



Discussion of Selected RF Exposure Concepts and Related KDB Publications

Tim Harrington
Electronics Engineer (EE)
Equipment Authorization Branch (EAB)

Laboratory Division (LD)
Office of Engineering and Technology (OET)
Federal Communications Commission (FCC)



MPE Basics Review

- Filings for rule parts listed in 2.1091 with output power above the categorical exclusion levels must include at one of following:
 - MPE test (TCB or FCC filings)
 - Numerical model (FCC filings)
 - Other methods based on sound engineering practice (may be considered for FCC filings)
 - MPE *estimation* is not applicable for *routine evaluation* of mobile devices in lieu of preceding items
- Far-field power density equation can be used for MPE estimation only for $d \geq 20$ cm for FCC purposes
 - MPE *estimation* equation is not applicable in near-field $d < 20$ cm (i.e. portable *exposure condition*)
 - SAR limits apply for all distances less than 20 cm
=> MPE *estimation* for $d < 20$ cm is not relevant for SAR (portable)
- Do not include unsupported compliance claims in users manuals or filing other contents
 - Preclude analyses or statements based on use of inapplicable MPE *estimation* for $d < 20$ cm



MPE Basics Review

- 2.1033 requires device operating and installation instructions to be submitted during equipment authorization, which is requested to include antenna installation info, to support FCC RF exposure compliance
- Besides MPE, please ensure antenna configurations comply with service-rule ERP/EIRP limits (peak or average), where applicable
- Please ensure source-based time-average is used for power levels listed in MPE estimations and for comparison to 2.1091(c) ERP thresholds
 - e.g. 2.1091(c) check needs to address 1/8 duty factor for GSM

2.1091(c)	ERP, W	EIRP, W
$f \leq 1.5$ GHz	1.5	2.46
$f > 1.5$ GHz	3	4.92

$$EIRP = 1.64 \times ERP$$



Optional Antennas & Portable Devices

- USB-dongle transmitters for example are a peripheral device that can be used in various hosts chosen by the user
- Some designs might also support use configurations such as:
 - RF-connector port which can be freely used with optional and non-specific external antenna(s)
 - Mounting accessory or clip to attach USB-cable-connected dongle to the display section of a laptop computer or next to user
- Installation & operation instructions should effectively preclude:
 - Antenna installed directly at port thereby operating in portable exposure condition subject to SAR evaluation requirements
 - Simultaneous transmission operations for cabled external antenna, or USB-cable-connected integral-antenna dongle, attached to display section of laptops which already contain nearby built-in antennas (e.g. WiFi)
- Identify RF port is for testing purposes only
 - Additional SAR testing may be appropriate if specifically intended for connecting non-specified antenna(s)



Permissive Change Update

- In general changes in portable device antenna and/or key radiating or metallic structures need SAR evaluation to determine whether C1pc or C2pc applies
- SAR compliance considerations are separate from 15.204 antenna-gain test reductions
- KDB 178919 (v04r04) item 5) b) iii) (3) change for equivalent antenna for part 15 device SAR report in C2pc not required if:
 - Identical antenna type with the same or lower gain
 - No other change to the transmitter and host device configurations
 - Highest SAR measured for that antenna type in previous certification(s) is less than 0.8 W/kg
- Otherwise SAR report needed in C2pc for the additional equivalent antenna(s)

178919, v04r04, 8/6/09, D01 Permissive Change Policies



Grant Remarks Review

- Consistent grant notes are intended to support uniformity in application processing
- Most filings requiring RF exposure consideration should include some types of RF exposure grant remarks
 - Example: 15.247 desktop 100 mW or less, e.g. use:
 - “This device is approved as a mobile device with respect to 2.1091; the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons ...”
 - Mobile device grants shall list other distance for FCC RF exposure compliance when greater than 20 cm
 - Example: fixed-mounted devices, e.g. listed in 1.1307 Table 1:
 - The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of §1.1307(b)(3).
- Grant remarks for items other than RF exposure are also needed where applicable (including e-filing numbered grant notes, listed power is conducted not radiated for DSS, etc.)



Grant Remarks Review

- Rather than a “boilerplate” grant remarks list, FCC Lab staff have intended to prepare uniform guidance about filing contents to support and facilitate having minimal grant remarks
 - This task currently under review
- Items being compiled to be considered all together in preparing procedures for device categories include:
 - device installation requirements
 - operation configurations & usage conditions
 - end-user or OEM / integrator instructions
 - authorized operating frequency ranges & modes, SAR, HAC, modular



Grant Remarks Review

- Unless co-located (multi-transmitter) configurations have been evaluated or addressed within equipment authorization applications under an FCC ID, for uniformity in processing FCC and TCB approvals have continued using a "no co-location" grant remark (grant condition) for single module, single transmitter, or specific transmitter combination approvals
- As products and technologies have continued to evolve, the issue has become not so much about transmitters being co-located, rather what are the simultaneous transmitting conditions and configurations
- Authorized collocations are as documented within filings for specific FCC ID(s), or per exceptions or conditions established by FCC procedures or guidance where appropriate
 - Example grant remark:
 - The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.
 - Permissive change filings have not been required for all simultaneously-transmitting associated-device FCC IDs, e.g. categ. excl. mobile devices
 - Examples of recent FCC Lab policy and procedure documents about simultaneous transmit considerations include KDBs 447498, 616217, and 648474



Grant Remarks Review

- Any grant certificate remarks / conditions about device operations should be reflected in user instructions as well
 - As part of a Certification, all info within an application filing is reviewed, including specific device characteristics and whether operating instructions appear appropriate to ensure compliance with applicable FCC rules
 - FCC generally does not regulate actual contents of user instructions; however user instructions should be such as to ensure proper use of device in compliance with FCC rules
- See OET B 65 Suppl. C Appendix D for suggested phone handset body-worn grant notes and user instructions



Grant Remarks Review

- SAR listings on grant certificates
 - Numeric values
 - Grant-listed SAR rounded to two decimal places
 - Contact FCC Lab for other guidance e.g. in case round-off SAR is above a threshold for FCC filing
 - Example format for dual-band PCE:
The highest reported SAR values are:
Part 22: head 0.09 W/kg, body 0.75 W/kg;
Part 24: head 0.12 W/kg, body 1.41 W/kg.
 - SAR listing is in terms of head and/or body (i.e. liquid type)
 - consult with FCC for other applicable terms (omit e.g. face, hand, near-body, etc.)
- Class II filings must carry-over original grant remarks, but can amend / expand remarks
 - Class II grants list highest SAR from all filings within an FCC ID



In closing

- TCBs need to diligently and exhaustively apply policies and procedures in existing documents
- Consult the FCC Lab for additional guidance on the current policies
- Contact FCC whenever the application of the rules or requirements or policies is unclear, and/or where interpretations of the regulations or test procedures may be necessary