



***Mobile and Portable Device RF
Exposure Equipment Authorization
Procedures
- Selected Refresher Items***

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Overview

- KDB pub 447498 (aka *KDB RFX*) *Mobile and Portable Device RF Exposure Equipment Authorization Procedures*¹
- Refresher of some RFX and *KDB RFX* topics
 - Tablet PCs
 - Cable-connected module-like devices (e.g. USB-peripheral)
 - Permissive changes and RFX for portables & mobiles
- Due to ongoing rulemaking proceedings and other activities, certain aspects and topics remain deferred for future *KDB RFX* versions and/or separate procedures documents; e.g., some module, collocation items

¹ FCC/OET/Lab *Mobile and Portable Device RF Exposure Equipment Authorization Procedures*, March 2007
html (<https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=20676&switch=P>)
<<447498 D01 Mobile Portable RF Exposure v01, Published on: Apr 5 2007>>

- refresher = topics where applicants / test labs / TCBs have had questions in past 1-2 years, and/or topics where KDB pub 447498 or other FCC docs might be updated (refreshed) TBD



SAR for Tablet PCs

- Most tablet PCs are one-section (slate) type or two-section hinged (convertible) type
- Tablets may have up to four user-selectable display orientations: 0-deg portrait, 0-deg landscape, 180-deg portrait, 180-deg landscape
- Similarly as for notebooks with antenna(s) in the keyboard section, for lap-held use-configuration SAR is tested with tablet bottom-face against a flat phantom

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• from KDB pub 447498 item 7) d) ii)



SAR for Tablet PCs

- SAR is tested with edges of the tablet computer in direct contact against a flat phantom (display face perpendicular to phantom), for:
 - Each edge containing antenna(s), unless final-product firmware prevents radio transmissions for position having antenna-edge in contact with phantom, and 0-deg relative-to-phantom display orientation
 - Each edge not containing antenna(s) that is adjacent to an edge containing antenna(s), where adjacent-edge antenna(s) are within 10 cm from the phantom (next bullet)
- Considerations of exposure potential vs. test requirements (*Test Reduction Procedures*) may be possible - TBD

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- from KDB pub 447498 item 7) d) ii)



SAR for Tablet PCs

- Ultra-Mobile PC (UMPC), sort of like a sub-tablet - handheld-only or ...?
- For some mid-size tablet type devices, users could likely hold it closer to or resting against rather than further from body
 - Tablet PC standard SAR procedures may be appropriate
 - And/or use of firmware settings to disable transmitter(s) for some device configurations or screen orientations
 - Please contact FCC before processing if use unclear
- SAR for body-worn accessory may be applicable
- Considerations of exposure potential vs. test requirements (*Test Reduction Procedures*) may be possible - TBD

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- Some UMPCs containing transmitter(s) can be considered as intended primarily for handheld-only use.
- Due to various features such as screen and/or keyboard size, some UMPC typically are not expected to have cradled-in-arm or rested-against-body use positions, as do many tablet PCs.
- For UMPCs, user instructions should provide sufficient details about all intended use configurations, including holding guidance for any modes with screen open, closed, tablet -portrait, tablet-landscape, indicating corresponding recommended antenna positions for each, and being clear about intended handheld vs near-body conditions.
- If device has swivel or retractable antenna, operating instructions should include some guidance about antenna position variations around the intended orientation(s).
- If transmitter operations while held in a body-worn accessory or lanyard are intended or expected, the usual FCC body-worn SAR test procedures should be followed.
- If SAR evaluation is applicable, SAR test positions / configurations should be described in terms of how those are representative of intended use positions.



SAR for Cabled Devices

- Cable-connected devices without body-worn or held-to-ear normal-operating configurations are typically considered to be mobile devices for FCC RfX evaluation purposes
- Example – USB-peripheral transmitter:
 - Without plug for install and support in host-product slot or receptacle - instead connected by flexible extender cable
 - Typical usage expected to be desktop - not designed to normally be used within 20 cm from persons, e.g. like mobile-phone handset
 - SAR evaluation generally not applicable

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- USB “dongle” transmitters typically have size like small pen or key-fob, and have USB plug for direct-connection and rigid physical support in host-product receptacle
- “A dongle is a small hardware device that connects to a computer ...” (wikipedia.org)
- Transmitting USB peripheral device normally connected to a computer only by a flexible extension cable - For FCC RF exposure compliance evaluation purposes, such devices are normally considered to operate in mobile RF exposure conditions. In other words, such devices are not designed to normally be used within 20 cm from persons while also providing features or conditions to maintain some spacing for RF exposure compliance, so as to be considered a portable device.
- OET 65 Suppl. C guidance for SAR test of handsets spaced away from phantom is based on availability of body-worn accessories, and is generally not applicable for this cabled-peripheral transmitters (belt-clips, holsters, etc are not expected to be available or applicable). In absence of sufficient means for users to maintain spacing represented in SAR tests to ensure compliance with FCC limits, if SAR were to be evaluated then direct-contact position with phantom could be appropriate. In general, SAR evaluation should not use a contrived spacing between device and phantom, unless device design and/or operating conditions provide a means to maintain such spacing.
- A cable-connected desktop device without body-worn or held-to-ear normal-operating configurations such as USB cabled-peripheral transmitter is typically considered to be a mobile device for FCC RF exposure evaluation purposes, therefore SAR evaluation is generally not applicable. FYI note also KDB pub 447498 item 4) c), ie uniform SAR procedures have not been established for stand-alone testing of such module-like devices.



SAR for Cabled Devices

- OET B 65 Suppl C guidance for SAR test of handsets spaced away from phantom is based on availability of body-accessories
- SAR evaluation generally should not use contrived spacing between device and phantom, unless device design and / or operating conditions provide means to maintain such spacing
- Without a device feature or accessory, position in direct-contact with phantom may be appropriate for SAR evaluations

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- FCC-TCB conference notes Oct03 Harrington

pg 16: "MPE/SAR Basic Considerations ... TCBs should not process SAR reports to demonstrate compliance for devices operating in mobile or fixed exposure conditions, other than for certain nearby exposures for devices referenced in 2.1091(d)(4), i.e., certain desktop phones and wireless modem modules (see also later slide)"

pg 68: "TCB APPLICATION RFx AUDITS ... TCBs should avoid accepting SAR to demonstrate compliance for devices operating in fixed or mobile exposure conditions, other than as allowed in 2.1091(d)(4), i.e., certain desktop phones and wireless modem modules"

- FCC-TCB conference notes Apr02 Chan

"Mobile Transmitters

- Handling different types of mobile transmitters ...

- - other standalone operating configurations

- - - desktop or self-mounted units, indoor wall-mounted WLL devices, wireless modems or similar devices [FCC14] ...

FCC14

- although sometimes fixed mounted, mostly indoors on walls and ceilings etc., when far-field whole-body exposure concepts are not suitable or inappropriate for the operating configurations and exposure conditions, mobile exposure criteria should be considered

- also see §2.1091(d)(4) on transmitters that may require SAR evaluation"

- FCC-TCB conference notes Feb02 Harrington

"SAR data for specific distance(s) and device configuration(s) reviewed to evaluate compliance as a mobile device per 2.1091(d)(4). SAR data for limited configurations may not support all portable exposure conditions, so device will not be designated as "portable" "



SAR for Cabled Devices

- Uniform SAR procedures have not been established for stand-alone testing of module-like devices [*KDB RFX* item 4) c)]
- Uniform and generic SAR procedures for 2.1091(d)(4) desktop mobile devices have not been established, therefore TCBs should contact FCC for guidance before processing SAR for mobile devices

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- KDB pub 447498

...

4) Modules and module-like devices used in portable final products – notebook (laptop) computers, PDAs, handsets, etc.

...

c) SAR test procedures for “stand-alone” modules are unavailable; when SAR tests are required, modules and module-like devices should be evaluated in applicable host products

- FCC 07-56 footnote 18: “Module-like transmitters are peripheral to a host and are typically plugged into an externally accessible standard bus on such hosts. Examples of such industry defined standard bus interfaces are PCMCIA (PC Card), SDIO or CompactFlash slots on laptop computers or PDAs.”

- 2.1091(d)(3) If appropriate, compliance with exposure guidelines for devices in this section can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas.

[NOTE: labeling for "compliance with exposure guidelines" does not replace RF exposure routine evaluation when applicable]

- 2.1091(d)(4) In some cases, e.g., modular or desktop transmitters, the potential conditions of use of a device may not allow easy classification of that device as either mobile or portable (also see 2.1093). In such cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength or power density, whichever is most appropriate.



RFX & PBA – Hands, Arms, etc

- Uniform SAR test and TCB review & approval procedures have not been established for devices having hands / wrists / feet / ankles normal-use positions
 - Compliance issues are not expected, and SAR testing is not requested, for most present handsets and handheld terminals or consumer notebook and tablet computers containing transmitters
 - PBA not needed e.g. for simple 802.11bg handheld terminal²
- TCBs, applicants, test-labs please contact FCC Lab for PBA or guidance before processing:
 - Products where application of standard SAR test procedures or device positions may be unclear (arm-worn, etc)
 - SAR tests for unique, new, or evolved product configurations and technologies

² KDB pub 388624 FCC/OET/Lab *Permit But Ask Procedure*
 html (<https://fjallfoss.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=28319&switch=P>)

• KDB pub 388624 FCC/OET/Lab *Permit But Ask Procedure*

“... TCBs may approve devices on the “permit but ask” list below, but must obtain FCC guidance prior to approval.

Permit but ask list:

...

3. Devices that are required to comply specifically with extremity (hands, wrists, feet and ankles) SAR limits. This does not include devices that must comply with body-worn or head exposure conditions.”

•Draft possible re-word of KDB pub 388624:

3. Devices that are subject to SAR routine evaluation under extremity SAR limits (hands, wrists, feet and ankles) but without other body-worn or held-to-ear usage, and devices where standard SAR test positions or procedures are not established or specifically applicable (arm-worn, etc).



RFx & Class II Changes

- SAR is dependent most strongly upon near fields and RF current distributions on a device, meaning minor and simple metallic changes may cause relatively large changes in SAR
- Modifications to transmitters subject to RFx routine evaluation shall apply the criteria of 2.1043(a) to determine which is applicable
 - C1pc, C2pc, C3pc, or new FCC ID
(C2pc = Class II permissive change)
 - Separate from measurement uncertainty
 - Production tolerances are not considered

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•2.1043 Changes in certificated equipment.

(a) Except as provided in paragraph (b)(3) of this section, changes to the basic frequency determining and stabilizing circuitry (including clock or data rates), frequency multiplication stages, basic modulator circuit or maximum power or field strength ratings shall not be performed without application for and authorization of a new grant of certification. Variations in electrical or mechanical construction, other than these indicated items, are permitted provided the variations either do not affect the characteristics required to be reported to the Commission or the variations are made in compliance with the other provisions of this section. Changes to the software installed in a transmitter that do not affect the radio frequency emissions do not require a filing with the Commission and may be made by parties other than the holder of the grant of certification.

(b) Three classes of permissive changes may be made in certificated equipment without requiring a new application for and grant of certification. None of the classes of changes shall result in a change in identification.

(1) A Class I permissive change includes those modifications in the equipment which do not degrade the characteristics reported by the manufacturer and accepted by the Commission when certification is granted. No filing with the Commission is required for a Class I permissive change.

(2) A Class II permissive change includes those modifications which degrade the performance characteristics as reported to the Commission at the time of the initial certification. Such degraded performance must still meet the minimum requirements of the applicable rules. When a Class II permissive change is made by the grantee, the grantee shall supply the Commission with complete information and the results of tests of the characteristics affected by such change. ...



RFX & Class II Changes

- RFX requirements in C2pc are based on comparing highest SAR for all configurations of original to highest SAR of the modified device under similar test configurations
- If highest SAR of modified device for a certain configuration (such as head or body) is larger than highest SAR for original device for those configurations, SAR is addressed in the C2pc filing for the applicable operating configurations in each frequency band

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- For determining whether reported SAR has degraded, at time of testing the modified product it is recommended to include testing also on an unmodified product, for purposes of establishing repeatability; particularly when the modified product is tested at a SAR lab different from as in original filing, testing concurrently with an unmodified product is encouraged, for purposes of establishing reproducibility.

• 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representations and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to 2.1043.

• 2.931 Responsibility of the grantee.

In accepting a grant of an equipment authorization, the grantee warrants that each unit of equipment marketed under such grant and bearing the identification specified in the grant will conform to the unit that was measured and that the data (design and rated operational characteristics) filed with the application for certification continues to be representative of the equipment being produced under such grant within the variation that can be expected due to quantity production and testing on a statistical basis.



RFx & Class II Changes

- Use of lower-gain same-type (same characteristics) antennas without retest permitted for part 15 devices
 - 15.204(c)(4); retest means e.g. 2.1033(b)(7), 2.1043(a); note also 15.204(c)(3) means antenna summary list required
 - Antenna gain is normally considered to be a far-field parameter - e.g. 15.31(f), 2.1053(a), OET B 65, 2.1
- SAR is mostly due to near-fields and nearby device structures and RF current distributions
 - 1.1307(b)(1) compliance is separate from 15.204
 - For example LMA intending use with different antennas should address maximum exposures in original filing
 - Considerations for exposure potential vs. test requirements (*Test Reduction Procedures*) may be possible - TBD

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• 2.1 Gain of an Antenna. The ratio, usually expressed in decibels, of the power required at the input of a loss free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength or the same power flux-density at the same distance. When not specified otherwise, the gain refers to the direction of maximum radiation. The gain may be considered for a specified polarization. ...

• 2.1053 Measurements required: Field strength of spurious radiation. (a) ... For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. ...

• 15.31 Measurement standards. ... (f) ... (1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; ...

• 1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared. ... (b) ... Commission actions granting ... equipment authorizations ... require the preparation of an Environmental Assessment (EA) if the particular facility, operation or transmitter would cause human exposure to levels of radiofrequency radiation in excess of the limits in §§ 1.1310 and 2.1093 of this chapter. Applications to the Commission for ... equipment authorizations ... must contain a statement confirming compliance with the limits unless the ... transmitter is categorically excluded, as discussed below. Technical information showing the basis for this statement must be submitted to the Commission upon request. ... (1) The appropriate exposure limits in §§ 1.1310 and 2.1093 of this chapter are generally applicable to all facilities, operations and transmitters regulated by the Commission. However, a determination of compliance with the exposure limits in § 1.1310 or § 2.1093 of this chapter (routine environmental evaluation), and preparation of an EA if the limits are exceeded, is necessary only for facilities, operations and transmitters that fall into the categories listed in table 1, or those specified in paragraph (b)(2) of this section. All other facilities, operations and transmitters are categorically excluded from making such studies or preparing an EA, except as indicated in paragraphs (c) and (d) of this section. ...



RFX & Class II Changes

- C2pc used e.g. to add mobile passive vehicle-mount antenna to portable held-to-head, body-worn and hand-held device grant (TNE, PCE, PCT, TNT)
 - New line-item radiated power where applicable
 - MPE evaluation if applicable
 - Distinct mobile and portable grant notes
- C2pc used e.g. to add specific hosts or antennas for Limited Modular Approval devices (including SAR evaluation where applicable)
 - Add specific-host laptop with display-top antennas (mobile) to LMA having specific-host laptop with keyboard-antennas (portable)
 - Add specific-host laptop or PDA (portable) to LMA for desktop access point or laptop with display-top antennas (mobile)

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- repeat from FCC-TCB conference notes Oct04 Perrine



Collocation Precursor

- The usual no-collocation grant remark essentially means that some collocation configurations may be subject to separate Equipment Authorization
- Any Certification (FCC ID) is valid for whatever representations and test data are on file, which historically was a single transmitter per FCC ID
- Whether or not a specific grant shows a no-collocation remark essentially is a secondary concern, i.e. secondary to whatever requirements and procedures have been or will be established by FCC for multi-transmitter final products and end-use conditions
- Authorized collocations are as documented within a filing, or per exceptions established by FCC where appropriate

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- precursor = precedes and indicates, suggests, or announces something to come
- refresher = topics where applicants / test labs / TCBs have had questions, and/or topics where KDB pub 447498 or other FCC docs might be updated (refreshed) TBD
- red herring = something that draws attention away from the central issue

-
- KDB pub 447498 item 5):

5) Collocation of simultaneously-transmitting antennas and transmitters within portable or mobile final products

a) For equipment authorization purposes, in general the term collocation refers to simultaneously-transmitting (co-transmitting) antennas located within 20 cm of each other within a final product

b) Mobile and portable devices operating with multiple co-transmitting antennas are evaluated and certified for each specific combination and product configuration [6]

[6] 2.1033(e) and FCC Form 731 related terms include composite system, associated device

c) A "no collocation" grant remark / condition is applied for transmitters that operate as a single module or single-transmitter product, and also for specific evaluated transmitter combinations and configurations within a specific product

i) This grant condition is applied for both routine-evaluation and categorically-excluded transmitters

ii) Subsequent incorporation of additional transmitters and/or modules may be handled as Class II permissive changes, or as a new FCC ID for the combination

iii) This grant condition requires separate RF exposure evaluation for each collocated combination where applicable

-
- example situation where C2pc not requested for both FCC IDs in collocated / co-transmitting configuration = KDB pub 447498 item 5) d) WWAN / WLAN gateway devices



Wrap-up

- Jul02 TCB Excl List still in effect
- Updated *KDB RFX* document may be released for conjunction with other OET SAR procedures
- TCBs continue to use RFX practices and procedures described in preceding info-meeting notes and other documents, e.g., most filings that include RF exposure info still use some type of grant note
- For best consistency, before completing device reviews and approvals, please review recent or applicable previous grants for similar devices
- Please ask for guidance from OET/Lab whenever anything is unclear, whatever the issue³

³ 47 CFR 2.962(c)(4), 2.962(f)(1), 2.962(f)(5)(i)

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• 2.962 Requirements for Telecommunication Certification Bodies.

...

(c) *Criteria for Designation.*

...

(4) The TCB shall demonstrate an ability to recognize situations where interpretations of the regulations or test procedures may be necessary. ...

...

(f) *Scope of responsibility.*

(1) A TCB shall certify equipment in accordance with the Commission's rules and policies.

...

(5) A TCB may not:

(i) Grant a waiver of the rules, or certify equipment for which the Commission rules or requirements do not exist or for which the application of the rules or requirements is unclear.

...