



RF Exposure Procedures Update

TCB Workshop
April 2013

Laboratory Division
Office of Engineering and Technology
Federal Communications Commission



Overview

- Overview of minor updates to the RF exposure KDB procedures released in October 2012 and a few reminders
 - KDB 447498 – mobile & portable RF exposure
 - KDB 865664 – SAR methodology & reporting
 - KDB 616217 – laptop and tablet computers
 - KDB 648474 – wireless handsets
 - KDB 941225 – SAR procedures for LTE
- Other KDB updates
 - KDB 941225 – HSPA, HSPA+, DC-HSCPA and 1x-Advanced
 - KDB 941225 – UMPC mini-tablet and hotspot mode
 - KDB 648474 – wireless charging battery cover
 - KDB 680106 – wireless power transfer applications (separate session)
 - KDB 388624 – PBA list
 - HSPA, HSPA+ & DC-HSDPA: no PBA unless SAR is required
 - no PBA for 1x-Advanced and Rel. 9 LTE
- Other RF exposure procedures updates



KDB 447498

**Mobile and Portable Devices
RF Exposure Procedures
and
Equipment Authorization Policies**



TCB Review & Approval Policies

- RF exposure testing must apply the latest revision of the *published RF exposure KDB procedures* to qualify for TCB approval
 - KDB inquiry is required for minor deviations of policies & test requirements to avoid PBA
 - all issues must be resolved during TCB review, between a TCB and the grantee or its test lab, before submitting a PBA
 - some test reports still contain/apply both new and obsolete procedures
- Applicants may apply directly at the FCC for equipment certification
 - to use alternative procedures or when requiring substantial deviation from KDB procedures
 - when substantial FCC involvement is required to complete review and approval
- Some TCBs have been ignoring the required policies to issue equipment approval
- When categorical exclusion applies, KDB procedures are required to qualify for TCB approval
 - documentation for RF exposure test exclusion is required, in lieu of the normally required test reports



Equipment Approval Policies

- Grants for modules must identify the RF exposure host platform
 - mobile only, portable only or mixed mobile and portable, according to item 3) in section 3 of KDB 447498
 - also see section 5.1 for listing of standalone and simultaneous transmission conditions
- Approved standalone & simultaneous transmission conditions
 - must be supported by the test results, installation and use conditions required for host configurations, including manual instructions
 - all test exclusion conditions must be clearly identified in test reports to qualify for the exclusion
 - cautions and warnings are for unintended use conditions
- User instructions and OEM integration requirements
 - manual instructions must be sufficient for the unskilled users
 - OEM instructions must include integration details and identify integrator responsibility, including end user disclosure requirements



General Test Requirements

- Transmitters should be tested at the maximum rated output power
 - according to source-based time-averaging requirements, and
 - within 2 dB of maximum tune-up tolerance & production specifications
- Results must be scaled to the maximum tune-up/production specifications to determine compliance
 - according to the output power tested for each channel
 - for simultaneous transmission SAR measurements
 - unless the SAR system can scale raw data in enlarged zoom scans, the aggregate 1-g SAR must be scaled by the sum of the differences between maximum tune-up and tested power of each transmitter
 - where $[(SAR_1 + SAR_2) * (P_{diff1} + P_{diff2})]$ is more conservative than $[(SAR_1 * P_{diff1}) + (SAR_2 * P_{diff2})]$



General Test Requirements

- Subsequent relaxation of tune-up or production specifications to accommodate a reduced maximum output power level
 - may require additional testing for original results to support compliance
 - additional equipment approval may be necessary
- When simultaneous transmission applies
 - SAR and EMC procedures for coherent and correlated signals must be considered separately because test concerns are different



Test Separation Distance

- The *test separation distance* must be sufficiently conservative to support the *operational separation distance* required by a device, its antennas and radiating structures, according to
 - the exposure conditions, device form factors and proximity to users etc.
 - to determine if distance should be from outer housing or antenna element
 - test distance for antenna edges on tablets and laptop keyboards are determined from the outer housing (section 4.1, item 5) of KDB 447498)
 - test distance for laptop display or adjacent edge on tablets and laptop keyboards are from antenna to user or opposite/adjacent edge of device
- Modules are tested according to separation from antenna to phantom
 - host configurations are typically not known during equipment approval
 - antenna to phantom distance is also used for SAR test exclusion
 - the operational distance from outer housing or antenna described above, for incorporation into host devices, must not exceed the *test separation distance*



SAR Phantom Requirements

- SAM phantom is for testing handsets operating next to the ear only
 - this is the only SAM phantom configuration that qualifies for TCB approval
 - it is generally unacceptable to use the SAM phantom for testing other head or body exposure conditions; for example, headsets or similar accessories
- KDB inquiry is required to use curved surfaces on the SAM phantom for specific circumstances
 - should include SAR probe trajectories info when submitting KDB
 - PBA is required unless it is waived through KDB inquiry
- When testing devices with uneven surfaces or contoured edges using a flat phantom, a KDB inquiry is highly recommended to ensure the test results are acceptable



SAR Test Exclusion & Reduction

- When applying standalone SAR test exclusion
 - use the equations in section 4.3.1 of KDB 447498
 - do not use Tables in Appendix; these are for examples only
- Estimated SAR applies only
 - when simultaneous transmission SAR test exclusion is considered
 - when standalone SAR is not measured because of standalone SAR test exclusion in section 4.3.1, and not due to test exclusions allowed by other *published RF exposure KDB procedures*; for example, hotspot mode 2.5 cm antenna/edge exclusion



SAR Test Exclusion & Reduction

- SAR test exclusion and reduction are applied independently for different wireless modes, frequency bands and exposure conditions
- Estimated SAR are considered in the sum of 1-g and SAR to peak location separation ratio simultaneous transmission SAR test exclusion
 - may be listed on a grant when it is the highest simultaneous transmission SAR according to procedures in KDB 690783
- Reported SAR
 - lower SAR measured at low end of tune-up tolerance, when scaled, could become highest reported SAR
 - highest SAR measured at high end of tune-up tolerance, when scaled, may not necessarily result in the highest reported SAR



Area Scan Based 1-g SAR Estimation

- Must be based on the polynomial version (Motorola fast SAR) reported in 2009 at 29th BEMS meeting
 - all other implementations do not apply
- A couple of additional (new) requirements to apply area scan based 1-g SAR estimation
 - area scan must be measured at
 - ≤ 4 mm at ≤ 3 GHz and ≤ 2 mm at > 3 GHz
 - to address SAR concerns due to certain non-radiating field conditions
 - when zoom scan is required, the zoom scan and area scan estimated 1-g SAR must be within 0.10 W/kg of each other
 - zoom scan 1-g SAR is used to determine compliance
 - area scan estimated SAR is used to confirm validity of algorithm
- The type of SAR scans and qualifying conditions must be clearly identified for the corresponding SAR results in the test reports



Modules and Peripheral Transmitters

- For the unrestricted generic platform with $SAR \leq 0.4 \text{ W/kg}$
 - when SAR is measured, test separation distance must be $\leq 5 \text{ mm}$
 - 5 mm is used to determine SAR test exclusion
 - except for modules with built-in integral antenna embedded within self-contained outer housing, test separation distance is from antenna to phantom
 - for incorporation in host devices, distance is determined according to item 5) of section 4.1
- In section 5.2.3, item 3), for peripheral transmitters
 - test separation distance of 5 mm is changed to $\leq 5 \text{ mm}$
 - test distance of 10 mm may be applied is changed to up to 10 mm may be applied



Other Exposure Conditions

- A duty factor of 75% may be applied to PTT radios with Bluetooth or voice activated transmission capabilities to avoid justification required for using lower duty factor
- Testing of third-party after-market accessories
 - must demonstrate host test sample is acceptable, as originally approved
 - through power measurements and selective SAR testing
 - requires a KDB to address host and accessory test configurations
 - hosts with proprietary test modes, software or similar test setup issues may not be easily tested
 - see KDB 648474 for third-party aftermarket cellphone accessories
 - sleeves, wireless charging adapters etc.



KDB 865664

SAR Measurement Requirements
for
100 MHz – 6 GHz
&
RF Exposure Compliance Reporting
and
Documentation Considerations



Signal Specific Probe Calibration

- Procedures are unclear and insufficient in on-going SAR standards to apply signal modulation specific SAR probe calibration
 - a publication is referenced to apply exponential curve-fitting to correct SAR measurement errors for CW probe calibration according to the peak to average power ratio of specific modulated signal(s)
- Bundled calibration applies the correction coefficients generated for a specific signal modulation characteristics to signals of similar modulation characteristics
- Until these concerns are resolved, SAR measurements using signal modulation specific or bundled probe calibration should be submitted directly to the FCC for equipment certification
 - accuracy of correction due to variability of modulated signal characteristics is unclear
 - need to establish probe calibration validation and SAR system verification requirements
 - similar calibration issues may apply to HAC



Tissue Dielectric Parameters

- SAR error compensation due to tissue dielectric parameter deviations for relaxing tissue dielectric parameter tolerances from 5% to 10%
 - the coefficients for conductivity in the original publication are different from those in the latest draft IEEE P1528
 - end results are similar
- When tissue-equivalent media are purchased from SAR equipment manufacturers, the temperature sensitivity is usually specified in the data sheets
- For some tissue-equivalent media that consist of a suspension
 - for example, mineral oil based mixtures
 - the short term stability characteristics of the tissue dielectric parameters should be known and verified



SAR Measurement Requirements

- It must be ensured that there are no antenna couple issues before applying overlapping partial area scans to large test devices or antenna
- Rotated SAM phantom addresses probe access difficulties
 - it does not address probe calibration issues inside mouth & jaw
 - 2.5 penetration depth is required between top of zoom scan and liquid surface above, which may not be feasible at low frequencies
- When measured 1-g or 10-g SAR is within 10% of the SAR limit
 - further restrictions for tissue dielectric parameters are required when SAR measurement frequencies exceed 50% of the acceptable probe calibration point frequency range, ± 25 and ± 50 MHz as describe in KDB 865664
 - TCB should check for this during review and approval
- When measuring multiple signals within the same probe calibration point frequency range for simultaneous transmission SAR
 - the aggregate peak to average power ratio (PAPR) is expected to increase
 - PAPR > 5 dB requires additional consideration to use CW probe calibration



Simultaneous Transmission SAR Measurement

- For large form factor devices where the peak SAR locations of the simultaneously transmitting antennas are spatially separated, the following may be applied instead of enlarged zoom scans
 - area scan is performed for each normally required enlarged zoom scan configuration to identify the peak SAR locations of all transmitters and antennas in all frequency bands
 - the normally required zoom scan procedures are applied to the peak SAR locations in each area scan
 - these normal zoom scans are repeated for transmitters and antennas in other frequency bands at that same peak SAR location
 - the volume scan post-processing procedures are applied to determine the aggregate 1-g SAR for all frequency bands at each peak SAR location
 - the highest of the aggregate 1-g SAR among all peak SAR locations is used to calculate the reported SAR to determine compliance



Measurement Variability and Uncertainty

- The conditions for requiring 2nd & 3rd repeated measurements are
 - 20% variations or 1.45 W/kg (~ 10 % from limit) for initial & 1st repeated measurements
 - 20% variations and 1.5 W/kg (~ 6% from limit) for initial, 1st or 2nd repeated measurements
- The typical measurement uncertainty plus other expected variations for test devices that are not included in the uncertainty budget are taken into consideration through the 20% variations
 - 30% expanded uncertainty = 15% combined uncertainty for k=2
 - an additional 5% is included for the device inherent variations not accounted for in uncertainty budgets established by SAR measurement standards
- The 2nd or 3rd repeated measurements are required to address measurement and device setup related compliance concerns
 - where there is an increased potential for the measured SAR to exceed the 30% expanded SAR measurement established by SAR measurement standards



SAR System Validation

- When SAR system software is updated or upgraded and there is no change to the hardware, probe and dipole calibrations or other system components
 - the validation should be limited to the software operational aspects of the SAR system
 - probes, dipoles and system components are necessary to perform measurements to validate the software
 - unless required by the software changes, re-validation of probes, dipoles and other components is generally not necessary
- When the same software is deployed on multiple, identical SAR systems
 - validation on one of the identical systems is acceptable
- The probe calibration signal characteristics should be identified in the SAR system validation summary required for the SAR report



System Validation Procedures

- Two types of probe calibration conditions are identified in KDB 865664
 - CW and signal modulation specific calibrations
- CW calibration applies to two measurement categories
 - CW-equivalent signals, and
 - using a CW-equivalent calibration to measure the SAR of other signal types, with an increased SAR measurement error at high SAR levels
 - when peak to average power ratio is > 5 dB, a summary of the relevant system validation results or a plot with equivalent info must be included in the SAR report to demonstrate probe conversion linearity
- Signal modulation specific probe calibration applies to
 - probes calibrated using a non-CW signal of specific modulation characteristics
 - curve-fitting error correction is applied to reduce the SAR measurement error
 - case-by-case determination through KDB inquiry is required
- Using CW-equivalent calibration to measure other signal types is not the same as using signal modulation specific calibration



System Verification at 100 - 300 MHz

- When the normally required SAR system verification procedures cannot be applied
 - the procedures in section 3.4.2 of KDB 865664 enable test labs to establish dipole SAR targets
 - at an offset frequency near the dipole tuned frequency, or
 - at the dipole tuned frequency using probe calibration and tissue dielectric parameters at an offset frequency
 - these are identified as items 1) and 2) in section 3.4.2
- Sub-item c) of item 2), difference in probe conversion factor has changed from 5% to 10%
- Sub-item d) of item 2) is not applicable
 - it was from a cut & paste error and has been removed
- Below 300 MHz procedures in section 3.5 applies item 2) of section 3.4.2
 - these are applicable only when acceptable system validation sources are unavailable from SAR system manufacturers
 - new shielded loop sources have been defined and will soon be available



KDB 616217

SAR Evaluation Considerations for Laptop, Notebook, Netbook & Tablet Computers



Laptop/Tablet Platform Issues

- Issues relating to feet, bumpers and protrusions or contours along edges and surfaces of laptop and tablet computers
 - if the antenna location can be positioned against the user during normal use, and
 - the additional distance introduced by the protrusions or contour between the outer housing of a device and the flat phantom is > 5 mm or the reported SAR with the protrusions or contour in place is > 1.2 W/kg
 - a KDB inquiry is required to determine if SAR measurements in additional test setup configurations are necessary
 - a KDB is not required when it is feasible to remove the protrusions, with no other modifications to the device, to enable SAR testing with the device in direct contact with the phantom



Laptop Platform Issues

- For antennas in the keyboard section of laptop computers
 - SAR is required for the keyboard bottom surface
 - SAR test exclusion is according to item 5) in section 4.1 of KDB 447498
 - when required, feet, bumper and protrusion issues also need consideration
 - when tablet use conditions do not apply to a laptop computer, bystander SAR for keyboard and display edges are not required
 - when edge testing is required, simultaneous transmission on adjacent or multiple edges must also be addressed
 - according to the tablet procedures in section 4.3 of KDB 616217



Test Separation Distance

- When the modular approach is applied
 - test separation distance is determined according to the antenna to user/phantom requirements in KDB 616217
 - the operational separation distance for incorporating transmitter modules in qualified hosts is determined according to item 5) in section 4.1 and item 1) in section 5.2.2 of KDB 447498
 - the test separation distance, due to unknown host configurations or highly variable exposure conditions, must be more conservative than the actual implementation
 - the outer housing of a host can often become a radiating structure and influence the SAR of the modular transmitter/antenna
- For dedicated host testing, test separation distance is determined from the outer housing of the host
- For SAR test exclusion, the test separation distance is determined differently for antenna edge and adjacent edges; see KDB 447498



Modular Approach SAR Testing

- When modular approach applies and SAR testing is required
 - the module and/or its antenna must be tested independently from the host device
 - the transmitter should be controlled by a representative host computer or, if applicable, an equivalent testing platform, such as a platform validation kit available from the chipset manufacturer
 - the transmitter should operate with the actual firmware, software drivers and other associated device operating software required for testing the wireless technologies



Proximity Sensor Considerations

- Power measurement issues during proximity sensor triggering and coverage tests
 - some devices have built-in software that reports the triggering condition and enables power levels to be confirmed separately
 - otherwise, conducted power measurement requiring internal access to antenna port inside tablet may interfere with the triggering tests
 - the test setup must be clearly described in SAR reports to address this type of concerns
- The triggering test procedures only require output power reporting
 - within +/- 5 mm of the triggering points or until tablet is touching phantom
 - to be tabulated in the SAR report for movements to and from the phantom
- Default power level for sensor failure and malfunctioning must also be addressed in SAR report to demonstrate compliance



KDB 648474

**SAR Evaluation Considerations
for
Wireless Handsets**



Product Convergence Issues

- Smart phones and mini-tablets are converging
 - advanced/enhanced mobile web and multimedia access features found mostly in tablets are now supported by recent generation smart phones
 - industry refers to these devices as phablets – phone + tablet
- UMPC mini-tablet procedures are primarily intended for devices
 - with overall diagonal dimension ≤ 20 cm
 - operate like a tablet
 - mainly for hand-held interactive use next to or near the body of users
 - with no provision for next to the ear voice mode operations
- Handset procedures are mainly intended for
 - next to the ear and body-worn accessory use
 - hotspot mode and interactive hand use are subsequent add-ons
- For handsets that operate without a traditional earpiece
 - the ERP location could be undefined
 - a KDB inquiry is required to establish the SAR test requirements



Phablet SAR Test Considerations

- Unless it is confirmed otherwise through KDB inquiries, phablet procedures apply to the following configurations
 - smart phones with display diagonal dimension > 15.0 cm or overall diagonal > 16.0 cm that support mobile web and multimedia access
 - tablets and mini-tablets that support next to the ear voice calls
- Phablet procedures
 - apply the normally required head SAR and, as appropriate, body-worn accessory SAR procedures for handsets
 - apply also the UMPC mini-tablet procedures to test all required surfaces and edges in direct contact with the flat phantom for 10-g SAR
 - the 1-g SAR at 5 mm for UMPC mini-tablets is not required
 - all normal tablet procedures in KDB 616217 are required when the overall diagonal dimension is > 20.0 cm
 - the simultaneous transmission configurations applicable to voice and data transmissions for both phone and mini-tablet modes must be taken into consideration to determine SAR testing and exclusion requirements



Wireless Technology Related

- EvDo Rev. B supports carrier aggregation
 - recent implementations allow up to 3 carriers to transmit simultaneously within the same frequency band
 - SAR testing requires each carrier to be controlled separately by a basestation simulator in a coordinated manner
 - KDB inquiry must include details of the test setup
 - TCB must review and ensure the detailed test setup is acceptable before submitting a PBA

- Phones with Wi-Fi Direct capabilities
 - when the optional “cross-connection” feature is available, a device can provide infrastructure access (AP) to other devices under its control
 - this type of unattended operation is transparent to users, which may require additional simultaneous transmission SAR tests in all applicable exposure conditions



Third-Party Accessory Testing

- Third-party accessories, such sleeves with or without built-in transmitters
 - must demonstrate SAR compliance with accessory attached to the hosts
 - a KDB inquiry is required to determine the applicable test configurations
 - maximum output power and SAR distribution of the host test sample(s) must be verified without the accessory attached and acceptable before testing with the accessory attached to a host sample
 - for each wireless mode and exposure conditions in each frequency band
 - the host SAR without accessory attached, when adjusted to 100% duty factor must be within 15% of those reported in host equipment certification
 - phones that require proprietary test mode, software or test setup to perform the necessary tests may require licensing and support agreement from the original host manufacturer to use such features
 - publically available apps should be used for Wi-Fi SAR testing
 - must support file transfer for the duration of area and/or zoom scan
 - at > 80% transmission duty factor and remain stable during measurement
 - all test setup and relevant information must be included in SAR reports



KDB 941225

LTE

HSPA, HSPA+, DC-HSDPA, 1x-Advanced

UMPC Mini-Tablet

Hotspot Mode

Wireless Charging Battery Cover



TDD LTE Considerations

- SAR must be tested with a fixed periodic duty factor
 - according to the highest transmission duty factor implemented for the device and supported by 3GPP
 - see 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
 - “special subframe S” contains both uplink and downlink transmissions and must be taken into consideration to determine the transmission duty factor
 - according to the worst case uplink and downlink cyclic prefix requirements for UpPTS to determine the highest SAR test duty factor
 - unless there are questions for the test setup or equipment concerns, a KDB inquiry is not necessary
- TCB must review and confirm the duty factor and test setup before submitting a PBA



HSPA/HSPA⁺/DC-HSDPA

- KDB 941225 has been updated for HSPA, HSPA⁺ and DC-HSDPA
 - SAR test exclusion applies
 - when maximum output power is $\leq \frac{1}{4}$ dB higher than without HSPA, HSPA⁺ or DC-HSDPA using 12.2 kbps RMC, and
 - when maximum SAR for 12.2 kbps RMC is $\leq 75\%$ of SAR limit
 - SAR is normally not required for HSPA, HSPA⁺ and DC-HSDPA
 - when SAR measurement is necessary, a KDB inquiry is required to confirm testing issues
 - a PBA is required when there is no KDB confirmation
- For consistency and potential SAR measurement difficult, the same exclusion criteria apply to HSPA and HSPA⁺
- When E-MPR applies, the normal MPR targets may be modified by the measured Cubic Metric, which should be taken into consideration and explained in the SAR report



1x-Advanced

- PBA is not required for 1x-Advanced
- Apply existing 1x procedures to measure maximum output power for 1x-Advanced
 - using SO75, with RC8 in uplink and RC11 in downlink
 - smart blanking must be disabled
 - use Forward Power Control Mode 000 and 400 bps for Reverse Power Control; i.e., 400 kHz for both uplink and downlink power control
- Based on the maximum output power measured for 1x-Advanced, apply the 1x procedures to determine SAR test exclusion
 - SAR is not required if the maximum output for 1x-Advanced is $\leq \frac{1}{4}$ dB higher than the maximum output measured for 1x
- If the measured SAR in any 1x mode exposure conditions (head, body etc.) is > 1.2 W/kg, repeat the highest SAR configuration for each exposure condition in 1x-Advanced mode
 - left, right, touch and tilt are considered as one exposure condition
- All measured SAR in 1x mode > 1.5 W/kg must be repeated in 1x-Advanced mode



UMPC Mini-Tablet

- Procedures have been updated to realign with other revised KDBs
 - handsets, tablets, phablets and with respect to voice and data mode operations
- Voice communication for UMPC mini-tablets should be limited to speaker mode only
 - additional SAR may be necessary if data mode SAR does not cover voice/speaker mode use for new/evolving products
- When next to the ear voice operations are supported
 - the phablet procedures in KDB 648474 must be applied
- When proximity sensor is used, the procedures in KDB 616217 should be applied
- Removed duplicate information and procedures that have been included in the revised versions of other KDB publications



Hotspot Mode & Battery Cover

- Procedures have been updated to realign with other revised KDBs
 - referencing applicable procedures in KDB 447498
 - removed obsolete reference to $60/f_{(\text{GHz})}$
 - clarified that voice and data mode SAR test configurations can be different for some wireless modes when using hotspot mode results to support body-worn SAR compliance
- Removed duplicate information and procedures that have been included in the revised versions of other KDB publications
- Wireless charging battery cover KDB has some minor update to include more current info



KDB 388624

PBA List



PBA List

- PBA is required for TDD when SAR measurement is required
 - some TDD configurations may qualify for SAR test exclusion; e.g. DECT
- PBA is required for HSPA, HSPA⁺ and DC-HSDPA only when SAR measurement is necessary and there is no test lab KDB confirmation
- PBA is not required for Rel. 9 LTE
 - confirm with a KDB inquiry if there are questions
- PBA is required for 3GPP Rel. 10 and higher
- PBA is not required for 1x-Advanced
- PBA is required for power increase features to selectively boost the maximum conducted output power within output requirements on the grant
- Clarified PBA requirement for (non-standard) phantom configurations and test procedures, with respect to flat and SAM phantoms
 - “non-standard” typically refers to configurations and procedures not described in the *published RF exposure KDB procedures*
- Effective date: to be determined



Other RF Exposure Procedures Updates



Miscellaneous Updates

- EvDo guidance from October 2012 TCB workshop continues to apply
- Update for 802.11, KDB 248227, is still pending
- PBA for channel/carrier aggregation does not apply to 802.11ac single 80 MHz channels transmitting one channel at time, not simultaneously, in different 5 GHz bands
 - apply usual 802.11 test exclusion considerations, but include 802.11ac SAR for highest 802.11a configuration in each 5 GHz band and each exposure condition
- When test software and firmware are used, with or without a basestation simulator, the non-standard test setup must be clearly explained in SAR reports to qualify for TCB approval
- 2.1091(d)(4) applies to user and bystander exposure for WLL-like devices with a traditional telephone handset
 - SAR is required at 2.5 cm from the antenna
 - KDB is recommended for swivel antenna
 - larger test distance may be considered with appropriate justification through KDB inquiry



Miscellaneous Updates

- Touch screen laptop computers may have use conditions that are not covered by existing SAR procedures
 - if unclear, submit a KDB inquiry
- Due to evolving implementations, when G-sensors are used to trigger power reduction
 - PBA requirement could be unclear; a KDB inquiry is recommended
- Devices and modules approved according to earlier $60/f_{(\text{GHz})}$ test exclusion
 - may need Class II permissive change when used in configurations that do not satisfy the test exclusion conditions in latest version of KDB 447498
 - $60/f$ was not intended for separation distances < 2.5 cm and mainly intended for previous generation product configurations
 - KDB 447498 SAR test exclusion may not apply to some higher output low power devices with separation distances < 25 mm
- Third-party SAR probe and dipole calibration requires original manufacturer accreditation and FCC coordination



Miscellaneous Updates

- RF exposure compliance is determined at the maximum average power level according to source-based time averaging requirements
 - maximum conducted power applies to SAR
 - ERP applies to MPE
 - when allowed by the applicable radio service rules, devices with no provision for conducted power measurements; for example, FRS devices, SAR test exclusion should be based on the maximum conducted output power determined by the hardware design requirements
 - not recommended for transmitters in products they normally have antenna ports
- With KDB confirmation, item 17 a) in PBA list allows PBA to be waived when power reduction implementation is for a fixed level, according to table lookup and triggered by a single specific event
 - when multiple mechanisms are used to trigger power reduction, according to fixed table lookup procedures, PBA requirement applies



Miscellaneous Updates

- RF exposure considerations for 15.255 devices operating in 60 GHz band under portable exposure conditions
 - compliance is with respect to power density limit
 - 5 cm distance in the rules are intended for measurement with RF survey probes, typically at lower frequencies
 - evaluation must be consistent with use conditions of final (host) product
- Antennas arrays and beam-forming are typically used
 - details are required to determine the RF exposure test requirements
 - including beam angles and antenna coverage with respect to product configuration and use conditions; including coherent signal issues
- Calibrated miniature waveguide probes may be used for field measurements
 - at closest far-field distance and extrapolate to the required test distance by accounting for free-space attenuation to determine compliance
 - all typical 60 GHz field measurement concerns must be taken into consideration
 - waveguide probes used for measurement must be surrounded by RF absorbers



Recent Rulemaking Activity

FCC 13-39

ET Docket 03-137

ET Docket 13-84



RF Exposure Rulemaking

- Three Part rulemaking adopted on March 27, 2013
- Order (Terminated previous docket 03-137)
 - adopts rules on certain “settled” issues.
 - OET is reviewing the adopted changes to determine if KDB guidance documents need updating or new guidance to be provided
 - many of the issues raised in the Further Notice
- Further Notice of Proposed Rulemaking (New docket 13-84)
 - invites comments on a variety of proposals
 - proposed exemption criteria for low power transmitters
 - based on frequency, power and distance
 - proposes guidelines for Occupational use
- Notice of Inquiry (Docket 13-84)
 - provides opportunity for comments on exposure limits
 - need for revision of evaluation procedures
 - further review of information to consumers
- Comments on the rulemaking should be provided directly to the Commission’s ECFS system (and not to the current draft KDBs)
 - current KDB guidance continue to apply based on the existing rules