## 13.4 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 13.5 SAR Averaged Methods

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10g and 1 g requires a very fine resolution in the three dimensional scanned data array.

## 13.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In SATIMO measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

# 14. SAR Test Result

## 14.1 Conducted RF Output Power

According KDB 447498 D01 General RF Exposure Guidance v06 Section 4.1 2) states that "Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies to SAR and, as required by § 2.1091(c), time-averaged ERP applies to MPE. When an antenna port is not available on the device to support conducted power measurement, such as FRS and certain Part 15 transmitters with built-in integral antennas, the maximum output power allowed for production units should be used to determine RF exposure test exclusion and compliance."

The Tune-up limit already includes component tolerance. KDB 447498 sec.4.1.(d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

**<GSM>**
General Note:
1. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions.
3. Per October 2013 TCB Workshop: When the maximum frame-averaged powers levels are within 0.25 dB of each other, test the configuration with the most number of time slots.

**Conducted power measurement results**

| GSM - Burst Average Power (dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Band** | **GSM850** | | | **Tune-up** | **GSM1900** | | | **Tune-up** |
| **Channel** | **128** | **190** | **251** | | **512** | **661** | **810** | |
| **Frequency (MHz)** | **824.2** | **836.6** | **848.8** | | **1850.2** | **1880** | **1909.8** | |
| GSM | **31.56** | 31.35 | 31.33 | 32.0 | **29.05** | 28.98 | 28.81 | 39.5 |

| GSM - Source-Based Time-Average Power (dBm) | | | | | | |
|---|---|---|---|---|---|---|
| **Band** | **GSM850** | | | **GSM1900** | | |
| **Channel** | **128** | **190** | **251** | **512** | **661** | **810** |
| **Frequency (MHz)** | **824.2** | **836.6** | **848.8** | **1850.2** | **1880** | **1909.8** |
| GSM | 22.56 | 22.35 | 22.33 | 20.05 | 19.98 | 19.81 |

Notes:Per KDB 941225 D01, SAR is not required for EDGE (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4dB higher than GPRS/EDGE (GMSK) or the adjusted SAR of the highest reported SAR of GPRS/EDGE (GMSK) is ≤ 1.2W/kg.

**<W-CDMA>**

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station E5515C referred to theSetup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (βc and βd) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

**Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ *(SF)* | $\beta_c/\beta_d$ | $\beta_{HS}$ *(Note1, Note 2)* | CM (dB) *(Note 3)* | MPR (dB) *(Note 3)* |
|---|---|---|---|---|---|---|---|
| 1 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 0.0 | 0.0 |
| 2 | 12/15 *(Note 4)* | 15/15 *(Note 4)* | 64 | 12/15 *(Note 4)* | 24/15 | 1.0 | 0.0 |
| 3 | 15/15 | 8/15 | 64 | 15/8 | 30/15 | 1.5 | 0.5 |
| 4 | 15/15 | 4/15 | 64 | 15/4 | 30/15 | 1.5 | 0.5 |

Note 1: $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, $\Delta_{ACK}$ and $\Delta_{NACK}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$, and $\Delta_{CQI}$ = 24/15 with $\beta_{hs}$ = 24/15 * $\beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d$ =12/15, $\beta_{hs}/\beta_c$=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the $\beta_c/\beta_d$ ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 11/15 and $\beta_d$ = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base StationR&S CMU200 referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (βc and βd) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

**Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{HS}$ (Note1) | $\beta_{ec}$ | $\beta_{ed}$ (Note 5) (Note 6) | $\beta_{ed}$ (SF) | $\beta_{ed}$ (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) | AG Index (Note 6) | E-TFCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | $\beta_{ed}1$: 47/15<br>$\beta_{ed}2$: 47/15 | 4<br>4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 (Note 4) | 15/15 (Note 4) | 64 | 15/15 (Note 4) | 30/15 | 24/15 | 134/15 | 4 | 1 | 1.0 | 0.0 | 21 | 81 |

Note 1: $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d$ =12/15, $\beta_{hs}/\beta_c$=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the $\beta_c/\beta_d$ ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 10/15 and $\beta_d$ = 15/15.

Note 4: For subtest 5 the $\beta_c/\beta_d$ ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 14/15 and $\beta_d$ = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: $\beta_{ed}$ can not be set directly, it is set by Absolute Grant Value.

General Note

1. Per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If AMR 12.2kbps power is < 0.25dB higher than RMC 12.2kbps, SAR tests with AMR 12.2kbps can be excluded.
2. By design, AMR and HSDPA/HSUPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
3. It is expected by the manufacturer that MPR for some HSDPA/HSUPA subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.

**Conducted power measurement results**

| Band | WCDMA Band II | | | | WCDMA Band V | | | |
|---|---|---|---|---|---|---|---|---|
| Channel | 9262 | 9400 | 9538 | Tune-up | 4132 | 4182 | 4233 | Tune-up |
| Frequency (MHz) | 1852.4 | 1880.0 | 1907.6 | | 826.4 | 836.4 | 846.6 | |
| RMC 12.2K | 19.15 | **19.23** | 19.09 | 20.0 | 20.11 | **20.24** | 20.21 | 21.0 |
| HSDPA Subtest-1 | 19.38 | 18.64 | 18.71 | 20.0 | 20.29 | 20.51 | 19.93 | 21.0 |
| HSDPA Subtest-2 | 19.08 | 18.22 | 18.38 | | 19.96 | 20.30 | 19.85 | |
| HSDPA Subtest-3 | 18.8 | 18.03 | 18.08 | | 19.51 | 20.01 | 19.57 | |
| HSDPA Subtest-4 | 18.56 | 17.84 | 18.81 | | 19.27 | 19.68 | 19.32 | |
| HSUPA Subtest-1 | 19.34 | 18.77 | 18.65 | 20.0 | 20.21 | 20.34 | 19.76 | 21.0 |
| HSUPA Subtest-2 | 19.45 | 18.90 | 18.74 | | 20.01 | 20.41 | 19.92 | |
| HSUPA Subtest-3 | 19.20 | 18.83 | 18.45 | | 19.95 | 20.00 | 19.68 | |
| HSUPA Subtest-4 | 19.52 | 18.84 | 18.77 | | 20.18 | 20.39 | 19.92 | |
| HSUPA Subtest-5 | 19.20 | 18.60 | 18.43 | | 19.87 | 20.26 | 19.43 | |

Note:
1. Per KDB 941225 D01 v03, the 12.2kbps RMC mode was selected for SAR testing (the primary mode).
2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤1/4dB higher than the primary mode (RMC12.2kbps) or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

**<LTE>**

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.
LTE QPSK configuration has the highest maximum average output power per 3GPP standard.

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 18607 | 18900 | 19193 |
| Band2 | 1.4 | 1 | #0 | QPSK | 21.88 | 21.90 | 21.92 |
| | | 1 | #Mid | | 21.93 | 21.83 | **21.95** |
| | | 1 | #Max | | 21.92 | 21.83 | 21.94 |
| | | 3 | #0 | | 21.70 | 21.92 | 21.87 |
| | | 3 | #Mid | | 21.73 | 21.90 | 21.85 |
| | | 3 | #Max | | 21.71 | 21.89 | 21.87 |
| | | 6 | #0 | | 20.17 | 20.39 | 20.43 |
| | 1.4 | 1 | #0 | QAM16 | 21.68 | 20.34 | 21.06 |
| | | 1 | #Mid | | 21.76 | 20.37 | 21.03 |
| | | 1 | #Max | | 21.75 | 20.41 | 21.01 |
| | | 3 | #0 | | 20.96 | 20.89 | 21.22 |
| | | 3 | #Mid | | 20.98 | 20.86 | 21.18 |
| | | 3 | #Max | | 20.95 | 20.88 | 21.18 |
| | | 6 | #0 | | 19.97 | 20.10 | 20.07 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 18615 | 18900 | 19185 |
| Band2 | 3 | 1 | #0 | QPSK | 21.78 | 21.90 | 21.80 |
| | | 1 | #Mid | | 21.76 | **21.93** | 21.88 |
| | | 1 | #Max | | 21.78 | 21.89 | 21.93 |
| | | 8 | #0 | | 20.42 | 20.51 | 20.32 |
| | | 8 | #Mid | | 20.43 | 20.43 | 20.29 |
| | | 8 | #Max | | 20.23 | 20.42 | 20.29 |
| | | 15 | #0 | | 20.40 | 20.41 | 20.29 |
| | 3 | 1 | #0 | QAM16 | 21.92 | 20.37 | 20.79 |
| | | 1 | #Mid | | 21.92 | 20.39 | 20.79 |
| | | 1 | #Max | | 21.82 | 20.37 | 20.78 |
| | | 8 | #0 | | 19.84 | 19.94 | 19.87 |
| | | 8 | #Mid | | 19.81 | 19.98 | 19.80 |
| | | 8 | #Max | | 19.73 | 19.93 | 19.83 |
| | | 15 | #0 | | 19.99 | 19.94 | 19.87 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 18625 | 18900 | 19175 |
| Band2 | 5 | 1 | #0 | QPSK | 21.75 | **21.88** | 21.75 |
| | | 1 | #Mid | | 21.82 | 21.86 | 21.64 |
| | | 1 | #Max | | 21.83 | 21.83 | 21.68 |
| | | 12 | #0 | | 20.40 | 20.44 | 20.36 |
| | | 12 | #Mid | | 20.33 | 20.43 | 20.38 |
| | | 12 | #Max | | 20.34 | 20.52 | 20.36 |
| | | 25 | #0 | | 20.35 | 20.43 | 20.36 |
| | 5 | 1 | #0 | QAM16 | 21.00 | 21.05 | 20.92 |
| | | 1 | #Mid | | 20.90 | 21.18 | 20.87 |
| | | 1 | #Max | | 21.03 | 21.00 | 20.86 |
| | | 12 | #0 | | 19.85 | 19.85 | 19.93 |
| | | 12 | #Mid | | 19.74 | 19.81 | 19.94 |
| | | 12 | #Max | | 19.76 | 19.90 | 19.92 |
| | | 25 | #0 | | 19.87 | 20.03 | 19.83 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 18650 | 18900 | 19150 |
| Band2 | 10 | 1 | #0 | QPSK | 21.85 | **22.00** | 21.85 |
| | | 1 | #Mid | | 21.92 | 21.90 | 21.86 |
| | | 1 | #Max | | 21.98 | 21.89 | 21.97 |
| | | 25 | #0 | | 20.38 | 20.52 | 20.36 |
| | | 25 | #Mid | | 20.31 | 20.49 | 20.46 |
| | | 25 | #Max | | 20.37 | 20.38 | 20.44 |
| | | 50 | #0 | | 20.39 | 20.45 | 20.38 |
| | 10 | 1 | #0 | QAM16 | 21.99 | 21.70 | 21.17 |
| | | 1 | #Mid | | 21.97 | 21.75 | 21.27 |
| | | 1 | #Max | | 22.07 | 21.70 | 21.08 |
| | | 25 | #0 | | 19.75 | 20.11 | 19.91 |
| | | 25 | #Mid | | 19.82 | 20.07 | 19.99 |
| | | 25 | #Max | | 19.82 | 20.00 | 20.01 |
| | | 50 | #0 | | 19.87 | 20.08 | 19.93 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 18675 | 18900 | 19125 |
| Band2 | 15 | 1 | #0 | QPSK | 21.91 | **21.98** | 21.75 |
| | | 1 | #Mid | | 21.89 | 21.95 | 21.78 |
| | | 1 | #Max | | 22.03 | 21.84 | 21.83 |
| | | 36 | #0 | | 20.45 | 20.48 | 20.35 |
| | | 36 | #Mid | | 20.48 | 20.46 | 20.38 |
| | | 36 | #Max | | 20.50 | 20.43 | 20.40 |
| | | 75 | #0 | | 20.46 | 20.51 | 20.40 |
| | 15 | 1 | #0 | QAM16 | 21.88 | 21.81 | 21.69 |
| | | 1 | #Mid | | 21.93 | 21.67 | 21.67 |
| | | 1 | #Max | | 22.10 | 21.58 | 21.70 |
| | | 36 | #0 | | 19.95 | 20.18 | 19.91 |
| | | 36 | #Mid | | 20.06 | 20.13 | 19.87 |
| | | 36 | #Max | | 20.09 | 20.08 | 19.90 |
| | | 75 | #0 | | 19.89 | 19.97 | 20.01 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 18700 | 18900 | 19100 |
| Band2 | 20 | 1 | #0 | QPSK | 21.93 | **22.21** | 21.87 |
| | | 1 | #Mid | | 22.07 | 22.07 | 21.84 |
| | | 1 | #Max | | 22.15 | 22.04 | 21.96 |
| | | 50 | #0 | | 20.43 | 20.63 | 20.44 |
| | | 50 | #Mid | | 20.47 | 20.50 | 20.33 |
| | | 50 | #Max | | 20.57 | 20.42 | 20.44 |
| | | 100 | #0 | | 20.42 | 20.47 | 20.35 |
| | 20 | 1 | #0 | QAM16 | 20.54 | 20.61 | 21.19 |
| | | 1 | #Mid | | 20.64 | 20.53 | 21.15 |
| | | 1 | #Max | | 20.82 | 20.52 | 21.19 |
| | | 50 | #0 | | 20.02 | 20.02 | 19.99 |
| | | 50 | #Mid | | 20.09 | 20.00 | 19.98 |
| | | 50 | #Max | | 20.22 | 19.96 | 20.02 |
| | | 100 | #0 | | 19.97 | 19.97 | 19.99 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 19957 | 20175 | 20393 |
| Band4 | 1.4 | 1 | #0 | QPSK | 19.78 | 19.85 | 19.66 |
| | | 1 | #Mid | | 19.75 | **19.94** | 19.77 |
| | | 1 | #Max | | 19.83 | 19.86 | 19.65 |
| | | 3 | #0 | | 19.63 | 19.71 | 19.52 |
| | | 3 | #Mid | | 19.66 | 19.74 | 19.58 |
| | | 3 | #Max | | 19.66 | 19.80 | 19.52 |
| | | 6 | #0 | | 18.68 | 18.77 | 18.58 |
| | 1.4 | 1 | #0 | QAM16 | 19.57 | 18.76 | 18.11 |
| | | 1 | #Mid | | 19.62 | 18.80 | 18.25 |
| | | 1 | #Max | | 19.62 | 18.76 | 18.16 |
| | | 3 | #0 | | 18.95 | 18.85 | 18.48 |
| | | 3 | #Mid | | 18.92 | 18.88 | 18.48 |
| | | 3 | #Max | | 18.92 | 18.88 | 18.49 |
| | | 6 | #0 | | 17.89 | 17.77 | 17.66 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 19965 | 20175 | 20385 |
| Band4 | 3 | 1 | #0 | QPSK | 19.70 | 19.89 | 19.75 |
| | | 1 | #Mid | | 19.71 | **19.98** | 19.73 |
| | | 1 | #Max | | 19.76 | 19.93 | 19.70 |
| | | 8 | #0 | | 18.69 | 18.85 | 18.57 |
| | | 8 | #Mid | | 18.76 | 18.86 | 18.62 |
| | | 8 | #Max | | 18.73 | 18.78 | 18.59 |
| | | 15 | #0 | | 18.69 | 18.81 | 18.59 |
| | 3 | 1 | #0 | QAM16 | 19.77 | 19.55 | 18.32 |
| | | 1 | #Mid | | 19.75 | 19.46 | 18.26 |
| | | 1 | #Max | | 19.77 | 19.52 | 18.15 |
| | | 8 | #0 | | 17.66 | 18.07 | 17.75 |
| | | 8 | #Mid | | 17.66 | 18.09 | 17.80 |
| | | 8 | #Max | | 17.58 | 18.07 | 17.78 |
| | | 15 | #0 | | 17.82 | 17.81 | 17.62 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 19975 | 20175 | 20375 |
| Band4 | 5 | 1 | #0 | QPSK | 19.73 | 19.77 | 19.45 |
| | | 1 | #Mid | | 19.71 | **19.79** | 19.36 |
| | | 1 | #Max | | 19.63 | 19.74 | 19.37 |
| | | 12 | #0 | | 18.76 | 18.87 | 18.58 |
| | | 12 | #Mid | | 18.69 | 18.84 | 18.60 |
| | | 12 | #Max | | 18.76 | 18.86 | 18.62 |
| | | 25 | #0 | | 18.77 | 18.82 | 18.59 |
| | 5 | 1 | #0 | QAM16 | 18.83 | 18.84 | 19.20 |
| | | 1 | #Mid | | 18.75 | 18.82 | 19.11 |
| | | 1 | #Max | | 18.80 | 18.84 | 19.20 |
| | | 12 | #0 | | 17.64 | 17.69 | 17.60 |
| | | 12 | #Mid | | 17.61 | 17.65 | 17.57 |
| | | 12 | #Max | | 17.65 | 17.66 | 17.59 |
| | | 25 | #0 | | 17.88 | 17.88 | 17.77 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20000 | 20175 | 20350 |
| Band4 | 10 | 1 | #0 | QPSK | 19.64 | 19.76 | 19.65 |
| | | 1 | #Mid | | 19.64 | 19.74 | 19.62 |
| | | 1 | #Max | | 19.66 | 19.76 | 19.63 |
| | | 25 | #0 | | 18.69 | 18.75 | 18.66 |
| | | 25 | #Mid | | 18.73 | 18.87 | 18.53 |
| | | 25 | #Max | | 18.78 | 18.77 | 18.55 |
| | | 50 | #0 | | 18.69 | 18.89 | 18.65 |
| | 10 | 1 | #0 | QAM16 | 19.69 | 19.49 | 19.51 |
| | | 1 | #Mid | | 19.74 | 19.56 | 19.31 |
| | | 1 | #Max | | **19.81** | 19.45 | 19.47 |
| | | 25 | #0 | | 17.74 | 17.88 | 17.81 |
| | | 25 | #Mid | | 17.78 | 17.88 | 17.71 |
| | | 25 | #Max | | 17.77 | 17.90 | 17.71 |
| | | 50 | #0 | | 17.82 | 17.87 | 17.59 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20025 | 20175 | 20325 |
| Band4 | 15 | 1 | #0 | QPSK | 19.61 | 19.76 | 19.71 |
| | | 1 | #Mid | | 19.70 | **19.77** | 19.65 |
| | | 1 | #Max | | 19.68 | 19.70 | 19.59 |
| | | 36 | #0 | | 18.69 | 18.93 | 18.77 |
| | | 36 | #Mid | | 18.74 | 18.85 | 18.69 |
| | | 36 | #Max | | 18.79 | 18.87 | 18.70 |
| | | 75 | #0 | | 18.76 | 18.89 | 18.75 |
| | 15 | 1 | #0 | QAM16 | 19.76 | 19.55 | 19.69 |
| | | 1 | #Mid | | 19.75 | 19.52 | 19.64 |
| | | 1 | #Max | | 19.83 | 19.48 | 19.49 |
| | | 36 | #0 | | 17.75 | 17.99 | 17.58 |
| | | 36 | #Mid | | 17.72 | 17.98 | 17.68 |
| | | 36 | #Max | | 17.76 | 17.98 | 17.61 |
| | | 75 | #0 | | 17.82 | 17.83 | 17.79 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20050 | 20175 | 20300 |
| Band4 | 20 | 1 | #0 | QPSK | 19.81 | **19.96** | 19.68 |
| | | 1 | #Mid | | 19.66 | 19.96 | 19.60 |
| | | 1 | #Max | | 19.74 | 19.86 | 19.52 |
| | | 50 | #0 | | 18.65 | 18.67 | 18.57 |
| | | 50 | #Mid | | 18.71 | 18.79 | 18.46 |
| | | 50 | #Max | | 18.67 | 18.70 | 18.46 |
| | | 100 | #0 | | 18.67 | 18.72 | 18.62 |
| | 20 | 1 | #0 | QAM16 | 18.67 | 18.74 | 19.11 |
| | | 1 | #Mid | | 18.68 | 18.82 | 19.06 |
| | | 1 | #Max | | 18.77 | 18.73 | 18.90 |
| | | 50 | #0 | | 17.73 | 17.75 | 17.73 |
| | | 50 | #Mid | | 17.83 | 17.76 | 17.67 |
| | | 50 | #Max | | 17.84 | 17.73 | 17.57 |
| | | 100 | #0 | | 17.74 | 17.76 | 17.63 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20775 | 21100 | 21425 |
| Band7 | 5 | 1 | #0 | QPSK | **19.42** | 19.23 | 18.76 |
| | | 1 | #Mid | | 19.40 | 19.08 | 18.68 |
| | | 1 | #Max | | 19.38 | 19.12 | 18.65 |
| | | 12 | #0 | | 18.56 | 18.36 | 17.85 |
| | | 12 | #Mid | | 18.49 | 18.34 | 17.80 |
| | | 12 | #Max | | 18.38 | 18.30 | 17.71 |
| | | 25 | #0 | | 18.54 | 18.22 | 17.80 |
| | 5 | 1 | #0 | QAM16 | 18.22 | 18.37 | 17.86 |
| | | 1 | #Mid | | 18.31 | 18.39 | 17.87 |
| | | 1 | #Max | | 18.52 | 18.38 | 17.97 |
| | | 12 | #0 | | 17.46 | 17.33 | 16.70 |
| | | 12 | #Mid | | 17.38 | 17.32 | 16.70 |
| | | 12 | #Max | | 17.37 | 17.27 | 17.03 |
| | | 25 | #0 | | 17.55 | 17.21 | 17.06 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20800 | 21100 | 21400 |
| Band7 | 10 | 1 | #0 | QPSK | 19.47 | 19.39 | 18.80 |
| | | 1 | #Mid | | 19.40 | 19.34 | 18.79 |
| | | 1 | #Max | | 19.47 | 19.40 | 18.85 |
| | | 25 | #0 | | 18.45 | 18.24 | 17.79 |
| | | 25 | #Mid | | 18.42 | 18.33 | 17.71 |
| | | 25 | #Max | | 18.35 | 18.23 | 17.81 |
| | | 50 | #0 | | 18.47 | 18.40 | 17.77 |
| | 10 | 1 | #0 | QAM16 | **19.60** | 18.33 | 17.89 |
| | | 1 | #Mid | | 19.54 | 18.29 | 17.78 |
| | | 1 | #Max | | 19.47 | 18.33 | 17.79 |
| | | 25 | #0 | | 17.45 | 17.40 | 17.21 |
| | | 25 | #Mid | | 17.84 | 17.39 | 17.21 |
| | | 25 | #Max | | 17.35 | 17.40 | 16.93 |
| | | 50 | #0 | | 17.84 | 17.44 | 17.15 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20825 | 21100 | 21375 |
| Band7 | 15 | 1 | #0 | QPSK | 19.41 | 19.30 | 18.83 |
| | | 1 | #Mid | | 19.31 | 19.32 | 18.72 |
| | | 1 | #Max | | 19.14 | 19.35 | 18.85 |
| | | 36 | #0 | | 18.36 | 18.25 | 17.87 |
| | | 36 | #Mid | | 18.54 | 18.28 | 17.85 |
| | | 36 | #Max | | 18.33 | 18.27 | 17.77 |
| | | 75 | #0 | | 18.44 | 18.31 | 17.81 |
| | 15 | 1 | #0 | QAM16 | **19.63** | 18.36 | 18.65 |
| | | 1 | #Mid | | 19.36 | 18.38 | 18.51 |
| | | 1 | #Max | | 19.34 | 18.36 | 18.61 |
| | | 36 | #0 | | 17.92 | 17.45 | 16.92 |
| | | 36 | #Mid | | 17.46 | 17.51 | 17.30 |
| | | 36 | #Max | | 17.49 | 17.41 | 16.83 |
| | | 75 | #0 | | 17.45 | 17.38 | 17.21 |

| Band | Bandwidth (MHz) | RB Size | RB Position | Modulation | Channel | | |
|---|---|---|---|---|---|---|---|
| | | | | | 20850 | 21100 | 21350 |
| Band7 | 20 | 1 | #0 | QPSK | 19.42 | 19.56 | 19.04 |
| | | 1 | #Mid | | 19.22 | **19.61** | 18.89 |
| | | 1 | #Max | | 19.10 | 19.55 | 18.87 |
| | | 50 | #0 | | 18.37 | 18.29 | 17.94 |
| | | 50 | #Mid | | 18.42 | 18.27 | 17.85 |
| | | 50 | #Max | | 18.31 | 18.17 | 17.78 |
| | | 100 | #0 | | 18.32 | 18.32 | 17.82 |
| | 20 | 1 | #0 | QAM16 | 18.74 | 18.21 | 18.48 |
| | | 1 | #Mid | | 18.62 | 18.39 | 18.25 |
| | | 1 | #Max | | 18.47 | 18.26 | 18.26 |
| | | 50 | #0 | | 17.96 | 17.43 | 17.06 |
| | | 50 | #Mid | | 17.57 | 17.41 | 16.94 |
| | | 50 | #Max | | 17.41 | 17.29 | 17.22 |
| | | 100 | #0 | | 17.48 | 17.29 | 17.01 |

| WLAN 2.4G | | | |
|---|---|---|---|
| Mode | Frequency | Maximum Conducted Output Power | Tune-up power |
| | (MHz) | (dBm) | (dBm) |
| 802.11b | 2412 | 16.78 | 17.0 |
| | 2437 | 16.80 | |
| | 2462 | 16.19 | |
| 802.11g | 2412 | 16.00 | 17.0 |
| | 2437 | 16.38 | |
| | 2462 | 16.21 | |
| 802.11n20 | 2412 | 16.14 | 17.0 |
| | 2437 | 15.41 | |
| | 2462 | 16.49 | |
| 802.11n40 | 2422 | 15.98 | 17.0 |
| | 2437 | **16.81** | |
| | 2452 | 16.42 | |

Note:
1. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 b/g/n modes, the channel in the lower order/sequence 802.11 mode (i.e. g, n) is selected. Therefore the SAR measurements performed for the 802.11b modes, as the lowest order modulation, cover 802.11g/n modes.
2. SAR is not required for the following 2.4 GHz OFDM conditions as the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
3. Per KDB 248227 D01 v02r02, For 802.11b DSSS SAR measurements ,when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ⩽ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

| Bluetooth | | | |
|---|---|---|---|
| Modulation | Frequency (MHz) | Output Power (dBm) | Tune-up power (dBm) |
| 1-DH1 | 2402 | 4.58 | 5.0 |
| | 2441 | 3.89 | |
| | 2480 | 2.70 | |
| 2-DH1 | 2402 | 4.74 | 5.0 |
| | 2441 | 3.90 | |
| | 2480 | 3.01 | |
| 3-DH1 | 2402 | **5.04** | 5.5 |
| | 2441 | 4.76 | |
| | 2480 | 3.64 | |

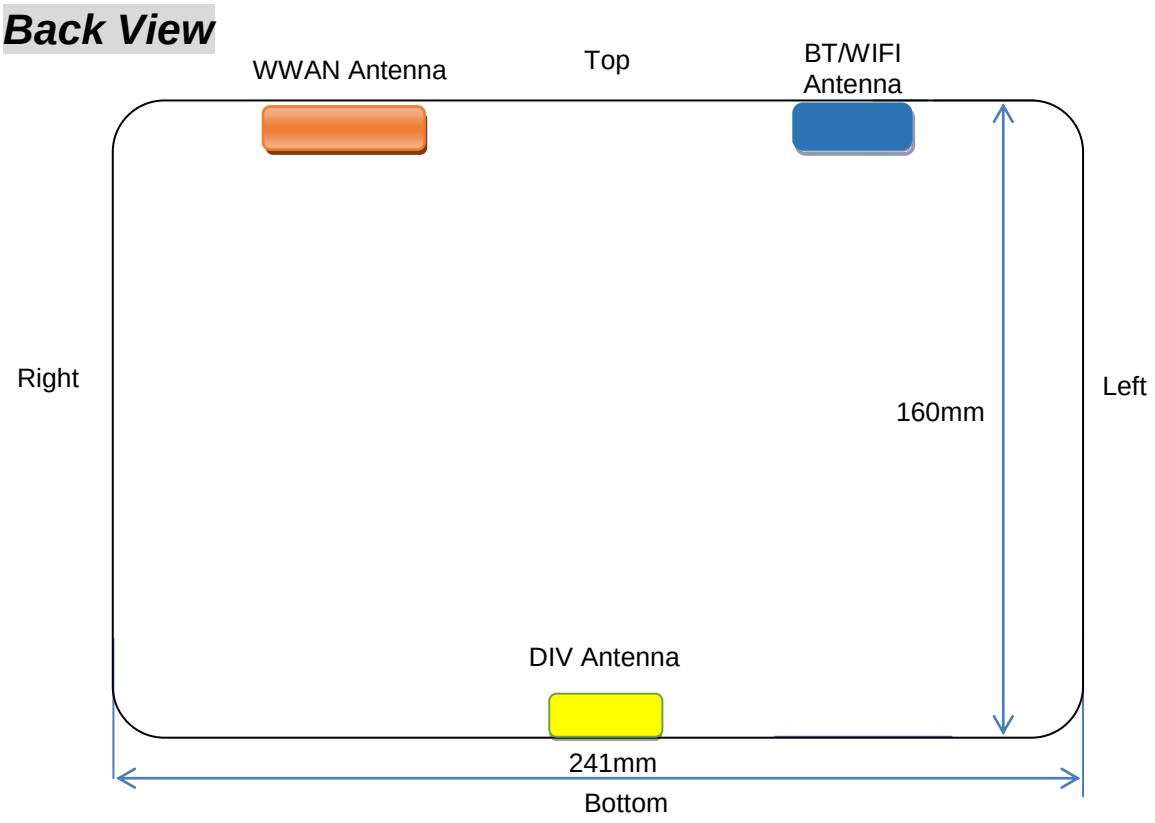
Note:
Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] •[ √f(GHz)] ≤ 3.0 for1-g SAR and ≤ 7.5 for 10-g extremity SAR
f(GHz) is the RF channel transmit frequency in GHz
Power and distance are rounded to the nearest mW and mm before calculation
The result is rounded to one decimal place for comparison

| Bluetooth Turn up Power (dBm) | Bluetooth Turn up Power (mW) | Separation Distance (mm) | Frequency (GHz) | Result | Exclusion Thresholds |
|---|---|---|---|---|---|
| 2.0 | 3.55 | 5 | 2.48 | 0.149 | 3.0 |

Per KDB 447498 D01v06, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
According to the calculation results in the table above, BT SAR does not need to be tested.

## 14.2 Transmit Antennas and SAR Measurement Position

**EUT Antenna Location:**




| Antennas | Support Band |
|---|---|
| WWAN | GSM 850/1900+WCDMA Band 2/5+LTE Band 2/4/7 TX |
| DIV | GSM 850/1900+WCDMA Band 2/5+LTE Band 2/4/7 RX |
| BT/WIFI | BT+2.4G WIFI |

| Distance of The Antenna to the EUT surface and edge (mm) | | | | | | |
|---|---|---|---|---|---|---|
| Antennas | Front | Back | Top Side | Bottom Side | Left Side | Right Side |
| WWAN | <25 | <25 | <25 | 158 | 70 | 170 |
| BT/WIFI | <25 | <25 | <25 | 158 | 220 | 40 |

**EUT Testing Location Evaluation:**

| Positions for SAR tests; Hotspot mode | | | | | | |
|---|---|---|---|---|---|---|
| Antennas | Front | Back | Top Side | Bottom Side | Left Side | Right Side |
| WWAN | Yes | Yes | Yes | No | No | No |
| BT/WIFI | Yes | Yes | Yes | No | No | No |

Note:

1. According to the KDB 941225 D06 Hot Spot SAR v02, the edges with less than 25 mm distance to the antennas need to be tested for SAR.

## 14.3 Measured and Reported (Scaled) SAR Results

The calculated SAR is obtained by the following formula:
1. Reported SAR for WWAN=Measured SAR * Tune-up Scaling factor
2. Reported SAR for WLAN and Bluetooth=Measured SAR * Tune-up Scaling factor * Duty Cycle Scaling factor
3. Duty Cycle Scaling factor=1/ Duty Cycle (%)

**KDB 447498 D01 General RF Exposure Guidance:**
Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

**KDB 648474 D04 Handset SAR v01r03:**
1. When the *reported* SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest *reported* SAR configuration for that wireless mode and frequency band should be repeated for the body-worn accessory with a headset attached to the handset.
2. when the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, using the same wireless mode test configuration for voice and data, such as UMTS, LTE and Wi-Fi, and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface)
3. For Smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

**KDB 941225 D01 3G SAR Procedures:**
When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤1/4dB higher than the primary mode (RMC12.2kbps) or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

**KDB 941225 D05 SAR for LTE Devices:**
1. Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
2. When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
3. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
4. SAR measurement is not required for the 16QAM and 64QAM. When the highest maximum output power for 16QAM and 64QAM is ≤ ½ dB higher than the QPSK or when the reported SAR for the QPSK configuration is ≤ 1.45 W/kg.
5. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

**KDB 248227 D01 802.11 Wi-Fi SAR**

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements.

For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions.

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.16 The initial test position procedure is described in the following:

a) When the *reported* SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band. SAR is also not required for that exposure configuration in the subsequent test configuration(s).
b) When the *reported* SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1-g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.
c) For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

Additional power measurements may be required for this step, which should be limited to those necessary for identifying the subsequent highest output power channels.

When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR

**TCB workshop April 2015:**

SAR test exclusion can be applied for testing overlapping LTE bands as follows:

a) The maximum output power, including tolerance, for the smaller band must be s the larger band to qualify for the SAR test exclusion.
b) The channel bandwidth and other operating parameters for the smaller band must be fully supported by the larger band.

LTE Band 17 (704-716 MHz) is covered by LTE Band 12 (699-716 MHz)

| GSM 850 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | GSM | Back | 128 | 824.2 | 31.56 | 32.0 | 1.107 | 0.207 | 0.229 | |
| | | GSM | Front | 128 | 824.2 | 31.56 | 32.0 | 1.107 | 0.129 | 0.143 | |
| Hotspot | 0 | GSM | Top Side | 128 | 824.2 | 31.56 | 32.0 | 1.107 | 0.240 | **0.266** | 1 |

| GSM 1900 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | GSM | Back | 512 | 1850.2 | 29.05 | 29.5 | 1.109 | 0.152 | 0.169 | |
| | | GSM | Front | 512 | 1850.2 | 29.05 | 29.5 | 1.109 | 0.114 | 0.126 | |
| Hotspot | 0 | GSM | Top Side | 512 | 1850.2 | 29.05 | 29.5 | 1.109 | 0.221 | **0.245** | 2 |

| WCDMA Band II | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | RMC* | Back | 9400 | 1880 | 19.23 | 20.0 | 1.194 | 0.192 | 0.229 | |
| | | RMC* | Front | 9400 | 1880 | 19.23 | 20.0 | 1.194 | 0.273 | 0.326 | |
| Hotspot | 0 | RMC* | Top Side | 9400 | 1880 | 19.23 | 20.0 | 1.194 | 0.530 | **0.633** | 3 |

| WCDMA Band V | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | RMC* | Back | 4182 | 836.4 | 20.24 | 21.0 | 1.191 | 0.093 | 0.111 | |
| | | RMC* | Front | 4182 | 836.4 | 20.24 | 21.0 | 1.191 | 0.321 | **0.382** | 4 |
| Hotspot | 0 | RMC* | Top Side | 4182 | 836.4 | 20.24 | 21.0 | 1.191 | 0.221 | 0.263 | |

| FDD-LTE Band 2 (20MHz Bandwidth) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | QPSK,1RB | Back | 18900 | 1880 | 22.21 | 22.5 | 1.069 | 0.294 | 0.314 | |
| | | QPSK,1RB | Front | 18900 | 1880 | 22.21 | 22.5 | 1.069 | 0.390 | 0.417 | |
| | | QPSK,50%RB | Back | 18900 | 1880 | 22.21 | 22.5 | 1.069 | 0.197 | 0.211 | |
| | | QPSK,50%RB | Front | 18900 | 1880 | 22.21 | 22.5 | 1.069 | 0.309 | 0.330 | |
| Hotspot | 0 | QPSK,1RB | Top Side | 18900 | 1880 | 22.21 | 22.5 | 1.069 | 0.821 | 0.878 | |
| | | QPSK,1RB | Top Side | 18700 | 1860 | 22.21 | 22.5 | 1.069 | 0.807 | 0.863 | |
| | | QPSK,1RB | Top Side | 19100 | 1900 | 22.21 | 22.5 | 1.069 | 0.862 | **0.922** | 5 |
| | | QPSK,50%RB | Top Side | 18900 | 1880 | 22.21 | 22.5 | 1.069 | 0.552 | 0.590 | |

| FDD-LTE Band 4 (20MHz Bandwidth) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | QPSK,1RB | Back | 20175 | 1732.5 | 19.98 | 20.5 | 1.127 | 0.262 | 0.295 | |
| | | QPSK,1RB | Front | 20175 | 1732.5 | 19.98 | 20.5 | 1.127 | 0.344 | 0.388 | |
| | | QPSK,50%RB | Back | 20175 | 1732.5 | 19.98 | 20.5 | 1.127 | 0.240 | 0.271 | |
| | | QPSK,50%RB | Front | 20175 | 1732.5 | 19.98 | 20.5 | 1.127 | 0.301 | 0.339 | |
| Hotspot | 0 | QPSK,1RB | Top Side | 20175 | 1732.5 | 19.98 | 20.5 | 1.127 | 0.747 | 0.842 | |
| | | QPSK,1RB | Top Side | 20050 | 1720 | 19.98 | 20.5 | 1.127 | 0.821 | **0.925** | 6 |
| | | QPSK,1RB | Top Side | 20300 | 1745 | 19.98 | 20.5 | 1.127 | 0.782 | 0.881 | |
| | | QPSK,50%RB | Top Side | 20175 | 1732.5 | 19.98 | 20.5 | 1.127 | 0.574 | 0.647 | |

| FDD-LTE Band 7 (20MHz Bandwidth) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | QPSK,1RB | Back | 21100 | 2535 | 19.63 | 20.0 | 1.089 | 0.286 | 0.311 | |
| | | QPSK,1RB | Front | 21100 | 2535 | 19.63 | 20.0 | 1.089 | 0.567 | 0.617 | |
| | | QPSK,50%RB | Back | 21100 | 2535 | 19.63 | 20.0 | 1.089 | 0.239 | 0.260 | |
| | | QPSK,50%RB | Front | 21100 | 2535 | 19.63 | 20.0 | 1.089 | 0.497 | 0.541 | |
| Hotspot | 0 | QPSK,1RB | Top Side | 21100 | 2535 | 19.63 | 20.0 | 1.089 | 0.820 | 0.893 | |
| | | QPSK,1RB | Top Side | 20850 | 2510 | 19.63 | 20.0 | 1.089 | 0.634 | 0.690 | |
| | | QPSK,1RB | Top Side | 21350 | 2560 | 19.63 | 20.0 | 1.089 | 0.881 | **0.959** | 7 |
| | | QPSK,50%RB | Top Side | 21100 | 2535 | 19.63 | 20.0 | 1.089 | 0.612 | 0.666 | |

| WLAN 2.4G | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RF Exposure Conditions | Dist. (mm) | Mode | Test Position | CH. | Freq. (MHz) | Duty Cycle (%) | Output Power (dBm) | | | SAR1g (W/kg) | | Plot No. |
| | | | | | | | Meas. | Turn-up | Scaling Factor | Meas. | Scaled | |
| Body & Hotspot | 0 | 802.11b | Back | 6 | 2437 | 100 | 16.80 | 17.0 | 1.047 | 0.158 | **0.165** | 8 |
| | | 802.11b | Front | 6 | 2437 | 100 | 16.80 | 17.0 | 1.047 | 0.137 | 0.143 | |
| Hotspot | 0 | 802.11b | Top Side | 6 | 2437 | 100 | 16.80 | 17.0 | 1.047 | 0.123 | 0.129 | |

Remark:
1. The value with the bold is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels SAR tests are not necessary.

## 14.4 SAR Measurement Variability

According to KDB865664, Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required. The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.19 The repeated measurement results must be clearly identified in the SAR report. All measured SAR, including the repeated results, must be considered to determine compliance and for reporting according to KDB 690783.Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

1) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
2) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20

| Test Mode | Frequency Band (MHz) | RF Exposure Configuration | Test Position | Repeated SAR (yes/no) | Highest Measured SAR1-g (W/Kg) | First Repeated | |
|---|---|---|---|---|---|---|---|
| | | | | | | Measued SAR1-g (W/Kg) | Largest to Smallest SAR Ratio |
| FDD-LTE Band 2 1RB | 1900 | Hotspot | Top Side | Yes | 0.922 | 0.909 | 1.014 |
| FDD-LTE Band 4 1RB | 1720 | Hotspot | Top Side | Yes | 0.925 | 0.913 | 1.013 |
| FDD-LTE Band 7 1RB | 2560 | Hotspot | Top Side | Yes | **0.959** | 0.936 | 1.025 |

## 14.5 Simultaneous Transmission Evaluation

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmiting antenna.

Application Simultaneous Transmission information:

| No. | Configurations | Body SAR | Hotspot SAR |
|---|---|---|---|
| **1** | WWAN+WLAN 2.4G (Data) | Yes | Yes |
| **2** | WWAN+ Bluetooth (Data) | Yes | Yes |

**Remark:**
1. WWAN cannot transmit simultaneously.
2. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. WLAN 2.4G and WLAN 5G cannot transmit simultaneously.
3. According to the KDB 447498 D01 v06, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

● (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
● 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm

| Estimated stand alone SAR | | | | | | |
|---|---|---|---|---|---|---|
| Communication system | Frequency (MHz) | Maximum Power (dBm) | Maximum Power (mW) | Separation Distance (mm) | X | Estimated SAR1-g (W/kg) |
| Bluetooth* | 2480 | 5.5 | 3.55 | 5 | 7.5 | 0.149 |
| Bluetooth* | 2480 | 5.5 | 3.55 | 10 | 7.5 | 0.075 |

Note:
1. Bluetooth*- Including Lower power Bluetooth
2. Maximum average power including tune-up tolerance;
3. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

4. Per FCC KD B447498 D01, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is ≤1.6 W/Kg. When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio}=\frac{(SAR_1+SAR_2)^{1.5}}{(\text{peak location separation,mm})}<0.04$$

5. Simultaneous transmission of maximum SAR sum calculation.

| RF Exposure Conditions | Test Position | WWAN | WLAN 2.4G | Summed SAR (W/kg) | SAR1-g Limit (W/kg) |
|---|---|---|---|---|---|
| | | Scaled SAR (W/kg) | Scaled SAR (W/kg) | | |
| Body-worn & Hotspot | Back | 0.331 | 0.165 | 0.496 | 1.6 |
| | Front | 0.617 | 0.143 | 0.760 | 1.6 |
| Hotspot | Top side | 0.959 | 0.129 | **1.088** | 1.6 |

| RF Exposure Conditions | Test Position | WWAN | Bluetooth | Summed SAR (W/kg) | SAR1-g Limit (W/kg) |
|---|---|---|---|---|---|
| | | Scaled SAR (W/kg) | Scaled SAR (W/kg) | | |
| Body-worn & Hotspot | Back | 0.331 | 0.149 | 0.480 | 1.6 |
| | Front | 0.617 | 0.149 | 0.766 | 1.6 |
| Hotspot | Top side | 0.959 | 0.149 | **1.108** | 1.6 |

## 15. Test Plots

### 15.1 System Performance Check

# System check at 835 MHz

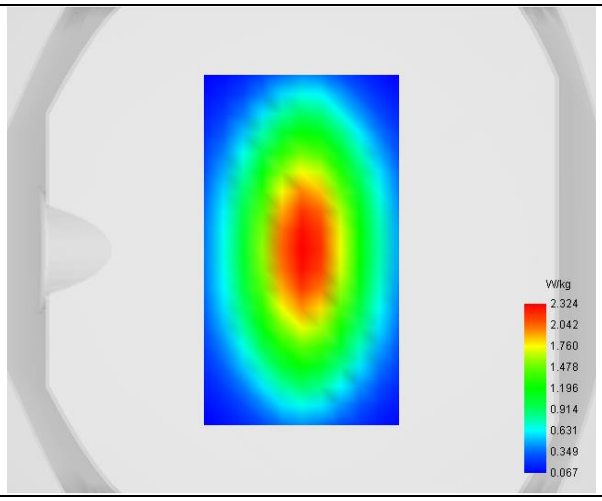
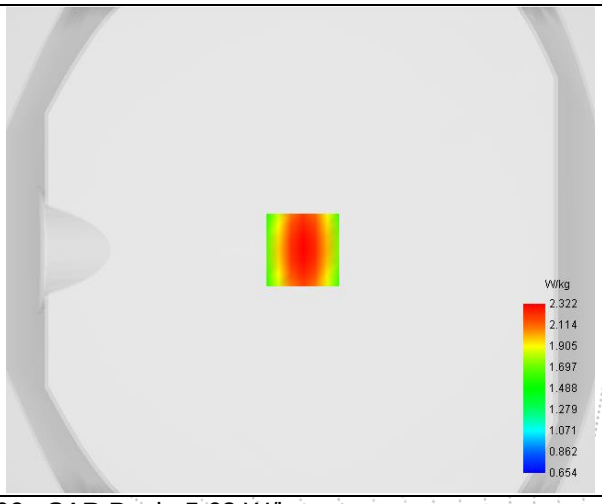
**A. Experimental conditions.**

| | |
|---|---|
| Probe | SN 26/23 EPGO420 |
| ConvF | 0.81 |
| Area Scan | surf_sam_plan.txt |
| Zoom Scan | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Phantom | Validation plane |
| Device Position | Dipole |
| Band | CW835 |
| Channels | Middle |
| Signal | CW (Crest factor: 1.0) |

**B. Permitivity**

| | |
|---|---|
| **Frequency (MHz)** | 835.000 |
| **Relative permitivity (real part)** | 40.822 |
| **Relative permitivity (imaginary part)** | 20.910 |
| **Conductivity (S/m)** | 0.865 |

**C. SAR Surface and Volume**

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |





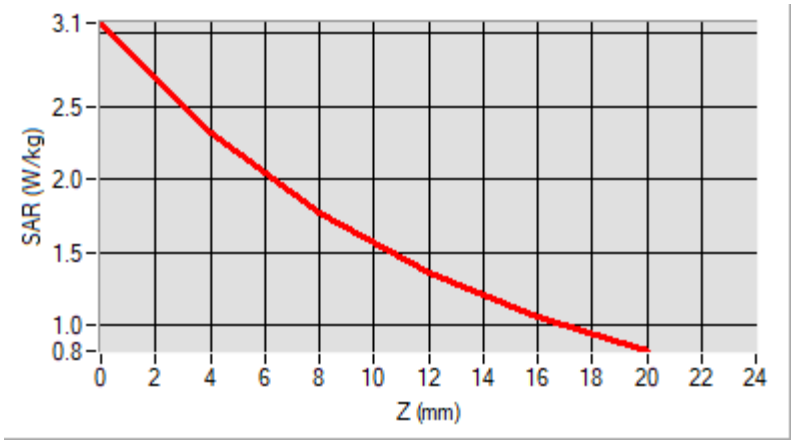
Maximum location: X=1.00, Y=0.00 ; SAR Peak: 5.68 W/kg

**D. SAR 1g & 10g**

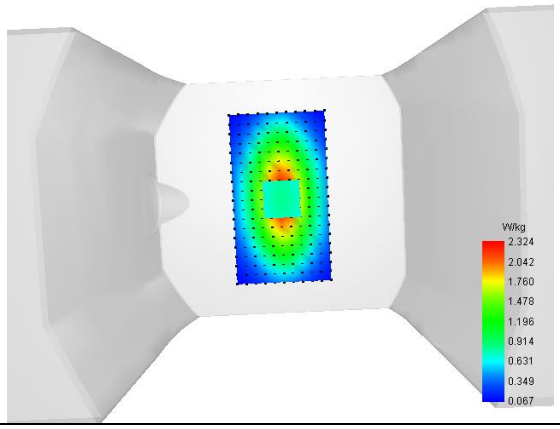
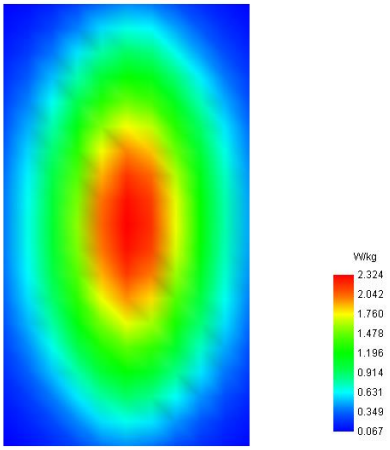
| | |
|---|---|
| SAR 10g (W/Kg) | 1.776 |
| SAR 1g (W/Kg) | 2.414 |
| Variation (%) | -2.093 |
| Horizontal validation criteria: minimum distance (mm) | - |
| Vertical validation criteria: SAR ratio M2/M1 (%) | - |

**E. Z Axis Scan**

| Z (mm) | 0.00 | 4.00 | 8.00 | 12.00 | 16.00 |
|---|---|---|---|---|---|
| SAR (W/Kg) | 3.108 | 2.344 | 1.786 | 1.395 | 1.109 |




**F. 3D Image**

| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# System check at 1800 MHz

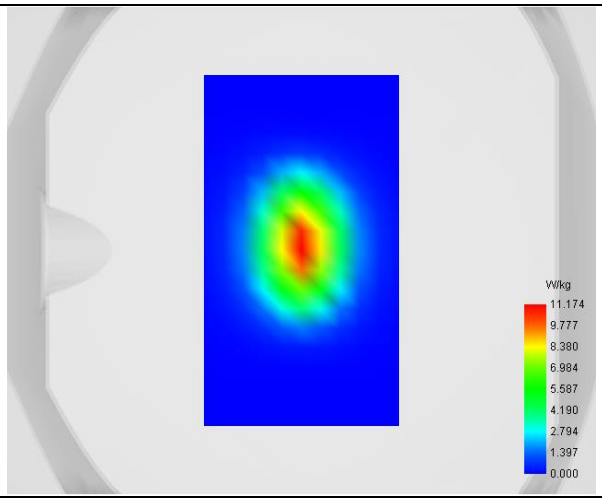
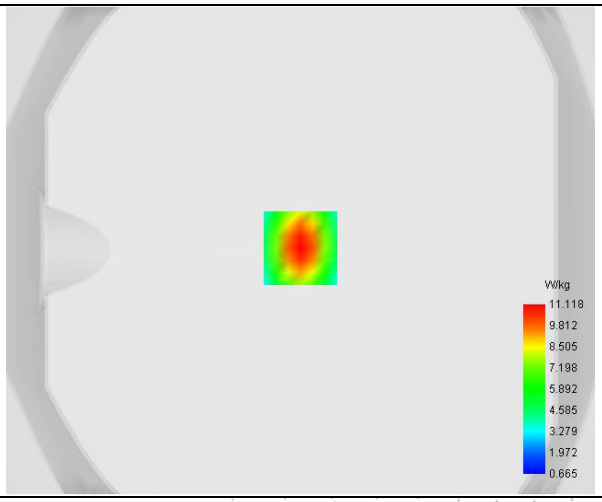
**A. Experimental conditions.**

| | |
|---|---|
| Probe | SN 26/23 EPGO420 |
| ConvF | 0.96 |
| Area Scan | surf_sam_plan.txt |
| Zoom Scan | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Phantom | Validation plane |
| Device Position | Dipole |
| Band | CW1800 |
| Channels | Middle |
| Signal | CW (Crest factor: 1.0) |

**B. Permitivity**

| | |
|---|---|
| **Frequency (MHz)** | 1800.000 |
| **Relative permitivity (real part)** | 39.641 |
| **Relative permitivity (imaginary part)** | 15.186 |
| **Conductivity (S/m)** | 1.436 |

**C. SAR Surface and Volume**

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |



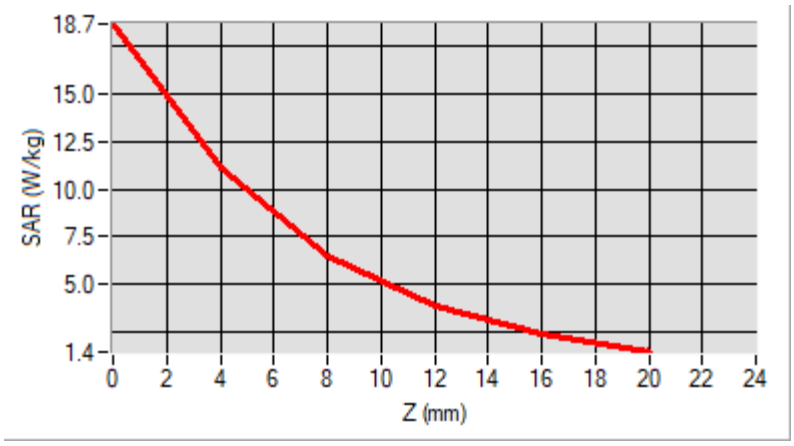
Maximum location: X=0.00, Y=1.00 ; SAR Peak: 22.78 W/kg

**D. SAR 1g & 10g**

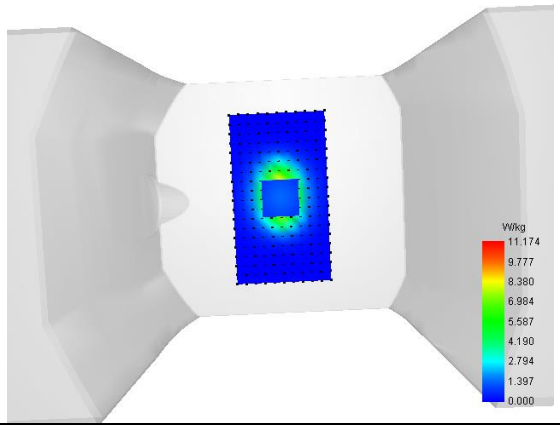
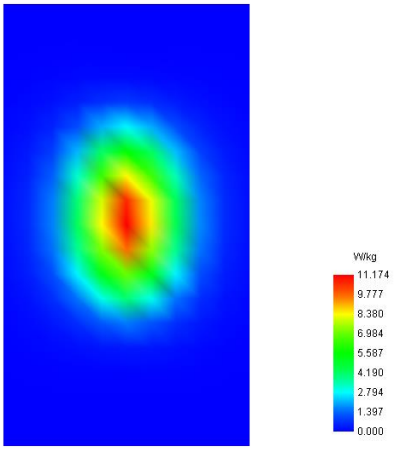
| | |
|---|---|
| SAR 10g (W/Kg) | 6.009 |
| SAR 1g (W/Kg) | 9.951 |
| Variation (%) | -0.930 |
| Horizontal validation criteria: minimum distance (mm) | - |
| Vertical validation criteria: SAR ratio M2/M1 (%) | - |

**E. Z Axis Scan**

| Z (mm) | 0.00 | 4.00 | 8.00 | 12.00 | 16.00 |
|---|---|---|---|---|---|
| SAR (W/Kg) | 18.71+ | 11.234 | 6.561 | 3.924 | 2.453 |




**F. 3D Image**

| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# System check at 1900 MHz

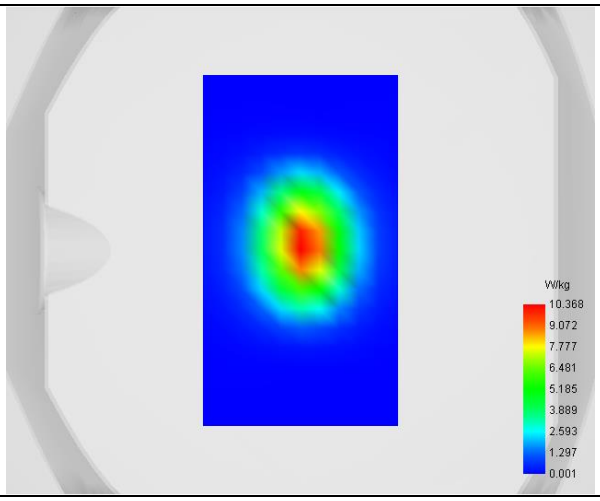
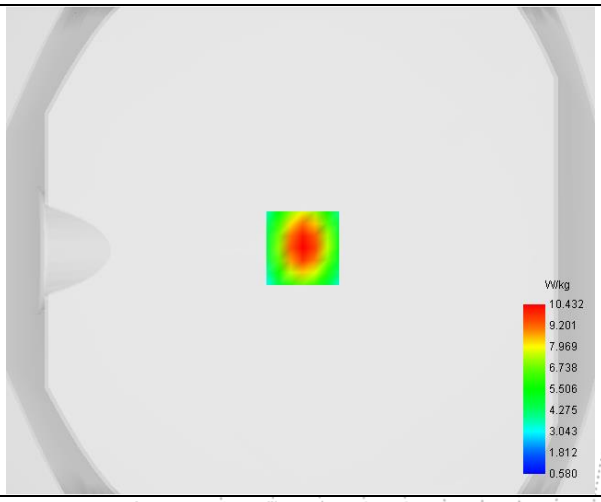
**A. Experimental conditions.**

| | |
|---|---|
| Probe | SN 26/23 EPGO420 |
| ConvF | 1.04 |
| Area Scan | surf_sam_plan.txt |
| Zoom Scan | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Phantom | Validation plane |
| Device Position | Dipole |
| Band | CW1900 |
| Channels | Middle |
| Signal | CW (Crest factor: 1.0) |

**B. Permitivity**

| | |
|---|---|
| **Frequency (MHz)** | 1900.000 |
| **Relative permitivity (real part)** | 40.809 |
| **Relative permitivity (imaginary part)** | 12.866 |
| **Conductivity (S/m)** | 1.361 |

**C. SAR Surface and Volume**

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |





Maximum location: X=1.00, Y=1.00 ; SAR Peak: 22.54 W/kg

**D. SAR 1g & 10g**

| | |
|---|---|
| SAR 10g (W/Kg) | 6.190 |
| SAR 1g (W/Kg) | 10.519 |
| Variation (%) | 3.421 |
| Horizontal validation criteria: minimum distance (mm) | - |
| Vertical validation criteria: SAR ratio M2/M1 (%) | - |

**E. Z Axis Scan**

| | | | | | |
|---|---|---|---|---|---|
| Z (mm) | 0.00 | 4.00 | 8.00 | 12.00 | 16.00 |
| SAR (W/Kg) | 17.387 | 10.484 | 6.206 | 3.672 | 2.184 |