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**Federal Communications Commission  
Office of Engineering and Technology  
Laboratory Division Public Draft Review**

**Draft Laboratory Division Publications Report**

**Title:** RF Exposure Compliance Reporting and Documentation Considerations

**Short Title:** SAR Reporting

**Reason:** Revision of attachment [865664 D02 SAR Reporting](#)

**Publication:** 865664

**Keyword/Subject:** SAR, 3 - 6 GHz, Section 2.1093

**First Category:** Radio Frequency (RF) Exposure

**Second Category:** Testing

**Third Category:**

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**Question:** Is there any additional guidance for SAR measurements that addresses devices operating in the 3 to 6 GHz range?

**Answer:**

Yes, see the attached documents:

865664 D01 SAR measurement 100 MHz to 6 GHz v01r01 describes SAR measurement procedures for devices operating between 100 MHz to 6 GHz.

865664 D02 SAR Reporting v01r01 provides general reporting requirements as well as certain specific information required to support MPE and SAR compliance.

**Attachment List:**

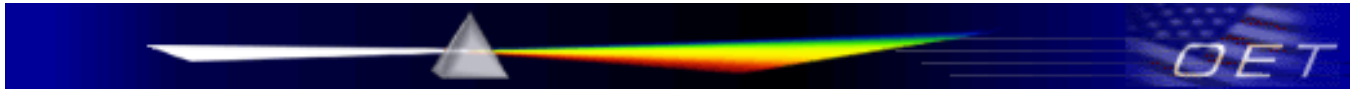
865664 D01 SAR measurement 3 to 6 GHz v01r01<sup>1</sup>

[865664 D02 SAR Reporting v01r01](#)<sup>2</sup>

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<sup>1</sup> 865664 D01 SAR measurement 3 to 6 GHz v01r01 is also available for review (until May 15th 2013), posted as a separate draft publications: [865664 D01 SAR measurement 3 to 6 GHz v01r01 DR04-41372](#). Comments to D01 must be filed under that separate draft posting and not under this draft posting.

<sup>2</sup> This draft is for attachment [865664 D02 SAR Reporting v01r01](#) which will be published by May 20, 2013. Prior to publication, applicants can use this draft guidance during the interim period for compliance testing.



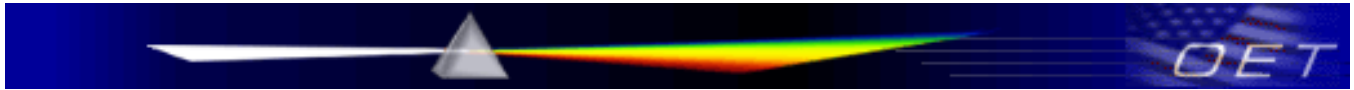
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## RF Exposure Compliance Reporting and Documentation Considerations

### Table of Contents

1. Introduction .....	2
2. Reporting RF Exposure Compliance.....	2
2.1. Information for all test reports .....	2
2.2. Information for MPE reports.....	3
2.3. Information for SAR reports .....	4
2.4. Information for analysis reports .....	6





## 1. Introduction

This document provides general guidance for manufacturers and test labs to prepare RF exposure test reports to document compliance for mobile and portable transmitting devices. While there is no requirement for test reports to be in a specific format, the reports should include all relevant information and test results in a structured manner as standalone documents, according to the device descriptions, test setup, equipment configurations, test procedures and supporting data, required for equipment approval. The following reporting and documentation guidelines should be considered to ensure reporting consistency and to avoid unnecessary delays in the TCB review and approval process.

## 2. Reporting RF Exposure Compliance

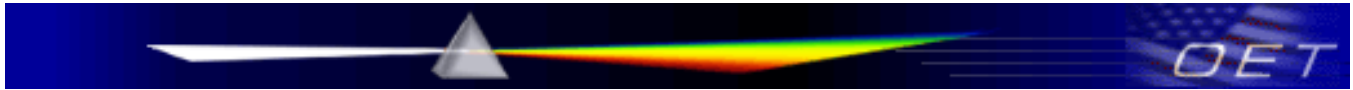
### 2.1. Information for all test reports

The following are generally required in all RF exposure test and analysis reports.

- 1) A test report must include the applicable device information, operating configurations and test setup descriptions to support the results as a standalone document.
- 2) A statement of compliance is required and should be included at the beginning of the test report to identify the applicable FCC RF exposure rules, transmitter operating requirements and exposure conditions.
- 3) The information and test data required to demonstrate compliance for FCC equipment authorization must be included in the test report. Information and test results that are not relevant to the equipment approval, when included should have prior FCC confirmation to avoid issues and must be clearly identified at the beginning of the test report as inapplicable for FCC equipment approval.<sup>1</sup>
- 4) The operating modes and exposure conditions of all wireless technologies applicable to the equipment approval must be clearly described in a separate section of the report, near the beginning, to support the test setup. The information should include at least the following.
  - a) The nominal and maximum output power of all wireless modes and frequency bands of production units should be specified. Tune-up tolerances should also be included when it is required for equipment authorization; otherwise, the maximum power allowed for production units should be identified. When multiple maximum output power levels are specified for a wireless or operating mode; for example, different time slots, data rates or modulation requirements, such as GPRS, EDGE, 802.11, WiMax and various 3GPP implementations, the maximum output power of each configuration should be identified separately.
  - b) Antenna dimensions and separation distances should be illustrated in photos and/or diagrams, according to the wireless technologies, frequency bands and diversity requirements to support the test configurations. Information for supporting the test setup and results typically does not qualify for confidentiality. When necessary, the dimensions and distances may be identified using representative diagrams and illustrations with further reference to detailed photos and descriptions in qualified confidential information in the technical descriptions exhibit.
  - c) Voice and data mode transmission requirements in all supported operating configurations and exposure conditions for standalone and simultaneous transmission operations should be clearly identified.
  - d) Device implementation and operating requirements that can influence the RF exposure evaluation; for example, MPR, testing duty factor for TDD systems, power reduction requirements and multiple transmission configurations, such as data rate, data mode, channel bandwidth and modulation etc. should be described with sufficient details to support the required test configurations.

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<sup>1</sup> For example, "This report contains results that are immaterial for FCC equipment approval, which are clearly identified within the report." Inclusion of this type of information and results in test reports often makes it more difficult to review the test results for FCC equipment approval; therefore, it should be minimized to avoid confusion and unnecessary approval delays. To expedite TCB review process, a copy of the FCC confirmation should be provided to the TCB.

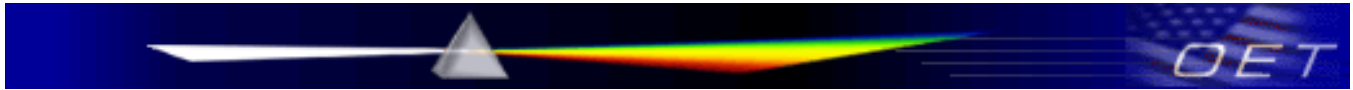


- e) Accessories supplied with the device or available as options from the device manufacturer or provisions for supporting other after-market accessories that can influence the RF exposure evaluation; for example, body-worn accessories, wireless charging and NFC battery covers etc. should be identified to support the required test configurations or to qualify for test exclusion.
  - f) Optional antennas for supporting additional mobile and portable exposure conditions should be clearly described to identify and support the required test configurations.
  - g) Other device operating capabilities that can influence the RF exposure evaluation but do not require RF exposure evaluation should also be identified.
  - h) Justifications for device operations and implementation restrictions to obviate RF exposure evaluation are required for test reports to support compliance.
- 5) The device test setup and operating configurations used to establish transmission in various wireless modes should be documented in a separate section of the test report. The information should include at least the following.
- a) The test setup, measurement procedures and KDB numbers of *published RF exposure KDB procedures* applied to test the device, include latest applicable TCB workshop guidance, should be clearly identified. Information for test codes and commands that qualify for confidentiality, when included in confidential exhibits must be clearly referenced in the test reports. Other information and descriptions that are unrelated or irrelevant to the actual tests applied to the device should not be included in test reports.
  - b) Test guidance and other considerations provided through specific KDB inquiries to manufacturers and test labs should be fully described in test reports to support the test results. KDB tracking numbers should not be identified in test reports (see KDB 388624 D01). Test procedures generally do not qualify for confidentiality.
  - c) Source-based time-averaging duty factors that are inherent to device transmissions or applied separately to the measured results must be clearly explained in the test reports.
  - d) When test reduction and exclusion are applied, justifications according to the *published RF exposure KDB procedures* or KDB inquiries are required; for example, the relevant power and distance data etc.
  - e) Except for generic test setup photos, other diagrams and illustrations should include proper explanations and descriptions to support the test setup and measurement results.
- 6) The test and supporting equipment used to test the device should be uniquely identified in test reports, including actual calibration dates, required calibration interval and calibration status. Equipment and apparatuses that are not used in the tests should not be listed.

## 2.2. Information for MPE reports

The following are generally required in test reports to document MPE compliance.

- 1) The test setups used to evaluate and demonstrate compliance should be clearly explained in the test report and must be equivalent to the RF exposure conditions expected for normal operations. When multiple or varying exposure conditions exist, the most conservative conditions must be considered to determine compliance.
- 2) The maximum output power available at the transmitter and delivered to the antenna must be determined and reported to support the RF exposure results. Cable losses and other attenuations must be accounted for and clearly identified for the test setup and results to demonstrate compliance.
- 3) The measurement points and separation distances from the antenna and radiating structures of the transmitter should be clearly identified in test reports, if applicable, using figures and illustrations. The measured results should be reported in accordance with the required test configurations. Either the measured peak or spatially averaged results can be used to demonstrate compliance; however, it must be clearly explained in the test report.
- 4) Compliance for simultaneous transmission from multiple antennas must also be evaluated to confirm that MPE limits are not exceeded due to higher aggregated exposures in overlapping regions of adjacent antennas.



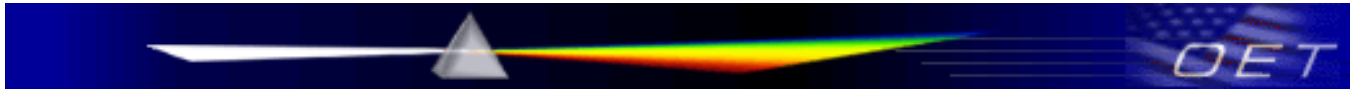
- a) The sum of the ratios of the measured peak or spatially averaged results to the applicable frequency dependent MPE limits must be  $\leq 1$  at all locations where users and bystanders can be exposed.
  - b) For complex antenna configurations, the results should be illustrated graphically according to antenna installation locations and separation distances to demonstrate compliance.
- 5) When occupational exposure limits apply, the use conditions must satisfy occupational exposure requirements. This must be fully documented in the test report and all relevant documents, such as installation and operating instructions, to substantiate the RF exposure training required for the radio operators. The antenna installation and operating restrictions must also be identified in the required documentation to ensure compliance.

### 2.3. Information for SAR reports

The following are generally required in test reports to document SAR compliance.

- 1) SAR system validation status and system verification results should be documented in a separate section of the SAR report, or as an attachment, to confirm measurement accuracy.
  - a) SAR measurement systems are validated according to procedures in KDB 865664 (D01). While detailed system validation results are not required in the SAR report, the validation status should be documented according to the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters. When multiple SAR systems are used to test a device, the validation status of each SAR system must be documented separately according to the associated system components. System validation status should be documented in a tabulated summary.
  - b) System verification is required for the probe calibration points used to measure the SAR of a device. Separate system verifications are required for head and body tissue-equivalent media, multiple SAR probes used with single or multiple systems and multiple probe calibration points used for different frequency bands etc. The tissue dielectric parameters measurement results and deviations from required target values should be reported in a tabulated summary. The measured 1-g SAR must be compared to the 1-g SAR reported in the calibration certificate of the specific dipole used in each measurement. The results should be tabulated according to the probe calibration points, SAR system and dipole used for the measurements. Return loss and impedance results are required for dipoles to qualify for extended calibration interval, which should be tabulated for comparison with the original calibration data.
- 2) Conducted output power measurements are required to support the SAR results and for scaling results to the maximum tune-up tolerance or production limit. The *published RF exposure KDB procedures* and guidance in KDB inquiries may require additional power measurements to qualify for SAR test reduction and exclusion; for example, 1x Advanced, DC-HSDPA etc. All these should be tabulated in the SAR report to support the device test conditions. When multiple maximum output power levels are applied to different transmission configurations; for example, due to time slot, data rate, transmission protocol or signal modulation requirements, such as GMSK vs. 8-PSK in EDGE and different MPR or RB configurations in WCDMA or LTE, separate maximum output power measurements are required to support the SAR test configurations and results. When power reduction is implemented, the maximum output power levels and triggering conditions for activating the power reduction and returning to normal full power conditions must be verified and reported according to *published RF exposure KDB procedures* or procedures determined through KDB inquiries. The test setup for verifying the power reduction triggering should be clearly described in the SAR report. When proximity or other sensors are used, power reduction, distance sensing, triggering and coverage must be verified and documented according to *published RF exposure KDB procedures* for the specific host platform or guidance provided through KDB inquiries. The normally required and any additional measurements of maximum output power should be listed along side the SAR results to support each test configuration.
- 3) The measured SAR results should be tabulated separately according to the test configurations documented in the test setup descriptions section of the test report, for the required test positions such as head, body-worn accessories, other use conditions (e.g. hotspot mode) and other host device specific exposure configurations. Information relating to duty factors, TDMA time-slots and maximum output power of the various operating

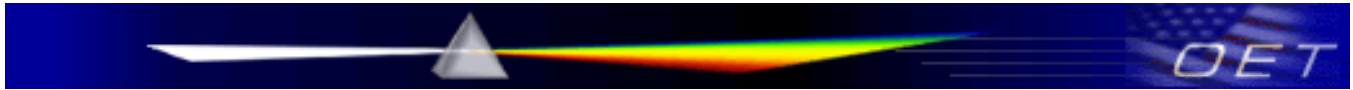




modes and conditions are also required to support the SAR results. The test results must be clearly identified when area scan based 1-g SAR estimation procedures are applied. The qualifying conditions for using the area scan based 1-g SAR must also be included in the SAR report, either with the data or in the plots.

- 4) When SAR scaling is required to determine compliance for duty factors that are neither source-based nor inherent to the measurements, the scaling procedures and scaled results should be included after the tabulated SAR summary. If the same scaling factor is applied to a group of SAR results; for example, a frequency band or operating mode, scaling the highest measured SAR within the group should generally be sufficient to demonstrate compliance. The SAR scaling procedures required by the *published RF exposure KDB procedures*, specific KDB inquiries or other FCC requirements must be correctly applied to qualify for TCB approval.
- 5) When required, the SAR measurement variability and measurement uncertainty analysis results should be included after the tabulated SAR summary, according to procedures in KDB 865664 (D01).
- 6) The analysis required to qualify for simultaneous transmission SAR test exclusion should be documented separately according to the head, body-worn accessory, other use conditions and host specific configurations described in the test setup section of the SAR report. When applying SAR peak location separation ratio test exclusion, the peak location coordinates of each test configuration must be identified according to procedures in KDB447498. The measured and estimated peak locations must be clearly identified, on SAR plots and illustrations as appropriate, to support the test exclusion. When simultaneous transmission SAR measurement is required, the enlarged zoom scan measurement and volume scan post-processing procedures must be applied to determine the aggregate SAR distribution. SAR plots for the enhanced zoom scans and post-processed volume scan, showing the peak SAR locations, are required to support the measurement configurations. When operation or implementation restrictions are required to limit certain simultaneous transmission operations and testing is not required to show compliance, these configurations must be clearly justified in the SAR report.
- 7) The SAR distribution plots should be included in a separate attachment or appendix to the SAR report. The plots should be numbered sequentially and referenced in the tabulated SAR summary to facilitate review. Information on test date, wireless mode, exposure configuration and test position, test channel & frequency, SAR probe serial number, probe conversion factors, transmission duty factor, tissue dielectric parameters, area and zoom scan measurement resolutions and dimensions, measurement drifts, 1-g or 10-g SAR and highest extrapolated SAR must be included on each SAR plot, with the peak location(s) clearly identified. When the area scan based 1-g SAR estimation provision in KDB 447498 is applied, all information, except for the zoom scan, must be included on the plots. Information on measurement point to phantom surface distance and extrapolated peak SAR at the phantom surface must be included for the area scan based 1-g SAR estimation to be acceptable.
- 8) SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; for example, WCDMA head SAR at 1900 MHz. Plots are also required when the measured SAR is  $> 1.5$  W/kg, or  $> 7.0$  W/kg for occupational exposure. The *published RF exposure KDB procedures* may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing. Z-axis plots are generally optional; these are included to address certain specific concerns, as determined by the test laboratory and measurement results. When Z-axis plots are included, the results should be extrapolated to the phantom surface and the purpose of the plots must be clearly explained in the SAR report. The relevant boundaries of the test device should be correctly illustrated on the SAR plots with the peak SAR location(s) identified on the SAR distribution.
- 9) The SAR numbers listed on the grant(s) of equipment authorization must be identified at the beginning of the SAR report, for each equipment class, according to procedures in KDB 690783. These reported numbers should be highlighted in the SAR summary results for easy reference and to ensure the proper numbers are listed on the grant(s).<sup>2</sup> The reported SAR number for simultaneous transmission is generally the same for all

<sup>2</sup> The reported numbers are based on measured SAR adjusted for maximum tune-up tolerance.



equipment classes (PCE, DTS, NII etc.) involved in the simultaneous transmission. The estimated SAR used to determine simultaneous transmission SAR test exclusion should not be reported as standalone SAR. When simultaneous transmission SAR test exclusion is applied, the estimated SAR can become a component of the highest reported SAR for simultaneous transmission on grants of equipment approval. Under no circumstances should any SAR reported on a grant of equipment authorization be higher than the SAR limit.

- 10) General specifications of the SAR system, SAR probe and dipole calibration certificates and results, tissue-equivalent media recipes, SAR system verification (dipole) plots, generic test setup photos and SAR system validation status information etc. should be included in a separate attachment or appendix to the SAR report. All scanned black and white copies of calibration certificates or other related documentation must be legible. Including only one SAR system verification plot, with the largest deviation from the dipole SAR target, for each dipole, SAR probe calibration point and SAR system combination is generally sufficient. When it is required by KDB 865664 (D01) or requested during equipment authorization, certain SAR system validation information may be required; for example, due to SAR probe linearity concerns. These should be included as attachments to the SAR report.

#### 2.4. Information for analysis reports

The following are generally required in analysis reports to document RF exposure compliance.

- 1) Details of the device operating configurations and exposure conditions, maximum output power, maximum duty factor, and other relevant information are required to support the RF exposure analysis required for test exclusion. Devices that qualify for low duty factor SAR test exclusion must clearly identify the contributing factors in the report. When the duty factor is not source-based, only operational-based duty factors approved through KDB inquiries and those allowed by the *published RF exposure KDB procedures* are acceptable. The maximum average conducted output power, including tune-up tolerance, adjusted by the most conservative duty factor, must satisfy the *SAR Exclusion Threshold* requirements in KDB 447498 to qualify for low duty test exclusion. Calculations and clear explanations must be included in the analysis to demonstrate the device qualifies for the exclusion.
- 2) When SAR test exclusion for low exposure potential due to a sufficiently large separation distance between the device and nearby persons, either built-in by design or provided through acceptable installation requirements, is confirmed through a KDB inquiry, the exposure analysis must be prepared according to the guidance provided through the KDB inquiry.
- 3) When RF exposure limits or evaluation requirements are not fully established, the provisions of §1.1307(c) and (d) are generally applied. Limits are not established for mobile exposure conditions below 300 kHz and portable exposure conditions below 100 kHz. SAR measurement procedures are generally unavailable below 100 MHz. A KDB inquiry is required to determine the RF exposure evaluation requirements for these situations. When applicable, test exclusion considerations may be considered for situations with low exposure potentials. An RF exposure analysis report is generally required to document compliance and must be prepared according to the specific guidance provided through the KDB inquiry for these circumstances.

#### Change Notice:

04/05/2013 As indicated by **track changes** in the document.