Mobile and Portable Device RF Exposure Policies
KDB Publication 447498 D01

Laboratory Division

Office of Engineering and Technology

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

Part I

Topics:

- Summary and status of KDB Publication 447498 D01 (v07) revision document, effective date, and transition-period considerations
- Selected highlights and revision aspects considering comments and questions received on draft 447498 D01 DR04 and interim 447498 D04

447498 Updates Background and Status

- KDB Pub. 447498 updates following FCC-19-126
  - KDB Pub. 447498 D04 v01 Interim (Nov. 2021, Mar. 2022)
  - 447498 D01 DR04 (v07) Draft-Publication-for-Review (Apr. 2021, Sep. 2021)
  - KDB Pub. 447498 D01 v06 (2015)
    - previous version may be used per transition considerations discussed below
- Next stage of 447498 (v07) is second circulation as Draft-Publication-for-Review
  - Next draft-for-comment is numbered DR05 (v07)
  - KDB Pub. 447498 D04 v01 will be retired and removed

447498 Transition Considerations

- Either 447498 D04 (and new §1.1307 exemption criteria) or the previous KDB Pub. 447498 D01 v06 (including test exemption criteria† therein) may continue to be used until June 30, 2022, as per:
  - No mix of old and new procedures within application filings
  - For devices using 447498 v06 and not subject to TCB PAG:
    - Form-731s and associated grants must be submitted to FCC by a TCB on or before June 30, 2022
  - For devices using 447498 v06 and subject to TCB PAG:
    - TCB must submit PAG KDB inquiry and fully-populated Form-731 application on or before June 30, 2022

† New rules provide *test exemption* criteria, while past KDB publications refer to *test exclusion.* Terminology harmonization and definition is in progress

FCC RF Exposure Basic Concepts Recap

- Docket No. 03-137 2nd R. & O. rule changes in effect from May 2021
- *Exemption* criteria generally replaces the *categorically excluded actions* criteria of the pre-May 2021 exposure rules
  - The phrase "categorically excluded" still occurs in §1.1307 for other environmental processing purposes [§1.1306, etc.]
- Per §1.1307(b)(1)(i) *RF sources* subject to any FCC authorization must:
  - (A) Determine if exemption qualifies per §1.1307(b)(3), or
  - (B) Determine compliance to §1.1310 by evaluation††
    - In this context, evaluation refers to determination of compliance to §1.1310 or §2.1093 exposure limits by calculation, measurement, or computational modeling using FCC-acceptable evaluation procedures
    - Further to §1.1310(d)(4), FCC KDB publications and OET Bulletins provide acceptable evaluation procedures

†† Here "evaluation" is a shorthand synonym for the term "routine environmental evaluation" used in FCC rules, etc.

447498 (v07) Discussion Proviso

- Work is in progress at OET to address important issues that emerged from comments and questions received on 447498 (v07)
- Updated guidance concepts are being devised for reducing industry burdens in certification applications processing, while preserving FCC RF exposure policies
- The following discussion items provide an overview of recent progress, with focus towards the updated 447498 (v07) draft publication
  - New soon-to-be-posted draft may differ from content in this presentation
  - Final publication will account for any further comments

447498 (v07) - Selected Topics (1)

- Testing and compliance procedures as in 447498 v06 for equipment such as wireless handsets were reaffirmed per the *Resolution of NOI* portion of FCC 19-126†††
  - SAR testing separation distance scheme of 447498 v06 also being retained
- For purposes of KDB SAR test exemption criteria and test reductions
  - Test separation distances for SAR testing [447498 (v07) Sec. 3.1.5]:
    - Use smallest distance to person's body from outer surface/housing
      - e.g., for handsets, and antennas in laptop-computer keyboard sections and tablets
    - Use smallest distance to person's body from antenna and radiating structure(s)
      - e.g., for antennas in top and side-upper edges of laptop computer display sections
      - KDB inquiry to confirm separation distance for some RF sources with unclear final host configurations [as per 447498 v06 4.1) f)] not required

††† FCC Docket No. 13-84, 34 FCC Rcd (14) 11695

447498 (v07) - Selected Topics (2)

- 447498 (v07) Secs. 2.1.3 and B.4 SAR test exemption criteria
  - Where minimum test separation distance is < 5 mm, a 5 mm distance using 447498 (v07) Sec. 3.1.5 guidance is applied to determine SAR test exemption
- Concerning SAR estimations used for simultaneous-transmission test exemption per E.1 of 447498 (v07):
  - Estimated SAR is calculated as $SAR_{est} = 0.4 \times P_{ant} / P_{th}$ [W/kg]
    - With 447498 (v07) P_{th} is per Secs. 2.1.3 and B.4, and P_{ant} is per Sec. 3.1.2
  - As in 447498 v06, the formula has been considered in conjunction with the SAR test exemption criteria to result in substantially conservative SAR $\leq$ 0.4 W/kg

447498 (v07) - Selected Topics (3)

- Emphasizing different power definitions in exemption criteria
  - Use delivered maximum power (ERP) with MPE-based of §1.1307(b)(3)(i)(C)
  - Use available maximum (matched conducted) power with SAR test exemptions of §1.1307(b)(3)(i)(B)
    - Maximum power delivered into a matched antenna, considering line loss or any other loss that diminishes power delivered to an antenna
- Further revisions to remove approach and specific provisions of 447498 v06 *mixed mobile and portable exposure host*
- Other comments and questions received pursuant to the Apr. 2021 review-draft circulation but not discussed herein being accommodated and addressed where viable in new draft 447498 DR05

SDoC, Certification-Optional, and Authorization-Exempt Equipment

- For RF sources not subject to certification (§2.907 *et seq*.), or not subject to any Part 2 Subpart J equipment authorization requirements (EA-exempt), no filing showing the basis for RF exposure compliance is requested
- Examples of equipment exempt from equipment authorization include:
  - incidental radiators (§15.3(n))
  - §90.203(b)(3) 1427-1435 MHz transmitting devices
  - Part 95 RCRS 26-28 MHz transmitting devices
  - Part 97 transmitting devices (except amplifiers [§97.315])
- For authorizations using SDoC, include §1.1307(b)(1)(i)(A) exemption info or §1.1307(b)(1)(i)(B) compliance statement only for records-retention, per §2.938
- When certification is used for certification-optional equipment, per §2.906(c), regular certification procedures apply including documentation of RF exposure compliance

447498 (v07) Table 1 Update

Table 1 to 447498 (v07) - RF Exposure Limits in FCC Rules and OET Equipment Authorization Policies

<table>
<tr><th>Frequency range [a]</th><th>FCC Rules</th><th>OET Equipment Authorization Policies</th></tr>
<tr><td>$f \leq 100$ kHz</td><td>N/A
(under consideration) [c]</td><td>All devices assessed case-by-case, with field strength limits of E = 83 V/m and H = 90 A/m, in all body exposure relevant positions</td></tr>
<tr><td>100 kHz < $f \leq$ 300 kHz [b]</td><td>SAR limits in § 1.1310 (b), (c)</td><td>MPE limits at 300 kHz in Table 1 to § 1.1310(e)(1): E = 614 V/m and H = 1.63 A/m</td></tr>
<tr><td rowspan="2">300 kHz < $f \leq$ 4 MHz [b]</td><td>§ 2.1091 Mobile Devices:
MPE limits in Table 1 to § 1.1310(e)(1) [d]</td><td rowspan="2">MPE limits in Table 1 to § 1.1310(e)(1)</td></tr>
<tr><td>§ 2.1093 Portable Devices:
SAR limits in § 1.1310 (b), (c)</td></tr>
<tr><td rowspan="2">4 MHz < $f \leq$ 6 GHz</td><td colspan="2">§ 2.1091 Mobile Devices:
MPE limits in Table 1 to § 1.1310(e)(1) [d]</td></tr>
<tr><td colspan="2">§ 2.1093 Portable Devices:
SAR limits in § 1.1310 (b), (c)</td></tr>
<tr><td>f > 6 GHz</td><td colspan="2">MPE limits in Table 1 to § 1.1310(e)(1) [c]</td></tr>
<tr><td colspan="3">[a] For all $f \leq$ 6 GHz, SAR limits in § 1.1310 (b), (c) can always be applied if available, in place of MPE limits
[b] Policies for 100 kHz < f ≤ 4 MHz reflect capabilities of available SAR measurement equipment. Computational modeling may be also acceptable, subject to PAG per KDB Publication 388624
[c] Under consideration per NPRM docket no. 19-226; FCC 19-126, 34 FCC Rcd 11743
[d] Per § 2.1091(d)(4) SAR limits are applicable in some cases</td></tr>
</table>

Part II

Topics:

- RF Source Power Required for Test Exemptions
- Test Exemption Power Threshold
- Introducing Test Exemption Below 300 MHz
- Unintentional Radiators Requirements for Certification

RF Source Power for SAR Exemptions (I)

- SAR test exemptions are established based on maximum time-averaged (matched conducted) output power of the RF source
- This power level may be determined by direct measurements, or estimated via a combination of analysis and manufacturer-provided data
  - Estimates of conducted power for exemption criteria from measurements in the near-field shall properly account both E and H field patterns, in all the directions surrounding the antenna. To use EMC test data (e.g., E-field at 3 m, 10 m) and antenna gain, the far-field conditions need to be verified
- When power direct measurements are impractical, a conservative estimate is acceptable, so long as a clear description of the approach is provided in the RF exposure filing exhibits

RF Source Power for SAR Exemptions (II)

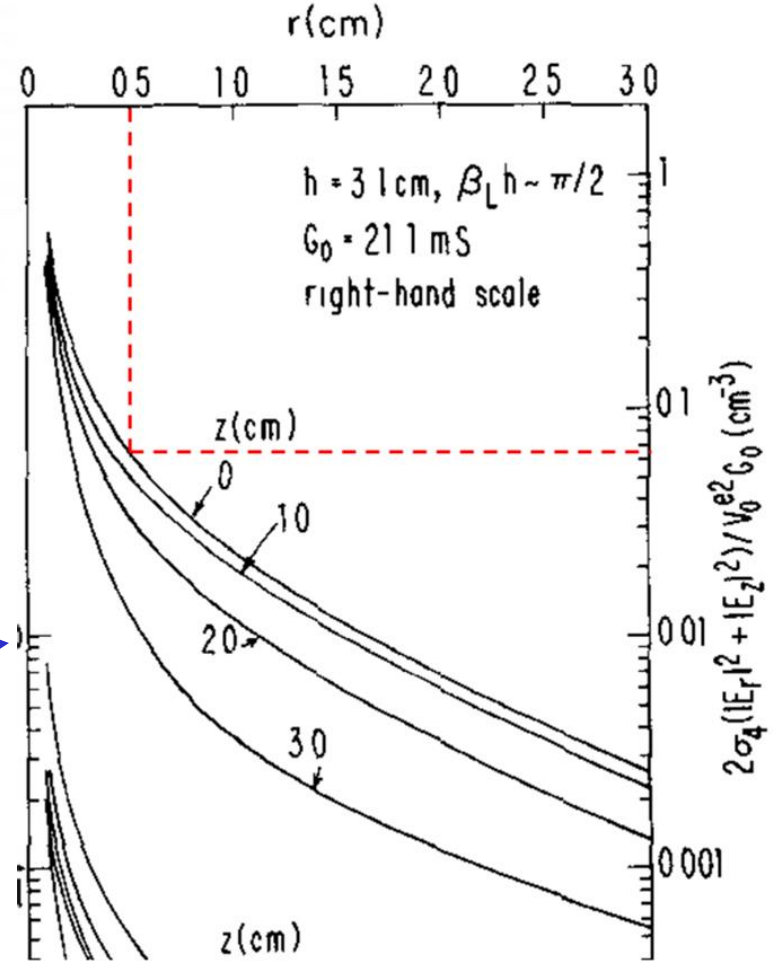
- Manufacturer data used to derive critical parameters used in the power evaluation (*e.g.*, antenna pattern, RF amplifier maximum power, duty cycle) must be provided in the filing
- Reminder: comprehensive evaluation of output power needed for determining the exemption eligibility, to include
  - all operating configurations allowed by design
  - for tune-up tolerance, adjustments
  - minimum *test separation distance* required for the particular RF exposure scenario under consideration

SAR Exemption Power Thresholds

- Per KDB 447498-v06, power thresholds were established for SAR exemption purposes from 100 kHz up to 6 GHz
- The formulas that provided the exemption levels were derived from best fit of measured and simulated emission conditions covering a wide range of realistic application scenarios
- The recent update of RF Exposure rulemaking provided (§1.1307) a new formulation of SAR exemption criteria from 300 MHz
- A compendium of the two formulations is here introduced, extending in a continuous fashion the formulas §1.1307 below 300 MHz and joining, still continuously, the v06 prescriptions at and below 100 MHz

Verification of Exemption Power Thresholds

- SAR-exemption power thresholds conservatively address realistic scenarios
- Comparison with published results in [King, 1983], [Casey, 1986] shows consistency of theory *vs.* 447498-v06 criteria
  - Per 447498-v06-Appendix A, at 900 MHz and 5 mm, the exemption threshold is 16 mW
  - [King, 1983] data for 1 W at 915 MHz show SAR=60 W/kg (head tissue), that is 0.96 W/Kg with linear scaling to 16 mW
  - 0.96 W/kg "safely" below 1.6 W/kg limit



915 MHz dipole source , head tissue ([King, 1983], Fig. 10)

KDB 447498-v06 Section 4.3.1

"v06" exemption power thresholds in mW P_x are defined as

- 4.3.1 a) – distance ≤ 50 mm, 100 MHz ≤ frequency < 6 GHz

$$P_{431a}(d_{mm}, f_{MHz}) := \frac{3\, d_{mm}}{\sqrt{f_{MHz}/1000}}$$

- 4.3.1 b) 1) – distance > 50 mm, 100 MHz ≤ frequency < 1500 MHz

$$P_{431b1}(d_{mm}, f_{MHz}) := P_{431a}(50, f_{MHz}) + \frac{(d_{mm} - 50)\cdot f_{MHz}}{150}$$

$$= \frac{3\cdot 50}{\sqrt{f_{MHz}/1000}} + \frac{(d_{mm} - 50)\cdot f_{MHz}}{150}$$

KDB 447498-v06 Section 4.3.1 (II)

- 4.3.1 b) 2) – distance > 50 mm, 1500 MHz ≤ frequency < 6000 MHz

$$P_{431b2}(d_{mm}, f_{MHz}) := P_{431a}(50, f_{MHz}) + (d_{mm} - 50) \cdot 10$$
$$= \frac{3 \cdot 50}{\sqrt{f_{MHz}/1000}} + (d_{mm} - 50) \cdot 10$$

- 4.3.1 c) Any distance, frequency < 100 MHz

$$P_{431c}(d_{mm}, f_{MHz}) :=$$
$$\begin{cases} P_{431b1}(d_{mm}, 100.) \cdot \left(1. + \log10\left(\frac{100.}{f_{MHz}}\right)\right) & d_{mm} > 50 \\ 0.5\, P_{431b1}(50., 100.) \cdot \left(1. + \log10\left(\frac{100.}{f_{MHz}}\right)\right) & d_{mm} \le 50 \end{cases}$$

KDB 447498-v06 Section 4.3.1 (III)

- With the additional definitions:

$$P_{431b}(d_{mm}, f_{MHz}) := \begin{cases} P_{431b1}(d_{mm}, f_{MHz}) & f_{MHz} \le 1500 \\ P_{431b2}(d_{mm}, f_{MHz}) & f_{MHz} > 1500 \end{cases}$$

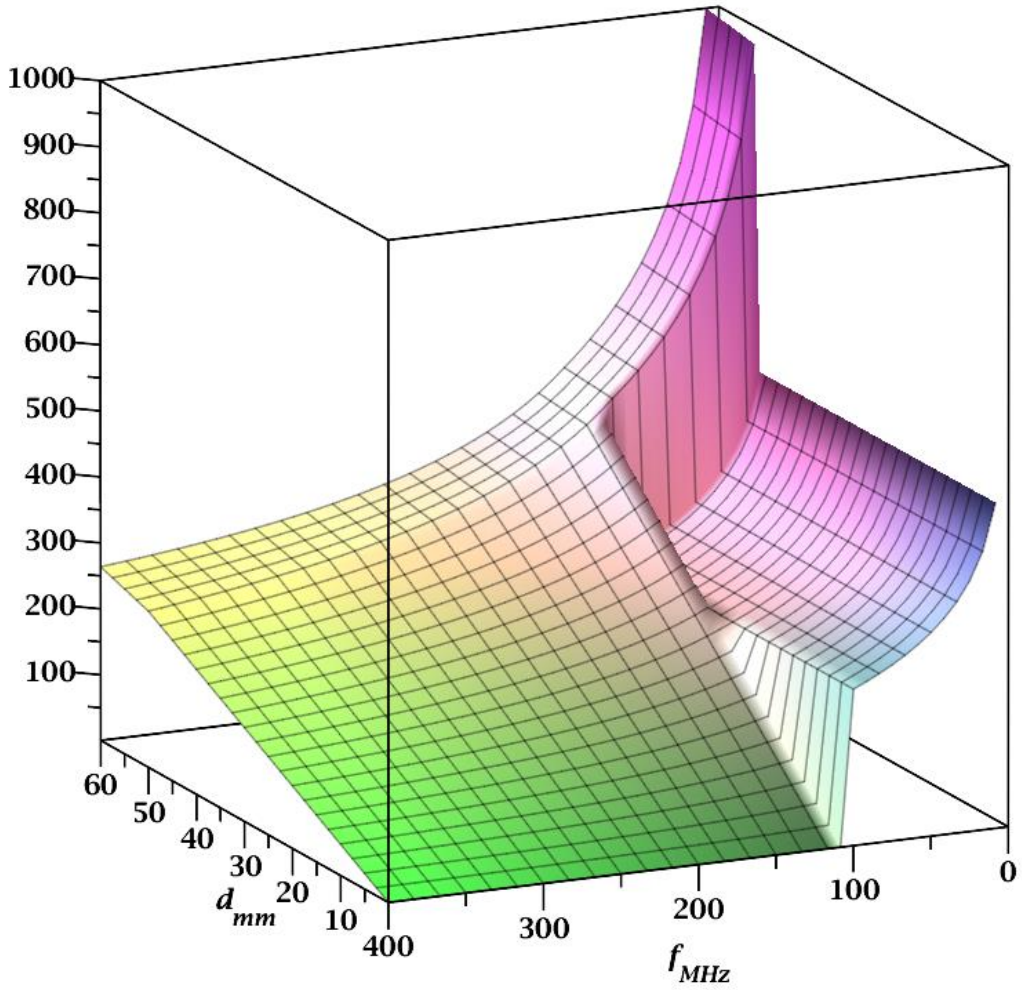
$$P_{431ab}(d_{mm}, f_{MHz}) := \begin{cases} P_{431a}(d_{mm}, f_{MHz}) & d_{mm} \le 50 \\ P_{431b}(d_{mm}, f_{MHz}) & d_{mm} > 50 \end{cases}$$

a compact expression for the “v06” power threshold may be written as

$$P_6(d_{mm}, f_{MHz}) := \begin{cases} P_{431ab}(d_{mm}, f_{MHz}) & f_{MHz} > 100 \\ P_{431c}(d_{mm}, f_{MHz}) & f_{MHz} \le 100 \end{cases}$$

“v06” Exemption Power Threshold

$P_6(d_{mm},f_{MHz})$ [mW]

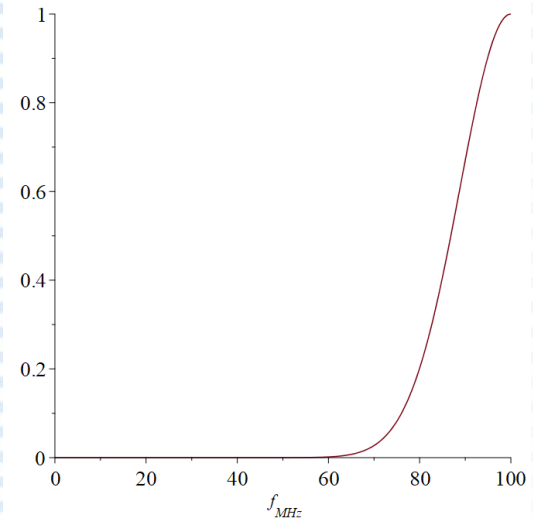


Plot of $P_6(d_{mm},f_{MHz})$ showing discontinuities in frequency and distance (by definition)

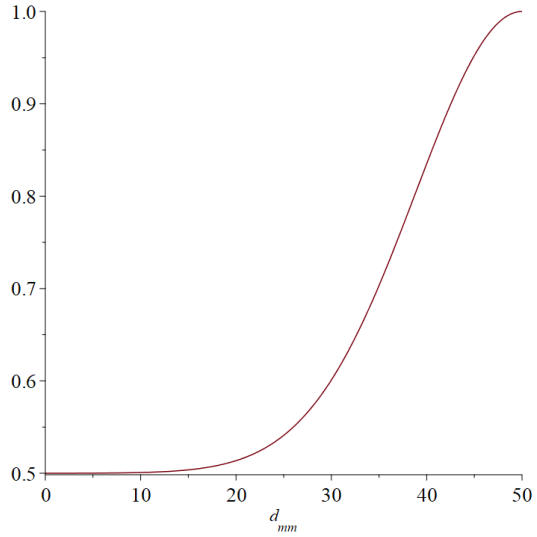
Smoothing "v06" Power Threshold Function

- The discontinuities in the power threshold function in v06 can be smoothed by imposing continuous transitions in the definitions
- Define smoothing functions S_f for f_{MHz} and S_d for d_{mm} as

$$S_f\left(f_{MHz}\right) := exp\left(-10\frac{\left(f_{MHz}-f_{\max}\right)^2}{\Delta f^2}\right)$$



$$S_d\left(d_{mm}\right) := 0.5 + 0.5\cdot exp\left(-10\frac{\left(d_{mm}-d_{\max}\right)^2}{\Delta d^2}\right)$$



Smoothing "v06" Power Threshold Function (II)

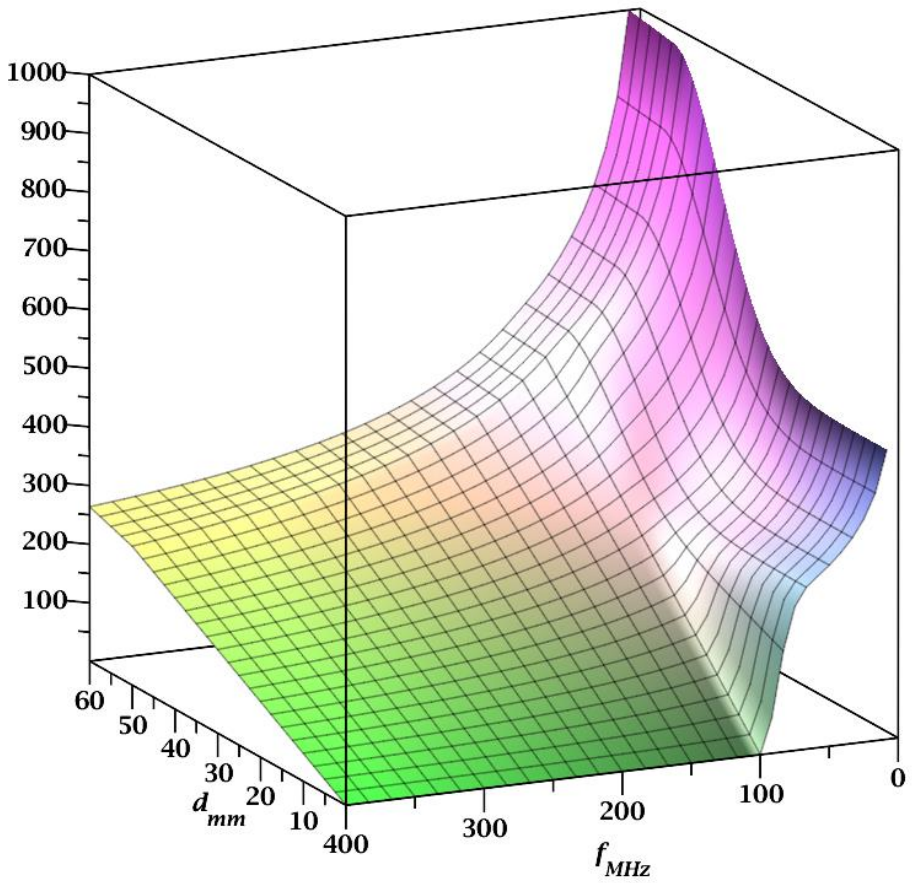
- With the smoothing functions S_f and S_d, a modified power threshold function P_{6S} (smoothed version of P_6) may be defined as

$$P_{6S}(d_{mm}, f_{MHz}) :=$$

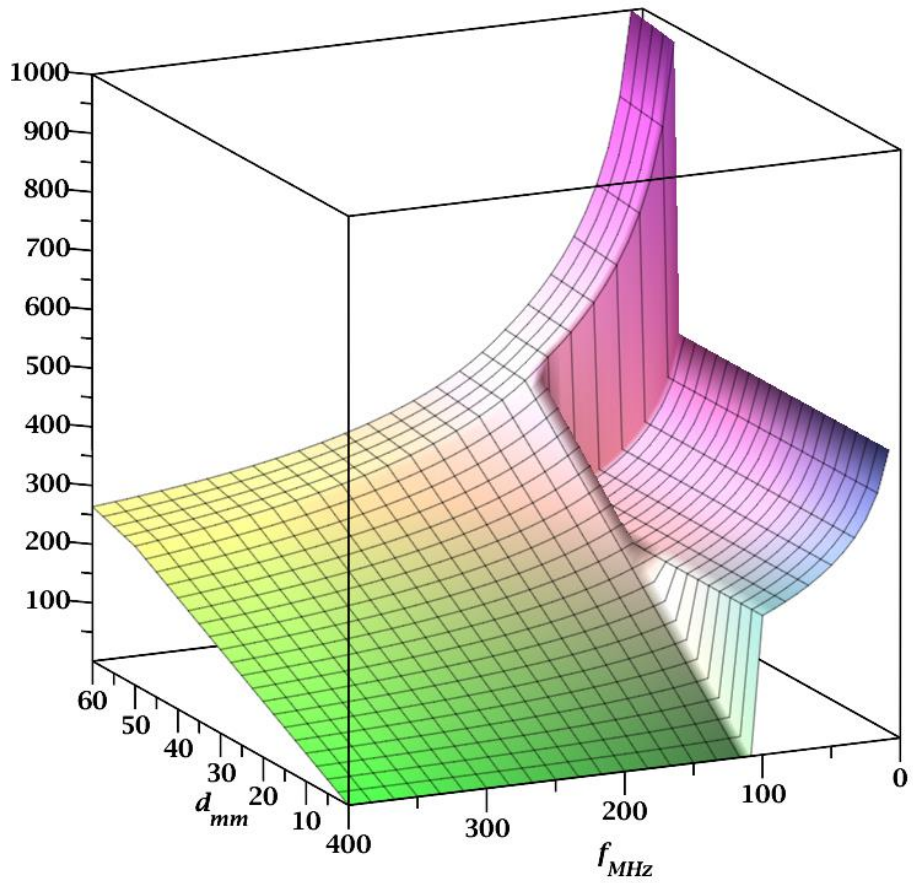
$$\begin{cases} P_{431a}(d_{mm}, f_{MHz}) & d_{mm} \le 50 \text{ and } f_{MHz} > 100 \\ P_{431b1}(d_{mm}, f_{MHz}) & d_{mm} > 50 \text{ and } 100 < f_{MHz} \le 1500 \\ P_{431b2}(d_{mm}, f_{MHz}) & d_{mm} > 50 \text{ and } f_{MHz} > 1500 \\ S_f(f_{MHz}) \cdot P_{431a}(d_{mm}, f_{MHz}) + (1 - S_f(f_{MHz})) \cdot S_d(d_{mm})\, P_{431b1}(50., 100.) \cdot \left(1. + log10\left(\frac{100.}{f_{MHz}}\right)\right) & d_{mm} \le 50 \text{ and } f_{MHz} \le 100 \\ S_f(f_{MHz}) \cdot P_{431b1}(d_{mm}, f_{MHz}) + (1 - S_f(f_{MHz})) \cdot P_{431b1}(d_{mm}, 100.) \cdot \left(1. + log10\left(\frac{100.}{f_{MHz}}\right)\right) & d_{mm} > 50 \text{ and } f_{MHz} \le 100 \end{cases}$$

Smoothing "v06" Power Threshold Function (III)

$P_{6S}(d_{mm}, f_{MHz})$



$P_{6}(d_{mm}, f_{MHz})$



Smoothed version of $P_6(d_{mm}, f_{MHz})$ vs. original definition

§1.1307–Based "v07" Power Threshold

- From §1.1307, limited to 300 MHz $\leq f \leq$ 6 GHz, 0.5 cm $\leq d \leq$ 40 cm, an exemption power threshold (in mW) is defined as

$$P_{1.1307}(d_{cm}, f_{GHz}) := \begin{cases} ERP(f_{GHz}) \cdot (d_{cm}/20)^{x(f_{GHz})} & d_{cm} < 20 \\ ERP(f_{GHz}) & d_{cm} \geq 20 \end{cases}$$

where

$$ERP(f_{GHz}) := \begin{cases} 2040 \cdot f_{GHz} & f_{GHz} < 1.5 \\ 3060 & f_{GHz} \geq 1.5 \end{cases} \qquad x(f_{GHz}) := -\log_{10}\left(\frac{60}{ERP(f_{GHz}) \cdot \sqrt{f_{GHz}}}\right)$$

- Converting the units to *mm* and *MHz* in $P_{1.1307}$:

$$P_7(d_{mm}, f_{MHz}) := P_{1.1307}\left(\frac{d_{mm}}{10.}, \frac{f_{MHz}}{1000.}\right)$$

"v07" - Extended Power Threshold (I)

- Defined an extension of $P_7\,(d_{mm}\,,\,f_{MHz})$ below 300 MHz, by imposing that $P_{6S}(d_{mm}\,,\,f_{MHz})$ is met at 100 MHz, and $P_7(d_{mm}\,,\,f_{MHz})$ is met at 300 MHz via a continuous function, for every distance value d_{mm}.
- Let

$$P_{6to7}(d_{mm}, f_{MHz}) := \frac{\alpha(d_{mm})}{f_{MHz}^{\beta(d_{mm})}}$$

and

$$P_{100}(d_{mm}) := P_{6S}(d_{mm}, 100.) : \quad P_{300}(d_{mm}) := P_7(d_{mm}, 300.)$$

- Then, the functions $\alpha(d_{mm})$ and $\beta(d_{mm})$ can be determined by imposing

$$P_{6to7}(d_{mm}, 100) = P_{100}(d_{mm}) : \quad P_{6to7}(d_{mm}, 300) = P_{300}(d_{mm})$$

"v07" - Extended Power Threshold (II)

- It can be shown that a solution for $\alpha(d_{mm})$ and $\beta(d_{mm})$ is

$$\alpha(d_{mm}) := P_{100}(d_{mm}) \cdot \left(\frac{P_{100}(d_{mm})}{P_{300}(d_{mm})} \right)^{\ln(100.)/\ln(3.)}$$

$$\beta(d_{mm}) := \frac{\ln(100.)}{\ln(3.)} \log_{100}\left(\frac{P_{100}(d_{mm})}{P_{300}(d_{mm})} \right)$$

- Finally, the "extended" power threshold $P_{7X}(d_{mm}, f_{MHz})$ is defined as

$$P_{7X}(d_{mm}, f_{MHz}) := \begin{cases} P_{6S}(d_{mm}, f_{MHz}) & f_{MHz} \leq 100 \\ P_{6to7}(d_{mm}, f_{MHz}) & 100 < f_{MHz} \leq 300 \\ P_{7}(d_{mm}, f_{MHz}) & 300 < f_{MHz} \end{cases}$$

“v07” - Extended Power Threshold (III)

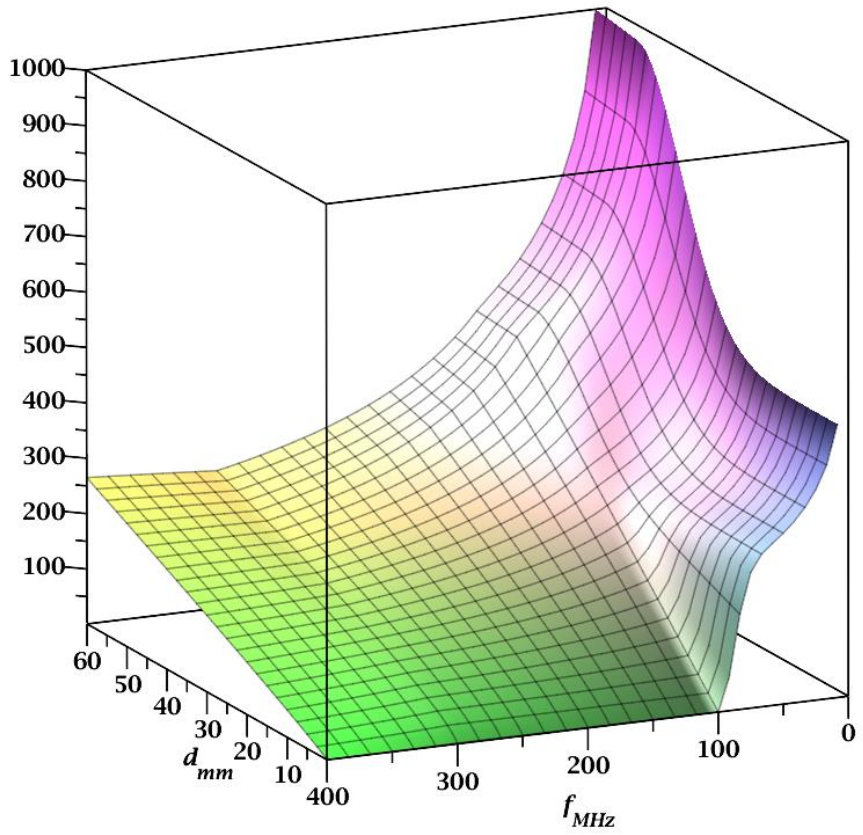
$$P_{7X}(d_{mm}, f_{MHz}) := \begin{cases} P_{6S}(d_{mm}, f_{MHz}) & f_{MHz} \leq 100 \\ P_{6to7}(d_{mm}, f_{MHz}) & 100 < f_{MHz} \leq 300 \\ P_{7}(d_{mm}, f_{MHz}) & 300 < f_{MHz} \end{cases}$$

Plot of P_{7X} vs. distance (5 mm to 60 mm) and frequency (5 MHz to 500 MHz)

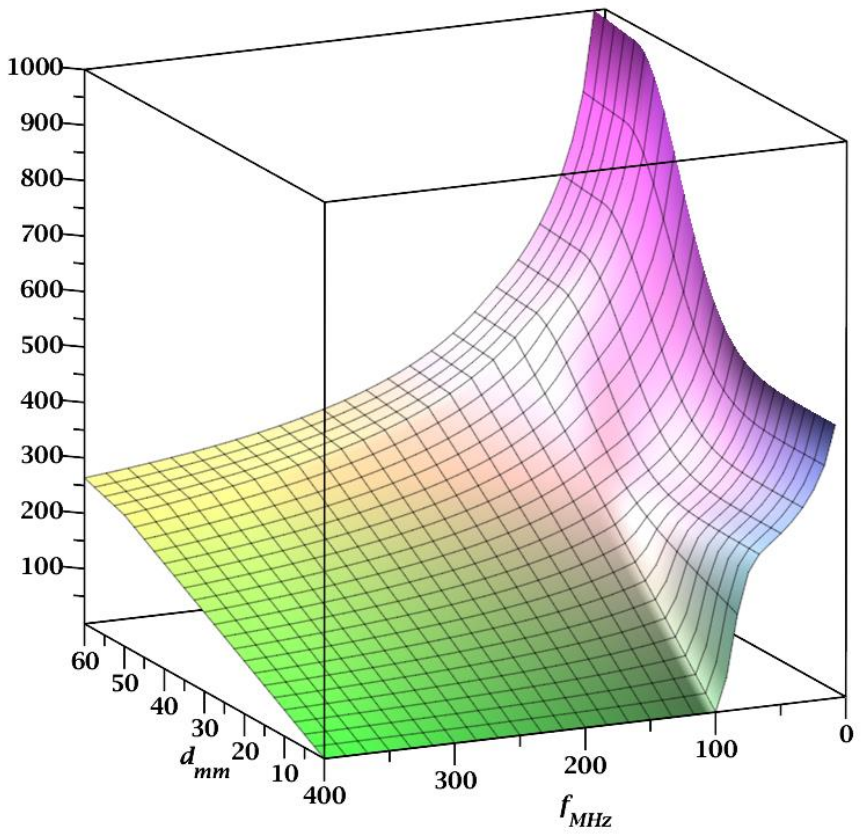
“v07” - Extended Power Threshold (IV)

$$P_{7X}(d_{mm}, f_{MHz}) := \begin{cases} P_{6S}(d_{mm}, f_{MHz}) & f_{MHz} \le 100 \\ P_{6to7}(d_{mm}, f_{MHz}) & 100 < f_{MHz} \le 300 \\ P_{7}(d_{mm}, f_{MHz}) & 300 < f_{MHz} \end{cases}$$

$P_{7X}(d_{mm},f_{MHz})$

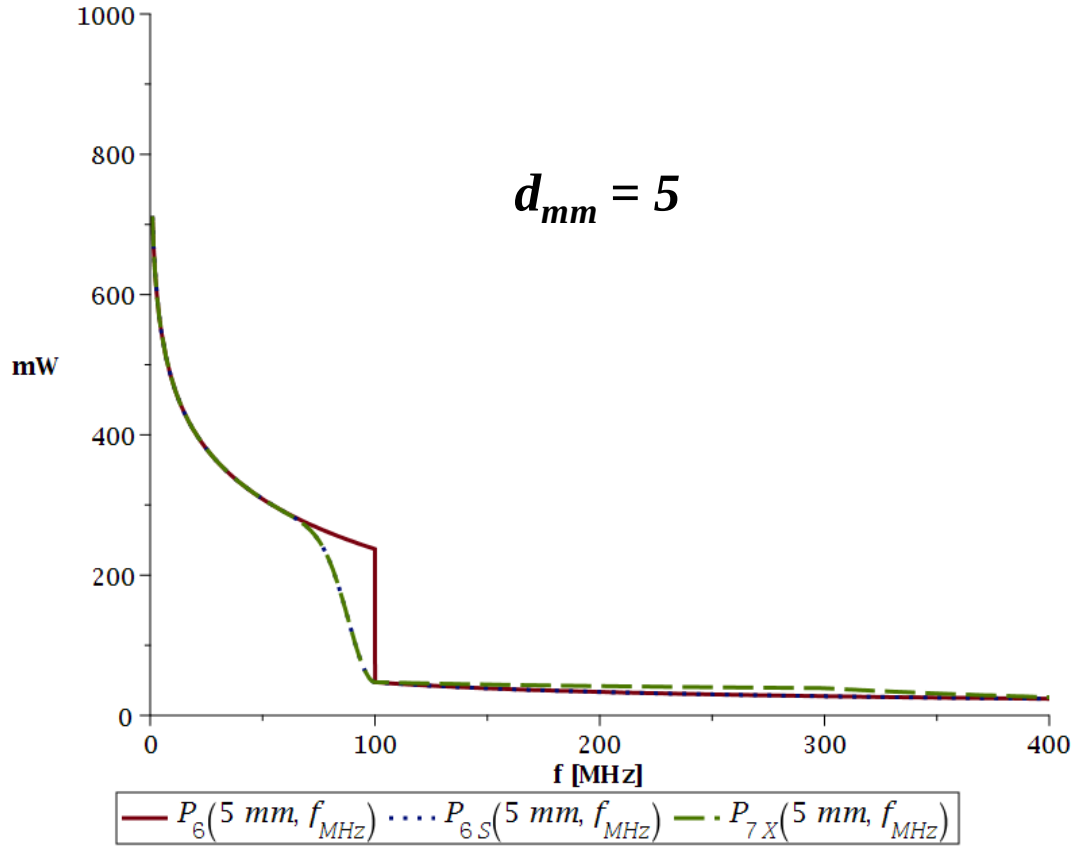


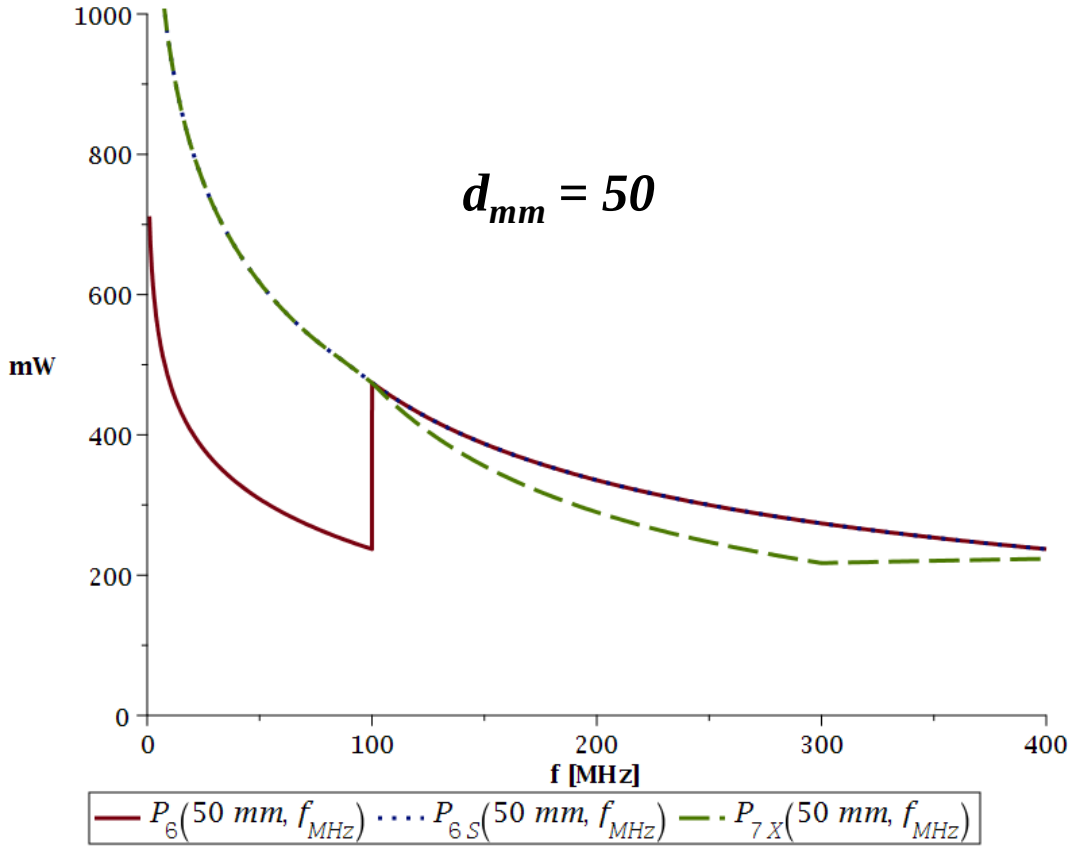
$P_{6S}(d_{mm},f_{MHz})$



$P_{7X}(d_{mm}, f_{MHz})$, the “extended” P_7, vs. $P_{6S}(d_{mm}, f_{MHz})$, the smoothed version of P_6

“v07” - Extended Power Threshold (V)





Comparison of power threshold functions for two selected distances, 5 mm and 50 mm

Unintentional Radiators (I)

- Per recent §1.1307 updates, in *applications for equipment authorization*, unintentional radiators are no longer excluded from evaluation required to show compliance with the RF exposure limits of §1.1310
- The rationale is that there may be situations, e.g., with emissions from multiple RF sources operating simultaneously, where the unintentional radiator contributions may bring a device out of compliance
- Accordingly, evaluation of RF exposure compliance of any product containing RF sources, shall include both intentional (including licensed transmitters) and unintentional radiators

Unintentional Radiators (II)

- In many cases, unintentional radiators provide a small contribution to the applicable RF exposure figure of merit considered for compliance
- This figure of merit can be SAR, MPE or, more in general, a combined quantity, hereafter referred to as total exposure ratio TER:

$$TER = \sum_{k=1}^{N_S} \left(\frac{SAR_k}{SAR_{\lim}} \right) + \sum_{k=1}^{N_f} \left(\frac{MPE_{field,\,k}}{MPE_{field,\,\lim}} \right)^2 + \sum_{k=1}^{N_{PD}} \left(\frac{MPE_{PD,\,k}}{MPE_{PD,\,\lim}} \right)$$

with N_S, N_f, and N_{PD} referring to sources requiring SAR, field-MPE, or PD-MPE, respectively, *k* referring to measured or estimated values for the source *k*, and "*lim*" to the corresponding applicable compliance limit

- With these definitions, compliance will require TER ≤ 1

Unintentional Radiators (III)

- Accordingly, a new RF exposure compliance policy has been determined for the purpose of equipment authorization of devices that include unintentional radiators
- The new policy is harmonized with the rules, yet includes provisions that minimize the additional burden required for evaluation of the unintentional radiators contributions to RF exposure
- Certifications will be allowed to use the new policy upon posting of the in new KDB 447498-v07 draft

Unintentional Radiator Compliance Policy (I)

i. All the unintentional radiator RF sources (hereafter URS) present in the device are identified and located

ii. If the emissions of any URS can be shown to already be included in the RF exposure evaluation of any intentional radiator on the device (e.g., a digital logic circuitry near an intentional radiator antenna), then that specific URS source does not require further separate evaluation

iii. For each URS requiring further evaluation, a conservative estimate of the total emission power (integrated over the spectrum, as required) shall be provided via well-supported documentation showing analytical/numerical models and/or measurements

Unintentional Radiator Compliance Policy (II)

iv. Based on the estimated power, URS emissions may be then assessed against test exemption criteria of KDB 447498: those URS sources that are found exempt, will not need to be accounted for any further in the RF exposure evaluation of the device

v. For any remaining URS, compute Total Exposure Ratio (TER) as

$$TER = \sum_{k=1}^{N_S} \left(\frac{SAR_k}{SAR_{\lim}} \right) + \sum_{k=1}^{N_f} \left(\frac{MPE_{field,\,k}}{MPE_{field,\,\lim}} \right)^2 + \sum_{k=1}^{N_{PD}} \left(\frac{MPE_{PD,\,k}}{MPE_{PD,\,\lim}} \right)$$

(see terms defined in previous slide)

Unintentional Radiator Compliance Policy (III)

vi. If TER ≤ 0.1 (10%), no further evaluation for URS is needed, based on the rationale that these contributions are about in the same order of magnitude of the approximations inherent with the TER formula approach

vii. If TER ≥ 0.1, this term shall be added to the contribution of the intentional radiators, for performing the RF Exposure evaluation of the entire device and determine compliance

Conclusions

- An overview of new policies to keep equipment authorization aligned with present RF Exposure rules
- New policies reinforce adherence to and compliance with FCC RF Exposure Rules while providing flexibility for minimal impact on industry innovation
- Policies will be in effect upon posting of new 447498 draft
- Comment period of 30 days will be provided
- Transition period will stay in effect to minimize impact on industry and TCB processes

Thanks for attention !