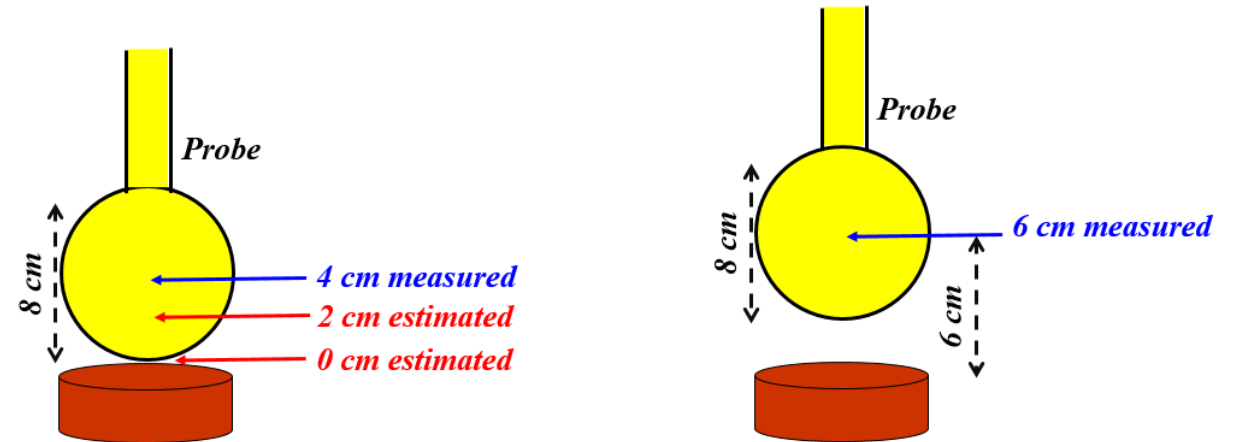
- “Traditional” WPT scenario: defined for WPTs that power their targets **within a one-meter distance** and that cease transmission if the target is further away.
- These WPT operations up to one meter are eligible for a **simplified Equipment Authorization approach**, essentially the same as in the guidance that has been in effect until now.
- Requirements are set for the authorization of **WPT “at a distance”** (WPT-AAD) with **no indoor restrictions**, and no additional constraints imposed for field strength.
- For **all WPT Part 18 devices**, EMC Electric field strength limits (at 300 m and 1600 m) are covered by §18.305, while RF Exposure limits are covered by §18.313.



Testing for Compliance

Field Measurements

- “Large size” probes may prevent the measurement of E- and/or H-fields near the surface of the radiating structure (e.g., a WPT source coil).



Probe (in yellow) measurements in points close to the WPT device (in brown). The probe radius is 4 cm, thus the closest point to the device where the field can be measured is at 4 cm from the surface (assuming probe calibration refers to the center of the sensing element structure, in this case a sphere of 4 cm radius).

Data at 0 and 2 cm must be estimated through a model, and then the model must be validated with the actual measurements at 4 and 6 cm, where the probe center can be positioned and collect valid data.

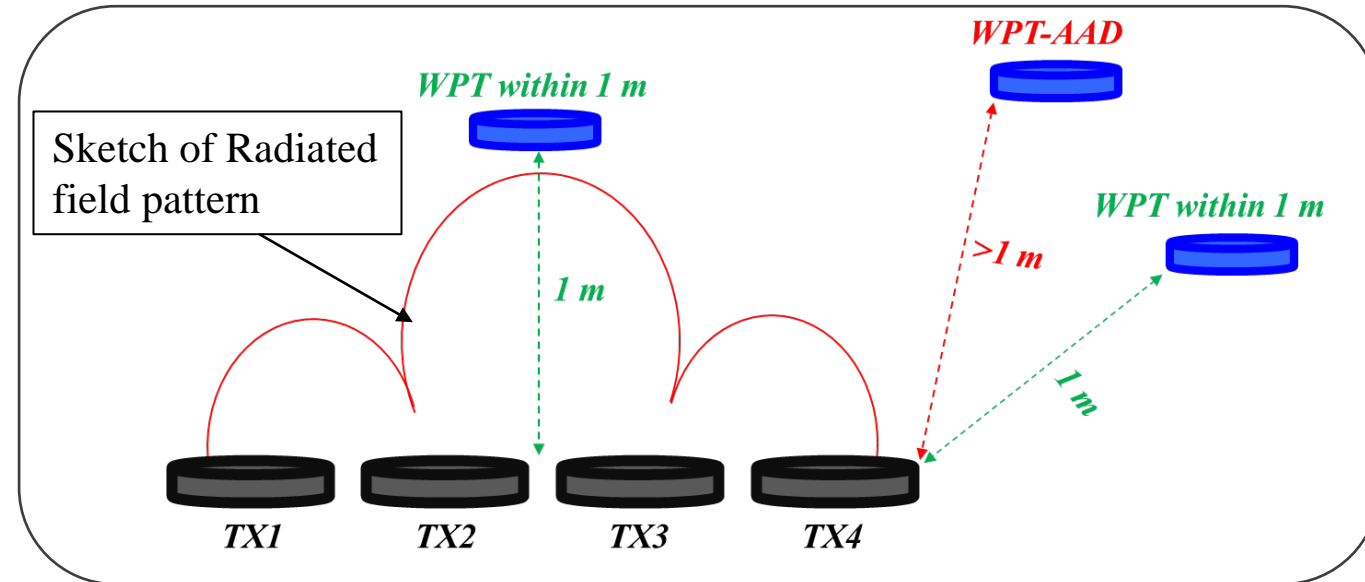


WPTs with Targets “At A Distance” (I)



- Targets at 1-m or at a distance?

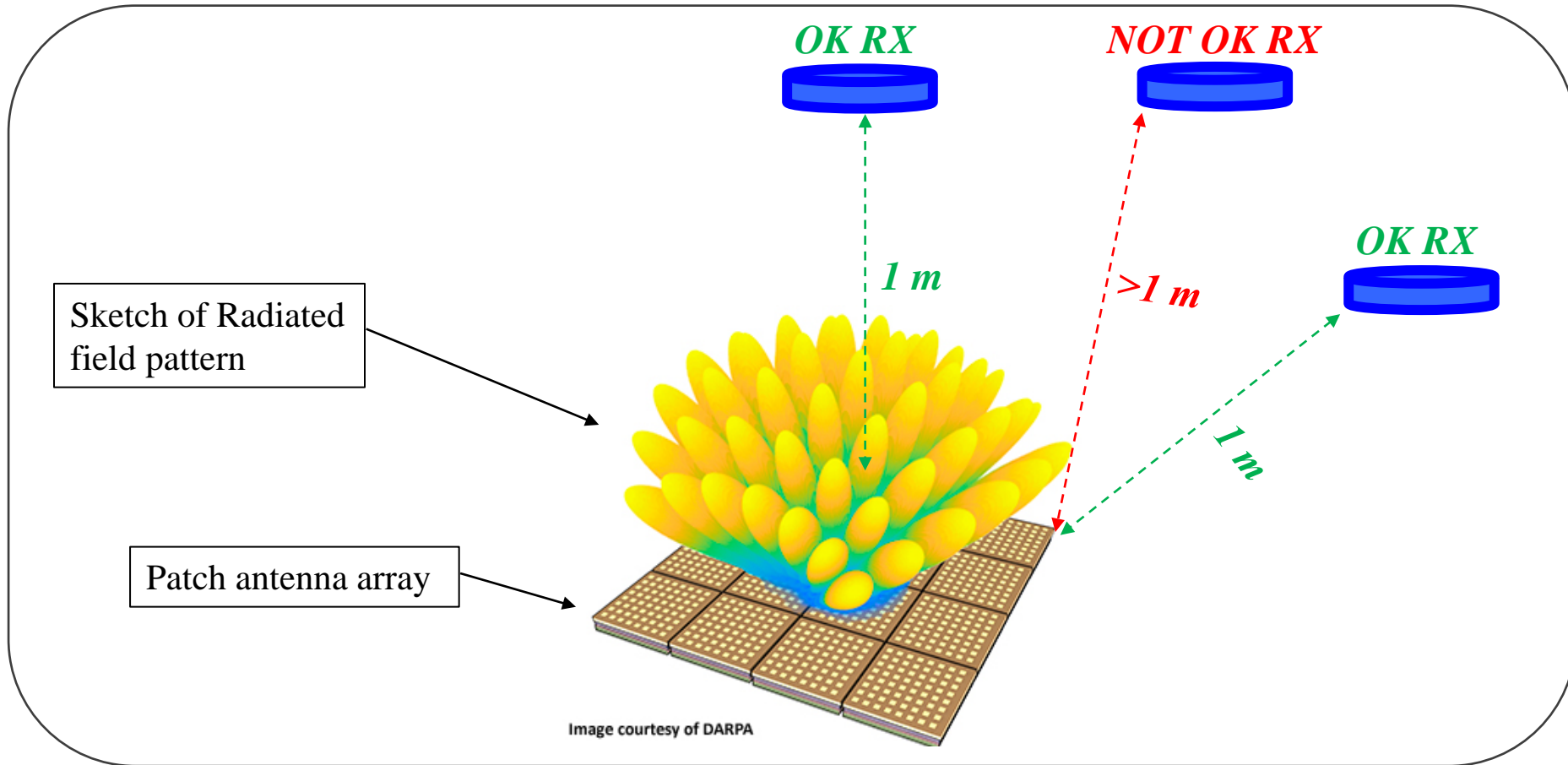
- For WPT with multiple coils/radiating structures, the **one-meter** distance for defining a WPT-AAD device is measured from the **closest edge** of any radiating element point



*Example: for a multiple-coil transmitter systems, the one-meter distance limit is measured from the closest coil edge. WPTs designed for **up to 1 meter** may operate only with loads placed as those labeled in **green** font, if a load can be powered beyond 1 meter (in **red**), then the WPT shall be considered “**at-a-distance**”*



WPTs with Targets “At A Distance” (II)



*Example: for massive-array beamed systems, the one-meter distance limit is still measured from the closest edge. WPTs designed for **up to 1 meter** may operate only with loads placed as those labeled in **green** font, if a load can be powered **beyond 1 meter** (in **red**), then the WPT shall be considered “**at-a-distance**”*



WPTs with Targets “*At A Distance*” (III)

Example: WPT Beam System Design

- Need a reliable determination of the **target contact** while **avoiding** beam intersecting human **body**
- For moving target, in general the **motion is unpredictable**, must address the most conservative scenario
 - beam moving to follow a target may temporarily illuminate a person, even **partially intercepting** the beam cross section.
 - **no statistical** description of estimated beam path/motion to predict max RFX on human body
- Upon detection of “**body hit**”
 - system must quantify a proper detection of a **partial beam intersection****AND**
 - the beam **shut-off and turn-back-on delay** is fast enough to meet RFX time-average guideline



WPT-AAD Scenarios for Special Consideration (I)

- There may be **cases of concern** where a WPT special design, even if compliant with the applicable rule parts for Equipment Authorization, could be more **at risk** for cause interference in some **specific installations/environments**
- Examples:
 - A sufficiently **large conducted power** at the source (especially for ISM frequencies) leading to significant levels of unwanted emissions, e.g., due to insufficient filtering when operating on an ISM fundamental frequency
 - Largely unobstructed, unshielded emissions, and/or **beamed** systems with small target devices
 - WPTs operating with a **high-gain directional antenna**, and/or showing compliance by referring § 18.305 EMC limits computed based on transmitters' maximum EIRP



WPT-AAD Scenarios for Special Consideration (II)

- **Special WPT designs** may need **professional installation/verification**
 - issue addressed case-by-case through reviews of **ECR-KDB** proposals.
 - applicant is required to **demonstrate** why they consider this provision not necessary before authorization can proceed
 - guidance is provided on **examples** of scenarios where professional installation may be important (KDB 680106-v04 - Sect. 5.3).
- Addressed the possibility of **using EIRP** for demonstrating compliance to Part 18.305 EMC limit requirements (as opposed to using conducted power).
- Designs that consider EIRP for compliance need to provide details in the ECR KDB Inquiry **and obtain FCC concurrence.**

Equipment	Operating frequency	RF Power generated by equipment (watts)	Field strength limit (uV/m)	Distance (meters)
Any type unless otherwise specified (miscellaneous)	Any ISM frequency	Below 500 500 or more	25 25 × SQRT(power/500)	300 1 ³⁰⁰
	Any non-ISM frequency	Below 500 500 or more	15 15 × SQRT(power/500)	300 1 ³⁰⁰

¹ Field strength may not exceed 10 μV/m at 1600 meters. Consumer equipment operating below 1000 MHz is not permitted the increase in field strength otherwise permitted here for power over 500 watts.



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Equipment	Operating frequency	RF Power generated by equipment (watts)	Field strength limit (uV/m)	Distance (meters)
Any type unless otherwise specified (miscellaneous)	Any ISM frequency	Below 500	25	300
		500 or more	$25 \times \text{SQRT}(\text{power}/500)$	¹ 300
	Any non-ISM frequency	Below 500	15	300
		500 or more	$15 \times \text{SQRT}(\text{power}/500)$	¹ 300

¹ Field strength may not exceed 10 $\mu\text{V}/\text{m}$ at 1600 meters. Consumer equipment operating below 1000 MHz is not permitted the increase in field strength otherwise permitted here for power over 500 watts.

Adapted from [§ 18.305 Field strength limits](#).



Conclusions

- Improved consistency of the WTP authorization options with both conventional designs (i.e., load close to the transmitter), and for “at a distance” concepts.
- New WPT-AAD provisions leverage solely existing Part 18 Rules, both for RF Exposure, and for EMC
- Equipment authorizations provisions solely based on quantitative parameter specifications
- ECR KDB Inquiry review process prior to equipment authorization minimizes non-compliance risks for all designs and concepts