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# SAR EVALUATION REPORT

**Applicant Name:**
LG Electronics U.S.A., Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

**Date of Testing:**
02/11/19 – 03/06/19
**Test Site/Location:**
PCTEST Lab, Columbia, MD, USA
**Document Serial No.:**
1M1902110024-01-R1.ZNF

**FCC ID:** **ZNFX220TB**

**APPLICANT:** **LG ELECTRONICS U.S.A., INC.**

**DUT Type:** Portable Handset
**Application Type:** Certification
**FCC Rule Part(s):** CFR §2.1093
**Model:** LM-X220TB
**Additional Model(s):** LMX220TB, X220TB, LM-X220MB, LMX220MB, X220MB

| Equipment Class | Band & Mode | Tx Frequency | SAR | | |
|---|---|---|---|---|---|
| | | | 1g Head (W/kg) | 1g Body-Worn (W/kg) | 1g Hotspot (W/kg) |
| PCE | GSM/GPRS/EDGE 850 | 824.20 - 848.80 MHz | 0.42 | 0.69 | 0.78 |
| PCE | GSM/GPRS/EDGE 1900 | 1850.20 - 1909.80 MHz | 0.42 | 0.40 | 0.40 |
| PCE | UMTS 850 | 826.40 - 846.60 MHz | 0.47 | 0.76 | 0.76 |
| PCE | UMTS 1750 | 1712.4 - 1752.6 MHz | 0.58 | 0.79 | 0.93 |
| PCE | UMTS 1900 | 1852.4 - 1907.6 MHz | 0.60 | 0.72 | 0.72 |
| PCE | LTE Band 71 | 665.5 - 695.5 MHz | 0.30 | 0.42 | 0.42 |
| PCE | LTE Band 12 | 699.7 - 715.3 MHz | 0.51 | 0.74 | 0.74 |
| PCE | LTE Band 26 (Cell) | 814.7 - 848.3 MHz | 0.57 | 0.77 | 0.77 |
| PCE | LTE Band 5 (Cell) | 824.7 - 848.3 MHz | N/A | N/A | N/A |
| PCE | LTE Band 66 (AWS) | 1710.7 - 1779.3 MHz | 0.58 | 0.93 | 1.09 |
| PCE | LTE Band 4 (AWS) | 1710.7 - 1754.3 MHz | N/A | N/A | N/A |
| PCE | LTE Band 25 (PCS) | 1850.7 - 1914.3 MHz | 0.57 | 0.58 | 0.67 |
| PCE | LTE Band 2 (PCS) | 1850.7 - 1909.3 MHz | N/A | N/A | N/A |
| DTS | 2.4 GHz WLAN | 2412 - 2462 MHz | 1.20 | 0.47 | 0.47 |
| NII | U-NII-1 | 5180 - 5240 MHz | 1.26 | N/A | 0.85 |
| NII | U-NII-2A | 5260 - 5320 MHz | 1.28 | 0.70 | N/A |
| NII | U-NII-2C | 5500 - 5700 MHz | 1.15 | 0.72 | N/A |
| NII | U-NII-3 | 5745 - 5825 MHz | 1.13 | 0.69 | 0.70 |
| DSS/DTS | Bluetooth | 2402 - 2480 MHz | N/A | < 0.1 | N/A |
| **Simultaneous SAR per KDB 690783 D01v01r03:** | | | 1.58 | 1.58 | 1.59 |

Note: This revised Test Report (S/N: 1M1902110024-01-R1.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.7 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

Randy Ortanez
President

The SAR Tick is an initiative of the Mobile & Wireless Forum (MWF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MWF. Further details can be obtained by emailing: sartick@mwfai.info.



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# 1 DEVICE UNDER TEST

## 1.1 Device Overview

| Band & Mode | Operating Modes | Tx Frequency |
|---|---|---|
| GSM/GPRS/EDGE 850 | Voice/Data | 824.20 - 848.80 MHz |
| GSM/GPRS/EDGE 1900 | Voice/Data | 1850.20 - 1909.80 MHz |
| UMTS 850 | Voice/Data | 826.40 - 846.60 MHz |
| UMTS 1750 | Voice/Data | 1712.4 - 1752.6 MHz |
| UMTS 1900 | Voice/Data | 1852.4 - 1907.6 MHz |
| LTE Band 71 | Voice/Data | 665.5 - 695.5 MHz |
| LTE Band 12 | Voice/Data | 699.7 - 715.3 MHz |
| LTE Band 26 (Cell) | Voice/Data | 814.7 - 848.3 MHz |
| LTE Band 5 (Cell) | Voice/Data | 824.7 - 848.3 MHz |
| LTE Band 66 (AWS) | Voice/Data | 1710.7 - 1779.3 MHz |
| LTE Band 4 (AWS) | Voice/Data | 1710.7 - 1754.3 MHz |
| LTE Band 25 (PCS) | Voice/Data | 1850.7 - 1914.3 MHz |
| LTE Band 2 (PCS) | Voice/Data | 1850.7 - 1909.3 MHz |
| 2.4 GHz WLAN | Voice/Data | 2412 - 2462 MHz |
| U-NII-1 | Voice/Data | 5180 - 5240 MHz |
| U-NII-2A | Voice/Data | 5260 - 5320 MHz |
| U-NII-2C | Voice/Data | 5500 - 5700 MHz |
| U-NII-3 | Voice/Data | 5745 - 5825 MHz |
| Bluetooth | Data | 2402 - 2480 MHz |

## 1.2 Power Reduction for SAR

This device uses an independent fixed level power reduction mechanism for WLAN operations during voice or VoIP held to ear scenarios. Per FCC Guidance, the held-to-ear exposure conditions were evaluated at reduced power according to the head SAR positions described in IEEE 1528-2013. Detailed descriptions of the power reduction mechanism are included in the operational description.




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## 1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

### 1.3.1 Maximum Output Power

| Mode / Band | | Voice (dBm) | Burst Average GMSK (dBm) | | | | Burst Average 8-PSK (dBm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 TX Slot | *1 TX Slots* | *2 TX Slots* | *3 TX Slots* | *4 TX Slots* | *1 TX Slots* | *2 TX Slots* | *3 TX Slots* | *4 TX Slots* |
| GSM/GPRS/EDGE 850 | Maximum | **33.7** | **33.7** | **31.7** | **29.7** | **27.7** | **26.7** | **25.7** | **24.7** | **23.7** |
| | Nominal | **33.2** | **33.2** | **31.2** | **29.2** | **27.2** | **26.2** | **25.2** | **24.2** | **23.2** |
| GSM/GPRS/EDGE 1900 | Maximum | **30.7** | **30.7** | **28.7** | **26.7** | **25.7** | **26.7** | **25.7** | **24.7** | **23.7** |
| | Nominal | **30.2** | **30.2** | **28.2** | **26.2** | **25.2** | **26.2** | **25.2** | **24.2** | **23.2** |

| Mode / Band | | Modulated Average (dBm) | | |
|---|---|---|---|---|
| | | *3GPP WCDMA* | *3GPP HSDPA* | *3GPP HSUPA* |
| UMTS Band 5 (850 MHz) | Maximum | **24.7** | **24.7** | **24.7** |
| | Nominal | **24.2** | **24.2** | **24.2** |
| UMTS Band 4 (1750 MHz) | Maximum | **24.7** | **24.7** | **24.7** |
| | Nominal | **24.2** | **24.2** | **24.2** |
| UMTS Band 2 (1900 MHz) | Maximum | **24.7** | **24.7** | **24.7** |
| | Nominal | **24.2** | **24.2** | **24.2** |

| Mode / Band | | Modulated Average (dBm) |
|---|---|---|
| LTE Band 71 | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 12 | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 26 (Cell) | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 5 (Cell) | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 66 (AWS) | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 4 (AWS) | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 25 (PCS) | Maximum | **24.7** |
| | Nominal | **24.2** |
| LTE Band 2 (PCS) | Maximum | **24.7** |
| | Nominal | **24.2** |




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| Mode / Band | | Modulated Average (dBm) | | |
|---|---|---|---|---|
| | | Ch 1 | Ch 2-10 | Ch 11 |
| IEEE 802.11b (2.4 GHz) | Maximum | **19.0** | | |
| | Nominal | **18.0** | | |
| IEEE 802.11g (2.4 GHz) | Maximum | **16.0** | **17.0** | **15.0** |
| | Nominal | **15.0** | **16.0** | **14.0** |
| IEEE 802.11n (2.4 GHz) | Maximum | **15.5** | **16.5** | **14.5** |
| | Nominal | **14.5** | **15.5** | **13.5** |

| Mode / Band | | Modulated Average (dBm) |
|---|---|---|
| Bluetooth | Maximum | **10.0** |
| | Nominal | **9.0** |
| Bluetooth LE | Maximum | **2.0** |
| | Nominal | **1.0** |

| Mode / Band | | Modulated Average (dBm) | | |
|---|---|---|---|---|
| | | 20 MHz Bandwidth | | 40 MHz Bandwidth |
| | | Ch 36, 64, 100, 161-165 | Ch 40-60, 104-157 | Ch. 38-159 |
| IEEE 802.11a (5 GHz) | Maximum | **14.5** | **16.0** | |
| | Nominal | **13.5** | **15.0** | |
| IEEE 802.11n (5 GHz) | Maximum | **14.5** | **16.0** | **12.0** |
| | Nominal | **13.5** | **15.0** | **11.0** |

### 1.3.2 Reduced Power

| Mode / Band | | Modulated Average (dBm) | | |
|---|---|---|---|---|
| | | Ch 1 | Ch 2-10 | Ch 11 |
| IEEE 802.11b (2.4 GHz) | Maximum | **16.0** | | |
| | Nominal | **15.0** | | |
| IEEE 802.11g (2.4 GHz) | Maximum | **15.0** | **16.0** | **14.0** |
| | Nominal | **14.0** | **15.0** | **13.0** |
| IEEE 802.11n (2.4 GHz) | Maximum | **15.0** | **16.0** | **14.0** |
| | Nominal | **14.0** | **15.0** | **13.0** |




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| Mode / Band | | Modulated Average (dBm) | | |
|---|---|---|---|---|
| | | 20 MHz Bandwidth | | 40 MHz Bandwidth |
| | | Ch 36, 64, 100, 161-165 | Ch 40-60, 104-157 | Ch. 38-159 |
| IEEE 802.11a (5 GHz) | Maximum | **11.0** | **12.5** | |
| | Nominal | **10.0** | **11.5** | |
| IEEE 802.11n (5 GHz) | Maximum | **11.0** | **12.5** | **12.0** |
| | Nominal | **10.0** | **11.5** | **11.0** |

## 1.4 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. The overall diagonal dimension of the device is ≤160 mm and the diagonal display is ≤150 mm. A diagram showing the location of the device antennas can be found in Appendix F.

**Table 1-1**
**Device Edges/Sides for SAR Testing**

| Mode | Back | Front | Top | Bottom | Right | Left |
|---|---|---|---|---|---|---|
| GPRS 850 | Yes | Yes | No | Yes | Yes | Yes |
| GPRS 1900 | Yes | Yes | No | Yes | No | Yes |
| UMTS 850 | Yes | Yes | No | Yes | Yes | Yes |
| UMTS 1750 | Yes | Yes | No | Yes | No | Yes |
| UMTS 1900 | Yes | Yes | No | Yes | No | Yes |
| LTE Band 71 | Yes | Yes | No | Yes | Yes | Yes |
| LTE Band 12 | Yes | Yes | No | Yes | Yes | Yes |
| LTE Band 26 (Cell) | Yes | Yes | No | Yes | Yes | Yes |
| LTE Band 66 (AWS) | Yes | Yes | No | Yes | No | Yes |
| LTE Band 25 (PCS) | Yes | Yes | No | Yes | No | Yes |
| 2.4 GHz WLAN | Yes | Yes | Yes | No | Yes | No |
| 5 GHz WLAN | Yes | Yes | Yes | No | Yes | No |

Note: Particular DUT edges were not required to be evaluated for wireless router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01 Section III. The distances between the transmit antennas and the edges of the device are included in the filing. When wireless router mode is enabled, U-NII-2A and U-NII-2C operations are disabled.

## 1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.



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**Table 1-2**
**Simultaneous Transmission Scenarios**

| No. | Capable Transmit Configuration | Head | Body-Worn Accessory | Wireless Router | Notes |
|---|---|---|---|---|---|
| 1 | GSM voice + 2.4 GHz WI-FI | Yes | Yes | N/A | |
| 2 | GSM voice + 5 GHz WI-FI | Yes | Yes | N/A | |
| 3 | GSM voice + 2.4 GHz Bluetooth | N/A | Yes | N/A | |
| 4 | GSM voice + 2.4 GHz Bluetooth + 5 GHz WI-FI | N/A | Yes | N/A | |
| 5 | UMTS + 2.4 GHz WI-FI | Yes | Yes | Yes | |
| 6 | UMTS + 5 GHz WI-FI | Yes | Yes | Yes | |
| 7 | UMTS + 2.4 GHz Bluetooth | N/A | Yes | N/A | |
| 8 | UMTS + 2.4 GHz Bluetooth + 5 GHz WI-FI | N/A | Yes | N/A | |
| 9 | LTE + 2.4 GHz WI-FI | Yes | Yes | Yes | |
| 10 | LTE + 5 GHz WI-FI | Yes | Yes | Yes | |
| 11 | LTE + 2.4 GHz Bluetooth | N/A | Yes | N/A | |
| 12 | LTE + 2.4 GHz Bluetooth + 5 GHz WI-FI | N/A | Yes | N/A | |
| 13 | GPRS/EDGE + 2.4 GHz WI-FI | Yes* | Yes* | Yes | * Pre-installed VOIP applications are considered |
| 14 | GPRS/EDGE + 5 GHz WI-FI | Yes* | Yes* | Yes | * Pre-installed VOIP applications are considered |
| 15 | GPRS/EDGE + 2.4 GHz Bluetooth | N/A | Yes* | N/A | * Pre-installed VOIP applications are considered |
| 16 | GPRS/EDGE + 2.4 GHz Bluetooth + 5 GHz WI-FI | N/A | Yes* | N/A | * Pre-installed VOIP applications are considered |

1. 2.4 GHz WLAN and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.
3. When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
4. Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. There are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
5. 5 GHz Wireless Router is only supported for U-NII 1 & U-NII-3 by S/W, therefore U-NII2A and U-NII2C were not evaluated for wireless router conditions.
6. This device supports VOLTE.
7. This device supports VOWIFI.

## 1.6 Miscellaneous SAR Test Considerations

### (A) WIFI/BT

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is greater than 1.2 W/kg, SAR is required for U-NII-1 band according to FCC KDB Publication 248227 D01v02r02.

Since Wireless Router operations are not allowed by the chipset firmware using U-NII-2A and U-NII-2C WIFI, only 2.4 GHz, U-NII-1, and U-NII-3 WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v02r01.

### (B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS/EDGE Data.

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v03r01.




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LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02r04.

This device supports LTE capabilities with overlapping transmission frequency ranges. When the supported frequency range of an LTE Band falls completely within an LTE band with a larger transmission frequency range, both LTE bands have the same target power (or the band with the larger transmission frequency range has a higher target power), and both LTE bands share the same transmission path and signal characteristics, SAR was only assessed for the band with the larger transmission frequency range.

## 1.7 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01, D05v02r04, D05Av01r02, D06v02r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

## 1.8 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 11.




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# 2 LTE INFORMATION

| LTE Information | | | |
|---|---|---|---|
| Form Factor | Portable Handset | | |
| Frequency Range of each LTE transmission band | LTE Band 71 (665.5 - 695.5 MHz) | | |
| | LTE Band 12 (699.7 - 715.3 MHz) | | |
| | LTE Band 26 (Cell) (814.7 - 848.3 MHz) | | |
| | LTE Band 5 (Cell) (824.7 - 848.3 MHz) | | |
| | LTE Band 66 (AWS) (1710.7 - 1779.3 MHz) | | |
| | LTE Band 4 (AWS) (1710.7 - 1754.3 MHz) | | |
| | LTE Band 25 (PCS) (1850.7 - 1914.3 MHz) | | |
| | LTE Band 2 (PCS) (1850.7 - 1909.3 MHz) | | |
| Channel Bandwidths | LTE Band 71: 5 MHz, 10 MHz, 15 MHz, 20 MHz | | |
| | LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz | | |
| | LTE Band 26 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz | | |
| | LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz | | |
| | LTE Band 66 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 | | |
| | LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 | | |
| | LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 | | |
| | LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 | | |
| Channel Numbers and Frequencies (MHz) | Low | Mid | High |
| LTE Band 71: 5 MHz | 665.5 (133147) | 680.5 (133297) | 695.5 (133447) |
| LTE Band 71: 10 MHz | 668 (133172) | 680.5 (133297) | 693 (133422) |
| LTE Band 71: 15 MHz | 670.5 (133197) | 680.5 (133297) | 690.5 (133397) |
| LTE Band 71: 20 MHz | 673 (133222) | 680.5 (133297) | 688 (133372) |
| LTE Band 12: 1.4 MHz | 699.7 (23017) | 707.5 (23095) | 715.3 (23173) |
| LTE Band 12: 3 MHz | 700.5 (23025) | 707.5 (23095) | 714.5 (23165) |
| LTE Band 12: 5 MHz | 701.5 (23035) | 707.5 (23095) | 713.5 (23155) |
| LTE Band 12: 10 MHz | 704 (23060) | 707.5 (23095) | 711 (23130) |
| LTE Band 26 (Cell): 1.4 MHz | 814.7 (26697) | 831.5 (26865) | 848.3 (27033) |
| LTE Band 26 (Cell): 3 MHz | 815.5 (26705) | 831.5 (26865) | 847.5 (27025) |
| LTE Band 26 (Cell): 5 MHz | 816.5 (26715) | 831.5 (26865) | 846.5 (27015) |
| LTE Band 26 (Cell): 10 MHz | 819 (26740) | 831.5 (26865) | 844 (26990) |
| LTE Band 26 (Cell): 15 MHz | 821.5 (26765) | 831.5 (26865) | 841.5 (26965) |
| LTE Band 5 (Cell): 1.4 MHz | 824.7 (20407) | 836.5 (20525) | 848.3 (20643) |
| LTE Band 5 (Cell): 3 MHz | 825.5 (20415) | 836.5 (20525) | 847.5 (20635) |
| LTE Band 5 (Cell): 5 MHz | 826.5 (20425) | 836.5 (20525) | 846.5 (20625) |
| LTE Band 5 (Cell): 10 MHz | 829 (20450) | 836.5 (20525) | 844 (20600) |
| LTE Band 66 (AWS): 1.4 MHz | 1710.7 (131979) | 1745 (132322) | 1779.3 (132665) |
| LTE Band 66 (AWS): 3 MHz | 1711.5 (131987) | 1745 (132322) | 1778.5 (132657) |
| LTE Band 66 (AWS): 5 MHz | 1712.5 (131997) | 1745 (132322) | 1777.5 (132647) |
| LTE Band 66 (AWS): 10 MHz | 1715 (132022) | 1745 (132322) | 1775 (132622) |
| LTE Band 66 (AWS): 15 MHz | 1717.5 (132047) | 1745 (132322) | 1772.5 (132597) |
| LTE Band 66 (AWS): 20 MHz | 1720 (132072) | 1745 (132322) | 1770 (132572) |
| LTE Band 4 (AWS): 1.4 MHz | 1710.7 (19957) | 1732.5 (20175) | 1754.3 (20393) |
| LTE Band 4 (AWS): 3 MHz | 1711.5 (19965) | 1732.5 (20175) | 1753.5 (20385) |
| LTE Band 4 (AWS): 5 MHz | 1712.5 (19975) | 1732.5 (20175) | 1752.5 (20375) |
| LTE Band 4 (AWS): 10 MHz | 1715 (20000) | 1732.5 (20175) | 1750 (20350) |
| LTE Band 4 (AWS): 15 MHz | 1717.5 (20025) | 1732.5 (20175) | 1747.5 (20325) |
| LTE Band 4 (AWS): 20 MHz | 1720 (20050) | 1732.5 (20175) | 1745 (20300) |
| LTE Band 25 (PCS): 1.4 MHz | 1850.7 (26047) | 1882.5 (26365) | 1914.3 (26683) |
| LTE Band 25 (PCS): 3 MHz | 1851.5 (26055) | 1882.5 (26365) | 1913.5 (26675) |
| LTE Band 25 (PCS): 5 MHz | 1852.5 (26065) | 1882.5 (26365) | 1912.5 (26665) |
| LTE Band 25 (PCS): 10 MHz | 1855 (26090) | 1882.5 (26365) | 1910 (26640) |
| LTE Band 25 (PCS): 15 MHz | 1857.5 (26115) | 1882.5 (26365) | 1907.5 (26615) |
| LTE Band 25 (PCS): 20 MHz | 1860 (26140) | 1882.5 (26365) | 1905 (26590) |
| LTE Band 2 (PCS): 1.4 MHz | 1850.7 (18607) | 1880 (18900) | 1909.3 (19193) |
| LTE Band 2 (PCS): 3 MHz | 1851.5 (18615) | 1880 (18900) | 1908.5 (19185) |
| LTE Band 2 (PCS): 5 MHz | 1852.5 (18625) | 1880 (18900) | 1907.5 (19175) |
| LTE Band 2 (PCS): 10 MHz | 1855 (18650) | 1880 (18900) | 1905 (19150) |
| LTE Band 2 (PCS): 15 MHz | 1857.5 (18675) | 1880 (18900) | 1902.5 (19125) |
| LTE Band 2 (PCS): 20 MHz | 1860 (18700) | 1880 (18900) | 1900 (19100) |
| UE Category | 4 | | |
| Modulations Supported in UL | QPSK, 16QAM | | |
| LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided) | YES | | |
| A-MPR (Additional MPR) disabled for SAR Testing? | YES | | |
| LTE Carrier Aggregation Possible Combinations | The technical description includes all the possible carrier aggregation combinations | | |
| LTE Additional Information | This device does not support full CA features on 3GPP Release 10. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 10 features are not supported: Carrier Aggregation, Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading,eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA. | | |




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12/05/2018

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# 3 INTRODUCTION

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

## 3.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 3-1).

**Equation 3-1**
**SAR Mathematical Equation**

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

**SAR is expressed in units of Watts per Kilogram (W/kg).**

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m$^3$)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]




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# 4 DOSIMETRIC ASSESSMENT

## 4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

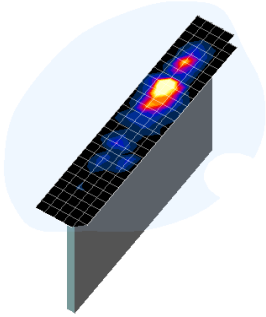

**Figure 4-1**
**Sample SAR Area Scan**

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 4-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

**Table 4-1**
**Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04***

| Frequency | Maximum Area Scan Resolution (mm) ($\Delta x_{area}$, $\Delta y_{area}$) | Maximum Zoom Scan Resolution (mm) ($\Delta x_{zoom}$, $\Delta y_{zoom}$) | Maximum Zoom Scan Spatial Resolution (mm) | | | Minimum Zoom Scan Volume (mm) (x,y,z) |
|---|---|---|---|---|---|---|
| | | | Uniform Grid | Graded Grid | | |
| | | | $\Delta z_{zoom}(n)$ | $\Delta z_{zoom}(1)$* | $\Delta z_{zoom}(n>1)$* | |
| ≤ 2 GHz | ≤ 15 | ≤ 8 | ≤ 5 | ≤ 4 | ≤ 1.5*$\Delta z_{zoom}(n-1)$ | ≥ 30 |
| 2-3 GHz | ≤ 12 | ≤ 5 | ≤ 5 | ≤ 4 | ≤ 1.5*$\Delta z_{zoom}(n-1)$ | ≥ 30 |
| 3-4 GHz | ≤ 12 | ≤ 5 | ≤ 4 | ≤ 3 | ≤ 1.5*$\Delta z_{zoom}(n-1)$ | ≥ 28 |
| 4-5 GHz | ≤ 10 | ≤ 4 | ≤ 3 | ≤ 2.5 | ≤ 1.5*$\Delta z_{zoom}(n-1)$ | ≥ 25 |
| 5-6 GHz | ≤ 10 | ≤ 4 | ≤ 2 | ≤ 2 | ≤ 1.5*$\Delta z_{zoom}(n-1)$ | ≥ 22 |

*Also compliant to IEEE 1528-2013 Table 6




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# 5 DEFINITION OF REFERENCE POINTS

## 5.1 EAR REFERENCE POINT

Figure 5-2 shows the front, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 5-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

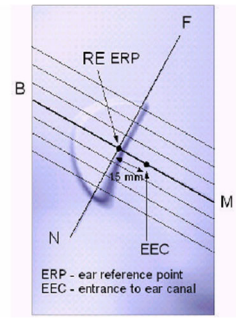


**Figure 5-1**
**Close-Up Side view of ERP**

## 5.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Figure 5-3). The acoustic output was than located at the same level as the center of the ear reference point. The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at its top and bottom edges, positioning the "ear reference point" on the outer surface of the both the left and right head phantoms on the ear reference point.

**Figure 5-2**
**Front, back and side view of SAM Twin Phantom**

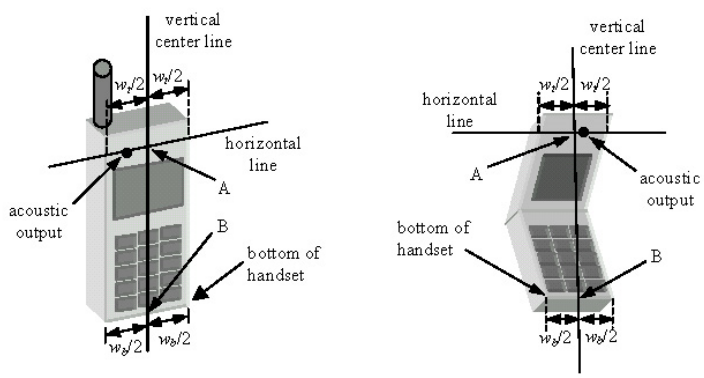


**Figure 5-3**
**Handset Vertical Center & Horizontal Line Reference Points**




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# 6 TEST CONFIGURATION POSITIONS

## 6.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.

## 6.2 Positioning for Cheek

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

**Figure 6-1 Front, Side and Top View of Cheek Position**

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 6-2).

## 6.3 Positioning for Ear / 15º Tilt

With the test device aligned in the "Cheek Position":

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 6-2).




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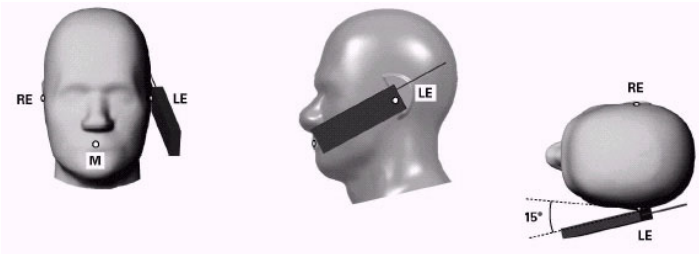


**Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position**

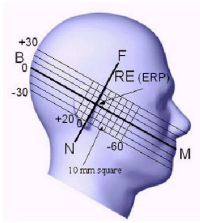


**Figure 6-3**
**Side view w/ relevant markings**

## 6.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. Per IEEE 1528-2013, a rotated SAM phantom is necessary to allow probe access to such regions. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed from the table for emptying and cleaning.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

## 6.5 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-4). Per FCC KDB Publication 648474 D04v01r03, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. 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 that body-worn accessory with a headset attached to the handset.

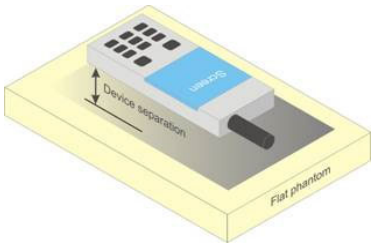


**Figure 6-4**
**Sample Body-Worn Diagram**

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not



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contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented.
Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

## 6.6 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1g body and 10g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

Per KDB Publication 447498 D01v06, Cell phones (handsets) are not normally designed to be used on extremities or operated in extremity only exposure conditions. The maximum output power levels of handsets generally do not require extremity SAR testing to show compliance. Therefore, extremity SAR was not evaluated for this device.

## 6.7 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06v02r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.



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# 7 RF EXPOSURE LIMITS

## 7.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

## 7.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

**Table 7-1**
**SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6**

| HUMAN EXPOSURE LIMITS | | |
|---|---|---|
| | UNCONTROLLED ENVIRONMENT<br>*General Population*<br>(W/kg) or (mW/g) | CONTROLLED ENVIRONMENT<br>*Occupational*<br>(W/kg) or (mW/g) |
| **Peak Spatial Average SAR**<br>Head | 1.6 | 8.0 |
| **Whole Body SAR** | 0.08 | 0.4 |
| **Peak Spatial Average SAR**<br>Hands, Feet, Ankle, Wrists, etc. | 4.0 | 20 |

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.




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# 8 FCC MEASUREMENT PROCEDURES

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

## 8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

## 8.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03r01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

## 8.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01 “3G SAR Measurement Procedures.”

The device is placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test are evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device is tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviates by more than 5%, the SAR test and drift measurements are repeated.

## 8.4 SAR Measurement Conditions for UMTS

### 8.4.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.




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### 8.4.2 Head SAR Measurements

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

### 8.4.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s". The 3G SAR test reduction procedure is applied to other spreading codes and multiple $DPDCH_n$ configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or $DPDCH_n$, for the highest reported SAR configuration in 12.2 kbps RMC.

### 8.4.4 SAR Measurements with Rel 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

### 8.4.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

## 8.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r04 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

### 8.5.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.



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### 8.5.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

### 8.5.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

### 8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   i. The required channel and offset combination with the highest maximum output power is required for SAR.
   ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
   iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

### 8.5.5 Downlink Only Carrier Aggregation

Conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. Additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band. Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for downlink only carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive.



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## 8.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

### 8.6.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

### 8.6.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg.

### 8.6.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, SAR must be considered for these channels. Each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

### 8.6.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.

### 8.6.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:



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1) 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.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position 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.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

### 8.6.6 OFDM Transmission Mode and SAR Test Channel Selection

When the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

### 8.6.7 Initial Test Configuration Procedure

For OFDM, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order IEEE 802.11 mode. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 8.6.6).

### 8.6.8 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg, no additional SAR tests for the subsequent test configurations are required.



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# 9 RF CONDUCTED POWERS

## 9.1 GSM Conducted Powers

**Table 9-1**
**Maximum Conducted Power**

| Maximum Burst-Averaged Output Power | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *Voice* | *GPRS/EDGE Data (GMSK)* | | | | *EDGE Data (8-PSK)* | | | |
| **Band** | **Channel** | **GSM [dBm] CS (1 Slot)** | **GPRS [dBm] 1 Tx Slot** | **GPRS [dBm] 2 Tx Slot** | **GPRS [dBm] 3 Tx Slot** | **GPRS [dBm] 4 Tx Slot** | **EDGE [dBm] 1 Tx Slot** | **EDGE [dBm] 2 Tx Slot** | **EDGE [dBm] 3 Tx Slot** | **EDGE [dBm] 4 Tx Slot** |
| **GSM 850** | 128 | 33.53 | 33.52 | 31.70 | **29.61** | 27.70 | 26.65 | 25.70 | 24.48 | 23.59 |
| | 190 | 33.70 | 33.38 | 31.68 | **29.58** | 27.62 | 26.49 | 25.70 | 24.46 | 23.53 |
| | 251 | 33.42 | 33.69 | 31.63 | **29.59** | 27.64 | 26.43 | 25.60 | 24.49 | 23.54 |
| **GSM 1900** | 512 | 30.58 | 30.67 | 28.63 | 26.52 | **25.57** | 26.70 | 25.58 | 24.70 | 23.70 |
| | 661 | 30.70 | 30.68 | 28.59 | 26.48 | **25.54** | 26.69 | 25.60 | 24.70 | 23.61 |
| | 810 | 30.44 | 30.65 | 28.58 | 26.41 | **25.53** | 26.67 | 25.65 | 24.56 | 23.61 |
| **Calculated Maximum Frame-Averaged Output Power** | | | | | | | | | | |
| | | *Voice* | *GPRS/EDGE Data (GMSK)* | | | | *EDGE Data (8-PSK)* | | | |
| **Band** | **Channel** | **GSM [dBm] CS (1 Slot)** | **GPRS [dBm] 1 Tx Slot** | **GPRS [dBm] 2 Tx Slot** | **GPRS [dBm] 3 Tx Slot** | **GPRS [dBm] 4 Tx Slot** | **EDGE [dBm] 1 Tx Slot** | **EDGE [dBm] 2 Tx Slot** | **EDGE [dBm] 3 Tx Slot** | **EDGE [dBm] 4 Tx Slot** |
| **GSM 850** | 128 | 24.50 | 24.49 | 25.68 | **25.35** | 24.69 | 17.62 | 19.68 | 20.22 | 20.58 |
| | 190 | 24.67 | 24.35 | 25.66 | **25.32** | 24.61 | 17.46 | 19.68 | 20.20 | 20.52 |
| | 251 | 24.39 | 24.66 | 25.61 | **25.33** | 24.63 | 17.40 | 19.58 | 20.23 | 20.53 |
| **GSM 1900** | 512 | 21.55 | 21.64 | 22.61 | 22.26 | **22.56** | 17.67 | 19.56 | 20.44 | 20.69 |
| | 661 | 21.67 | 21.65 | 22.57 | 22.22 | **22.53** | 17.66 | 19.58 | 20.44 | 20.60 |
| | 810 | 21.41 | 21.62 | 22.56 | 22.15 | **22.52** | 17.64 | 19.63 | 20.30 | 20.60 |
| **GSM 850** | **Frame Avg.Targets:** | 24.17 | 24.17 | 25.18 | **24.94** | 24.19 | 17.17 | 19.18 | 19.94 | 20.19 |
| **GSM 1900** | | 21.17 | 21.17 | 22.18 | 21.94 | **22.19** | 17.17 | 19.18 | 19.94 | 20.19 |

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
3. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

**GSM Class:** B
**GPRS Multislot class:** 12 (Max 4 Tx uplink slots)
**EDGE Multislot class:** 12 (Max 4 Tx uplink slots)
**DTM Multislot Class:** N/A



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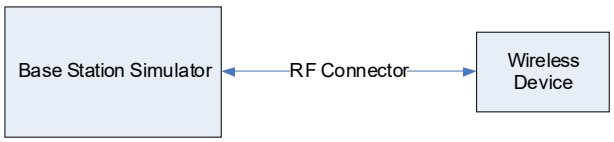


**Figure 9-1**
**Power Measurement Setup**

## 9.2 UMTS Conducted Powers

**Table 9-2**
**Maximum Conducted Power**

| 3GPP Release Version | Mode | 3GPP 34.121 Subtest | Cellular Band [dBm] | | | AWS Band [dBm] | | | PCS Band [dBm] | | | 3GPP MPR [dB] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 4132 | 4183 | 4233 | 1312 | 1412 | 1513 | 9262 | 9400 | 9538 | |
| 99 | WCDMA | 12.2 kbps RMC | 24.53 | 24.51 | 24.48 | 24.60 | 24.52 | 24.61 | 24.55 | 24.65 | 24.46 | - |
| 99 | | 12.2 kbps AMR | 24.46 | 24.38 | 24.55 | 24.63 | 24.56 | 24.58 | 24.53 | 24.61 | 24.45 | - |
| 6 | HSDPA | Subtest 1 | 24.56 | 24.52 | 24.47 | 24.63 | 24.54 | 24.62 | 24.55 | 24.63 | 24.58 | 0 |
| 6 | | Subtest 2 | 24.52 | 24.46 | 24.48 | 24.51 | 24.52 | 24.56 | 24.49 | 24.58 | 24.45 | 0 |
| 6 | | Subtest 3 | 23.64 | 23.50 | 23.54 | 24.17 | 24.05 | 24.00 | 23.56 | 23.57 | 23.48 | 0.5 |
| 6 | | Subtest 4 | 23.59 | 23.52 | 23.58 | 24.14 | 24.01 | 24.05 | 23.52 | 23.63 | 23.51 | 0.5 |
| 6 | HSUPA | Subtest 1 | 24.31 | 24.34 | 24.35 | 24.58 | 24.52 | 24.61 | 24.42 | 24.40 | 24.45 | 0 |
| 6 | | Subtest 2 | 22.69 | 22.64 | 22.53 | 22.64 | 22.61 | 22.51 | 22.61 | 22.51 | 22.61 | 2 |
| 6 | | Subtest 3 | 23.58 | 23.34 | 23.42 | 23.56 | 23.65 | 23.66 | 23.31 | 23.42 | 23.52 | 1 |
| 6 | | Subtest 4 | 22.64 | 22.61 | 22.33 | 22.60 | 22.57 | 22.61 | 22.56 | 22.47 | 22.61 | 2 |
| 6 | | Subtest 5 | 24.42 | 24.39 | 24.38 | 24.59 | 24.51 | 24.63 | 24.35 | 24.51 | 24.41 | 0 |

This device does not support DC-HSDPA.

**Figure 9-2**
**Power Measurement Setup**



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## 9.3 LTE Conducted Powers

### 9.3.1 LTE Band 71

**Table 9-3**
**LTE Band 71 Conducted Powers - 20 MHz Bandwidth**

| LTE Band 71 20 MHz Bandwidth | | | | | |
|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Mid Channel 133297 (680.5 MHz) Conducted Power [dBm] | MPR Allowed per 3GPP [dB] | MPR [dB] |
| QPSK | 1 | 0 | **24.61** | 0 | 0 |
| | 1 | 50 | 24.32 | | 0 |
| | 1 | 99 | 24.31 | | 0 |
| | 50 | 0 | 23.65 | 0-1 | 1 |
| | 50 | 25 | **23.68** | | 1 |
| | 50 | 50 | 23.65 | | 1 |
| | 100 | 0 | 23.57 | | 1 |
| 16QAM | 1 | 0 | 23.66 | 0-1 | 1 |
| | 1 | 50 | 23.51 | | 1 |
| | 1 | 99 | 23.41 | | 1 |
| | 50 | 0 | 22.52 | 0-2 | 2 |
| | 50 | 25 | 22.53 | | 2 |
| | 50 | 50 | 22.54 | | 2 |
| | 100 | 0 | 22.58 | | 2 |

Note: LTE Band 71 at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

**Table 9-4**
**LTE Band 71 Conducted Powers - 15 MHz Bandwidth**

| LTE Band 71 15 MHz Bandwidth | | | | | |
|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Mid Channel 133297 (680.5 MHz) Conducted Power [dBm] | MPR Allowed per 3GPP [dB] | MPR [dB] |
| QPSK | 1 | 0 | 24.45 | 0 | 0 |
| | 1 | 36 | 24.44 | | 0 |
| | 1 | 74 | 24.43 | | 0 |
| | 36 | 0 | 23.69 | 0-1 | 1 |
| | 36 | 18 | 23.70 | | 1 |
| | 36 | 37 | 23.70 | | 1 |
| | 75 | 0 | 23.67 | | 1 |
| 16QAM | 1 | 0 | 23.37 | 0-1 | 1 |
| | 1 | 36 | 23.35 | | 1 |
| | 1 | 74 | 23.58 | | 1 |
| | 36 | 0 | 22.67 | 0-2 | 2 |
| | 36 | 18 | 22.58 | | 2 |
| | 36 | 37 | 22.59 | | 2 |
| | 75 | 0 | 22.69 | | 2 |

Note: LTE Band 71 at 15 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.




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## Table 9-5
## LTE Band 71 Conducted Powers - 10 MHz Bandwidth

| LTE Band 71 10 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 133172 (668.0 MHz) | Mid Channel 133297 (680.5 MHz) | High Channel 133422 (693.0 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.45 | 24.54 | 24.38 | 0 | 0 |
| | 1 | 25 | 24.65 | 24.53 | 24.35 | | 0 |
| | 1 | 49 | 24.60 | 24.54 | 24.33 | | 0 |
| | 25 | 0 | 23.70 | 23.66 | 23.65 | 0-1 | 1 |
| | 25 | 12 | 23.67 | 23.66 | 23.61 | | 1 |
| | 25 | 25 | 23.69 | 23.66 | 23.45 | | 1 |
| | 50 | 0 | 23.70 | 23.66 | 23.66 | | 1 |
| 16QAM | 1 | 0 | 23.69 | 23.52 | 23.52 | 0-1 | 1 |
| | 1 | 25 | 23.69 | 23.53 | 23.68 | | 1 |
| | 1 | 49 | 23.69 | 23.54 | 23.68 | | 1 |
| | 25 | 0 | 22.62 | 22.50 | 22.55 | 0-2 | 2 |
| | 25 | 12 | 22.60 | 22.60 | 22.51 | | 2 |
| | 25 | 25 | 22.69 | 22.51 | 22.62 | | 2 |
| | 50 | 0 | 22.40 | 22.60 | 22.59 | | 2 |

## Table 9-6
## LTE Band 71 Conducted Powers - 5 MHz Bandwidth

| LTE Band 71 5 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 133147 (665.5 MHz) | Mid Channel 133297 (680.5 MHz) | High Channel 133447 (695.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.69 | 24.53 | 24.49 | 0 | 0 |
| | 1 | 12 | 24.66 | 24.57 | 24.42 | | 0 |
| | 1 | 24 | 24.54 | 24.58 | 24.42 | | 0 |
| | 12 | 0 | 23.67 | 23.46 | 23.61 | 0-1 | 1 |
| | 12 | 6 | 23.67 | 23.60 | 23.53 | | 1 |
| | 12 | 13 | 23.67 | 23.55 | 23.50 | | 1 |
| | 25 | 0 | 23.65 | 23.63 | 23.56 | | 1 |
| 16QAM | 1 | 0 | 23.24 | 23.36 | 23.45 | 0-1 | 1 |
| | 1 | 12 | 23.24 | 23.63 | 23.60 | | 1 |
| | 1 | 24 | 23.20 | 23.62 | 23.59 | | 1 |
| | 12 | 0 | 22.62 | 22.51 | 22.44 | 0-2 | 2 |
| | 12 | 6 | 22.42 | 22.62 | 22.62 | | 2 |
| | 12 | 13 | 22.54 | 22.59 | 22.64 | | 2 |
| | 25 | 0 | 22.56 | 22.61 | 22.60 | | 2 |



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## 9.3.2 LTE Band 12

**Table 9-7**
**LTE Band 12 Conducted Powers - 10 MHz Bandwidth**

| LTE Band 12 10 MHz Bandwidth | | | | | |
|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Mid Channel 23095 (707.5 MHz) Conducted Power [dBm] | MPR Allowed per 3GPP [dB] | MPR [dB] |
| QPSK | 1 | 0 | 24.44 | 0 | 0 |
| | 1 | 25 | **24.63** | | 0 |
| | 1 | 49 | 24.53 | | 0 |
| | 25 | 0 | 23.60 | 0-1 | 1 |
| | 25 | 12 | **23.62** | | 1 |
| | 25 | 25 | 23.60 | | 1 |
| | 50 | 0 | 23.58 | | 1 |
| 16QAM | 1 | 0 | 23.45 | 0-1 | 1 |
| | 1 | 25 | 23.41 | | 1 |
| | 1 | 49 | 23.32 | | 1 |
| | 25 | 0 | 22.56 | 0-2 | 2 |
| | 25 | 12 | 22.57 | | 2 |
| | 25 | 25 | 22.58 | | 2 |
| | 50 | 0 | 22.39 | | 2 |

Note: LTE Band 12 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

**Table 9-8**
**LTE Band 12 Conducted Powers - 5 MHz Bandwidth**

| LTE Band 12 5 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 23035 (701.5 MHz) | Mid Channel 23095 (707.5 MHz) | High Channel 23155 (713.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.55 | 24.57 | 24.41 | 0 | 0 |
| | 1 | 12 | 24.53 | 24.56 | 24.43 | | 0 |
| | 1 | 24 | 24.50 | 24.55 | 24.51 | | 0 |
| | 12 | 0 | 23.50 | 23.53 | 23.53 | 0-1 | 1 |
| | 12 | 6 | 23.50 | 23.53 | 23.54 | | 1 |
| | 12 | 13 | 23.50 | 23.54 | 23.55 | | 1 |
| | 25 | 0 | 23.38 | 23.49 | 23.54 | | 1 |
| 16QAM | 1 | 0 | 23.62 | 23.32 | 23.21 | 0-1 | 1 |
| | 1 | 12 | 23.60 | 23.32 | 23.32 | | 1 |
| | 1 | 24 | 23.51 | 23.32 | 23.25 | | 1 |
| | 12 | 0 | 22.27 | 22.39 | 22.24 | 0-2 | 2 |
| | 12 | 6 | 22.28 | 22.39 | 22.24 | | 2 |
| | 12 | 13 | 22.28 | 22.50 | 22.25 | | 2 |
| | 25 | 0 | 22.41 | 22.41 | 22.42 | | 2 |




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## Table 9-9
## LTE Band 12 Conducted Powers - 3 MHz Bandwidth

| LTE Band 12 3 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 23025 (700.5 MHz) | Mid Channel 23095 (707.5 MHz) | High Channel 23165 (714.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.55 | 24.45 | 24.53 | 0 | 0 |
| | 1 | 7 | 24.51 | 24.57 | 24.51 | | 0 |
| | 1 | 14 | 24.50 | 24.57 | 24.50 | | 0 |
| | 8 | 0 | 23.63 | 23.59 | 23.63 | 0-1 | 1 |
| | 8 | 4 | 23.63 | 23.59 | 23.64 | | 1 |
| | 8 | 7 | 23.64 | 23.58 | 23.63 | | 1 |
| | 15 | 0 | 23.58 | 23.64 | 23.69 | | 1 |
| 16QAM | 1 | 0 | 23.45 | 23.53 | 23.50 | 0-1 | 1 |
| | 1 | 7 | 23.54 | 23.52 | 23.51 | | 1 |
| | 1 | 14 | 23.61 | 23.56 | 23.45 | | 1 |
| | 8 | 0 | 22.62 | 22.62 | 22.60 | 0-2 | 2 |
| | 8 | 4 | 22.67 | 22.61 | 22.53 | | 2 |
| | 8 | 7 | 22.63 | 22.51 | 22.61 | | 2 |
| | 15 | 0 | 22.42 | 22.57 | 22.57 | | 2 |

## Table 9-10
## LTE Band 12 Conducted Powers -1.4 MHz Bandwidth

| LTE Band 12 1.4 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 23017 (699.7 MHz) | Mid Channel 23095 (707.5 MHz) | High Channel 23173 (715.3 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.46 | 24.41 | 24.64 | 0 | 0 |
| | 1 | 2 | 24.43 | 24.48 | 24.60 | | 0 |
| | 1 | 5 | 24.39 | 24.55 | 24.66 | | 0 |
| | 3 | 0 | 24.50 | 24.65 | 24.51 | | 0 |
| | 3 | 2 | 24.57 | 24.64 | 24.54 | | 0 |
| | 3 | 3 | 24.65 | 24.63 | 24.47 | | 0 |
| | 6 | 0 | 23.54 | 23.61 | 23.57 | 0-1 | 1 |
| 16QAM | 1 | 0 | 23.66 | 23.43 | 23.60 | 0-1 | 1 |
| | 1 | 2 | 23.65 | 23.43 | 23.64 | | 1 |
| | 1 | 5 | 23.45 | 23.39 | 23.51 | | 1 |
| | 3 | 0 | 23.45 | 23.62 | 23.33 | | 1 |
| | 3 | 2 | 23.45 | 23.49 | 23.33 | | 1 |
| | 3 | 3 | 23.36 | 23.43 | 23.33 | | 1 |
| | 6 | 0 | 22.29 | 22.35 | 22.50 | 0-2 | 2 |




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### 9.3.3 LTE Band 26 (Cell)

**Table 9-11**
**LTE Band 26 (Cell) Conducted Powers - 15 MHz Bandwidth**

| LTE Band 26 (Cell) 15 MHz Bandwidth | | | | | |
|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Mid Channel 26865 (831.5 MHz) Conducted Power [dBm] | MPR Allowed per 3GPP [dB] | MPR [dB] |
| QPSK | 1 | 0 | **24.49** | 0 | 0 |
| | 1 | 36 | 24.48 | | 0 |
| | 1 | 74 | 24.47 | | 0 |
| | 36 | 0 | 23.57 | 0-1 | 1 |
| | 36 | 18 | **23.60** | | 1 |
| | 36 | 37 | 23.57 | | 1 |
| | 75 | 0 | 23.53 | | 1 |
| 16QAM | 1 | 0 | 23.41 | 0-1 | 1 |
| | 1 | 36 | 23.41 | | 1 |
| | 1 | 74 | 23.69 | | 1 |
| | 36 | 0 | 22.54 | 0-2 | 2 |
| | 36 | 18 | 22.55 | | 2 |
| | 36 | 37 | 22.53 | | 2 |
| | 75 | 0 | 22.54 | | 2 |

Note: LTE Band 26 (Cell) at 15 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

**Table 9-12**
**LTE Band 26 (Cell) Conducted Powers - 10 MHz Bandwidth**

| LTE Band 26 (Cell) 10 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26740 (819.0 MHz) | Mid Channel 26865 (831.5 MHz) | High Channel 26990 (844.0 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.42 | 24.47 | 24.44 | 0 | 0 |
| | 1 | 25 | 24.41 | 24.46 | 24.42 | | 0 |
| | 1 | 49 | 24.40 | 24.45 | 24.41 | | 0 |
| | 25 | 0 | 23.62 | 23.55 | 23.60 | 0-1 | 1 |
| | 25 | 12 | 23.61 | 23.55 | 23.60 | | 1 |
| | 25 | 25 | 23.53 | 23.56 | 23.59 | | 1 |
| | 50 | 0 | 23.52 | 23.58 | 23.60 | | 1 |
| 16QAM | 1 | 0 | 23.60 | 23.46 | 23.65 | 0-1 | 1 |
| | 1 | 25 | 23.58 | 23.53 | 23.51 | | 1 |
| | 1 | 49 | 23.64 | 23.51 | 23.54 | | 1 |
| | 25 | 0 | 22.61 | 22.57 | 22.59 | 0-2 | 2 |
| | 25 | 12 | 22.62 | 22.53 | 22.70 | | 2 |
| | 25 | 25 | 22.60 | 22.51 | 22.70 | | 2 |
| | 50 | 0 | 22.46 | 22.51 | 22.43 | | 2 |




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## Table 9-13
## LTE Band 26 (Cell) Conducted Powers - 5 MHz Bandwidth

| LTE Band 26 (Cell) 5 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26715 (816.5 MHz) | Mid Channel 26865 (831.5 MHz) | High Channel 27015 (846.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.60 | 24.64 | 24.41 | 0 | 0 |
| | 1 | 12 | 24.63 | 24.51 | 24.49 | | 0 |
| | 1 | 24 | 24.62 | 24.38 | 24.47 | | 0 |
| | 12 | 0 | 23.54 | 23.52 | 23.50 | 0-1 | 1 |
| | 12 | 6 | 23.55 | 23.52 | 23.49 | | 1 |
| | 12 | 13 | 23.55 | 23.44 | 23.48 | | 1 |
| | 25 | 0 | 23.62 | 23.49 | 23.56 | | 1 |
| 16QAM | 1 | 0 | 23.50 | 23.38 | 23.44 | 0-1 | 1 |
| | 1 | 12 | 23.60 | 23.31 | 23.49 | | 1 |
| | 1 | 24 | 23.63 | 23.39 | 23.49 | | 1 |
| | 12 | 0 | 22.46 | 22.23 | 22.32 | 0-2 | 2 |
| | 12 | 6 | 22.30 | 22.46 | 22.32 | | 2 |
| | 12 | 13 | 22.31 | 22.44 | 22.42 | | 2 |
| | 25 | 0 | 22.51 | 22.54 | 22.60 | | 2 |

## Table 9-14
## LTE Band 26 (Cell) Conducted Powers - 3 MHz Bandwidth

| LTE Band 26 (Cell) 3 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26705 (815.5 MHz) | Mid Channel 26865 (831.5 MHz) | High Channel 27025 (847.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.58 | 24.46 | 24.52 | 0 | 0 |
| | 1 | 7 | 24.49 | 24.44 | 24.48 | | 0 |
| | 1 | 14 | 24.49 | 24.38 | 24.46 | | 0 |
| | 8 | 0 | 23.55 | 23.46 | 23.60 | 0-1 | 1 |
| | 8 | 4 | 23.56 | 23.47 | 23.59 | | 1 |
| | 8 | 7 | 23.56 | 23.47 | 23.58 | | 1 |
| | 15 | 0 | 23.51 | 23.45 | 23.58 | | 1 |
| 16QAM | 1 | 0 | 23.61 | 23.49 | 23.60 | 0-1 | 1 |
| | 1 | 7 | 23.64 | 23.54 | 23.61 | | 1 |
| | 1 | 14 | 23.68 | 23.48 | 23.51 | | 1 |
| | 8 | 0 | 22.59 | 22.45 | 22.59 | 0-2 | 2 |
| | 8 | 4 | 22.70 | 22.51 | 22.45 | | 2 |
| | 8 | 7 | 22.65 | 22.46 | 22.46 | | 2 |
| | 15 | 0 | 22.51 | 22.70 | 22.69 | | 2 |




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## Table 9-15
## LTE Band 26 (Cell) Conducted Powers -1.4 MHz Bandwidth

| LTE Band 26 (Cell) 1.4 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26697 (814.7 MHz) | Mid Channel 26865 (831.5 MHz) | High Channel 27033 (848.3 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.45 | 24.47 | 24.65 | 0 | 0 |
| | 1 | 2 | 24.45 | 24.47 | 24.62 | | 0 |
| | 1 | 5 | 24.62 | 24.48 | 24.67 | | 0 |
| | 3 | 0 | 24.47 | 24.50 | 24.54 | | 0 |
| | 3 | 2 | 24.47 | 24.55 | 24.61 | | 0 |
| | 3 | 3 | 24.46 | 24.55 | 24.51 | | 0 |
| | 6 | 0 | 23.53 | 23.54 | 23.52 | 0-1 | 1 |
| 16QAM | 1 | 0 | 23.53 | 23.60 | 23.65 | 0-1 | 1 |
| | 1 | 2 | 23.54 | 23.50 | 23.65 | | 1 |
| | 1 | 5 | 23.40 | 23.68 | 23.65 | | 1 |
| | 3 | 0 | 23.50 | 23.61 | 23.47 | | 1 |
| | 3 | 2 | 23.49 | 23.51 | 23.30 | | 1 |
| | 3 | 3 | 23.50 | 23.42 | 23.40 | | 1 |
| | 6 | 0 | 22.64 | 22.59 | 22.47 | 0-2 | 2 |




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## 9.3.4 LTE Band 66 (AWS)

**Table 9-16**
**LTE Band 66 (AWS) Conducted Powers - 20 MHz Bandwidth**

| LTE Band 66 (AWS) 20 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 132072 (1720.0 MHz) | Mid Channel 132322 (1745.0 MHz) | High Channel 132572 (1770.0 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.60 | 24.50 | 24.48 | 0 | 0 |
| | 1 | 50 | **24.68** | 24.49 | 24.55 | | 0 |
| | 1 | 99 | 24.65 | 24.41 | 24.54 | | 0 |
| | 50 | 0 | **23.65** | 23.64 | 23.52 | 0-1 | 1 |
| | 50 | 25 | 23.64 | 23.56 | 23.52 | | 1 |
| | 50 | 50 | 23.64 | 23.52 | 23.52 | | 1 |
| | 100 | 0 | 23.60 | 23.61 | 23.53 | | 1 |
| 16QAM | 1 | 0 | 23.51 | 23.65 | 23.62 | 0-1 | 1 |
| | 1 | 50 | 23.50 | 23.58 | 23.62 | | 1 |
| | 1 | 99 | 23.59 | 23.62 | 23.51 | | 1 |
| | 50 | 0 | 22.59 | 22.55 | 22.50 | 0-2 | 2 |
| | 50 | 25 | 22.60 | 22.55 | 22.50 | | 2 |
| | 50 | 50 | 22.61 | 22.56 | 22.51 | | 2 |
| | 100 | 0 | 22.59 | 22.44 | 22.47 | | 2 |

**Table 9-17**
**LTE Band 66 (AWS) Conducted Powers - 15 MHz Bandwidth**

| LTE Band 66 (AWS) 15 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 132047 (1717.5 MHz) | Mid Channel 132322 (1745.0 MHz) | High Channel 132597 (1772.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.50 | 24.41 | 24.55 | 0 | 0 |
| | 1 | 36 | 24.57 | 24.40 | 24.45 | | 0 |
| | 1 | 74 | 24.57 | 24.42 | 24.59 | | 0 |
| | 36 | 0 | 23.48 | 23.54 | 23.70 | 0-1 | 1 |
| | 36 | 18 | 23.48 | 23.54 | 23.69 | | 1 |
| | 36 | 37 | 23.47 | 23.54 | 23.68 | | 1 |
| | 75 | 0 | 23.52 | 23.34 | 23.60 | | 1 |
| 16QAM | 1 | 0 | 23.52 | 23.51 | 23.63 | 0-1 | 1 |
| | 1 | 36 | 23.50 | 23.68 | 23.62 | | 1 |
| | 1 | 74 | 23.59 | 23.55 | 23.61 | | 1 |
| | 36 | 0 | 22.43 | 22.69 | 22.60 | 0-2 | 2 |
| | 36 | 18 | 22.45 | 22.63 | 22.65 | | 2 |
| | 36 | 37 | 22.45 | 22.57 | 22.45 | | 2 |
| | 75 | 0 | 22.46 | 22.60 | 22.58 | | 2 |




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## Table 9-18
## LTE Band 66 (AWS) Conducted Powers - 10 MHz Bandwidth

| LTE Band 66 (AWS) 10 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 132022 (1715.0 MHz) | Mid Channel 132322 (1745.0 MHz) | High Channel 132622 (1775.0 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.47 | 24.47 | 24.46 | 0 | 0 |
| | 1 | 25 | 24.44 | 24.47 | 24.44 | | 0 |
| | 1 | 49 | 24.29 | 24.47 | 24.53 | | 0 |
| | 25 | 0 | 23.40 | 23.43 | 23.37 | 0-1 | 1 |
| | 25 | 12 | 23.40 | 23.44 | 23.37 | | 1 |
| | 25 | 25 | 23.40 | 23.45 | 23.37 | | 1 |
| | 50 | 0 | 23.44 | 23.44 | 23.42 | | 1 |
| 16QAM | 1 | 0 | 23.60 | 23.50 | 23.56 | 0-1 | 1 |
| | 1 | 25 | 23.59 | 23.62 | 23.57 | | 1 |
| | 1 | 49 | 23.52 | 23.31 | 23.56 | | 1 |
| | 25 | 0 | 22.40 | 22.42 | 22.41 | 0-2 | 2 |
| | 25 | 12 | 22.41 | 22.63 | 22.41 | | 2 |
| | 25 | 25 | 22.51 | 22.55 | 22.42 | | 2 |
| | 50 | 0 | 22.54 | 22.48 | 22.41 | | 2 |

## Table 9-19
## LTE Band 66 (AWS) Conducted Powers - 5 MHz Bandwidth

| LTE Band 66 (AWS) 5 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 131997 (1712.5 MHz) | Mid Channel 132322 (1745.0 MHz) | High Channel 132647 (1777.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.63 | 24.53 | 24.41 | 0 | 0 |
| | 1 | 12 | 24.60 | 24.53 | 24.42 | | 0 |
| | 1 | 24 | 24.59 | 24.46 | 24.62 | | 0 |
| | 12 | 0 | 23.35 | 23.43 | 23.42 | 0-1 | 1 |
| | 12 | 6 | 23.35 | 23.44 | 23.41 | | 1 |
| | 12 | 13 | 23.35 | 23.44 | 23.41 | | 1 |
| | 25 | 0 | 23.36 | 23.44 | 23.46 | | 1 |
| 16QAM | 1 | 0 | 23.70 | 23.40 | 23.37 | 0-1 | 1 |
| | 1 | 12 | 23.69 | 23.40 | 23.47 | | 1 |
| | 1 | 24 | 23.69 | 23.42 | 23.47 | | 1 |
| | 12 | 0 | 22.35 | 22.33 | 22.41 | 0-2 | 2 |
| | 12 | 6 | 22.24 | 22.34 | 22.43 | | 2 |
| | 12 | 13 | 22.37 | 22.35 | 22.32 | | 2 |
| | 25 | 0 | 22.24 | 22.39 | 22.38 | | 2 |




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## Table 9-20
## LTE Band 66 (AWS) Conducted Powers - 3 MHz Bandwidth

| LTE Band 66 (AWS) 3 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 131987 (1711.5 MHz) | Mid Channel 132322 (1745.0 MHz) | High Channel 132657 (1778.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.53 | 24.53 | 24.63 | 0 | 0 |
| | 1 | 7 | 24.52 | 24.59 | 24.60 | | 0 |
| | 1 | 14 | 24.41 | 24.54 | 24.58 | | 0 |
| | 8 | 0 | 23.47 | 23.53 | 23.58 | 0-1 | 1 |
| | 8 | 4 | 23.58 | 23.34 | 23.58 | | 1 |
| | 8 | 7 | 23.58 | 23.35 | 23.58 | | 1 |
| | 15 | 0 | 23.47 | 23.45 | 23.43 | | 1 |
| 16QAM | 1 | 0 | 23.64 | 23.62 | 23.47 | 0-1 | 1 |
| | 1 | 7 | 23.54 | 23.60 | 23.46 | | 1 |
| | 1 | 14 | 23.64 | 23.51 | 23.46 | | 1 |
| | 8 | 0 | 22.65 | 22.63 | 22.32 | 0-2 | 2 |
| | 8 | 4 | 22.66 | 22.64 | 22.33 | | 2 |
| | 8 | 7 | 22.65 | 22.68 | 22.34 | | 2 |
| | 15 | 0 | 22.44 | 22.53 | 22.48 | | 2 |

## Table 9-21
## LTE Band 66 (AWS) Conducted Powers -1.4 MHz Bandwidth

| LTE Band 66 (AWS) 1.4 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 131979 (1710.7 MHz) | Mid Channel 132322 (1745.0 MHz) | High Channel 132665 (1779.3 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.70 | 24.52 | 24.60 | 0 | 0 |
| | 1 | 2 | 24.67 | 24.52 | 24.51 | | 0 |
| | 1 | 5 | 24.65 | 24.53 | 24.49 | | 0 |
| | 3 | 0 | 24.66 | 24.43 | 24.54 | | 0 |
| | 3 | 2 | 24.64 | 24.50 | 24.52 | | 0 |
| | 3 | 3 | 24.63 | 24.50 | 24.50 | | 0 |
| | 6 | 0 | 23.43 | 23.38 | 23.49 | 0-1 | 1 |
| 16QAM | 1 | 0 | 23.57 | 23.51 | 23.50 | 0-1 | 1 |
| | 1 | 2 | 23.57 | 23.56 | 23.64 | | 1 |
| | 1 | 5 | 23.57 | 23.60 | 23.52 | | 1 |
| | 3 | 0 | 23.51 | 23.33 | 23.56 | | 1 |
| | 3 | 2 | 23.36 | 23.33 | 23.60 | | 1 |
| | 3 | 3 | 23.36 | 23.43 | 23.51 | | 1 |
| | 6 | 0 | 22.54 | 22.33 | 22.42 | 0-2 | 2 |




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## 9.3.5 LTE Band 25 (PCS)

**Table 9-22**
**LTE Band 25 (PCS) Conducted Powers - 20 MHz Bandwidth**

| LTE Band 25 (PCS) 20 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26140 (1860.0 MHz) | Mid Channel 26365 (1882.5 MHz) | High Channel 26590 (1905.0 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.52 | 24.58 | 24.48 | 0 | 0 |
| | 1 | 50 | 24.48 | 24.57 | 24.56 | | 0 |
| | 1 | 99 | **24.59** | 24.57 | 24.55 | | 0 |
| | 50 | 0 | 23.28 | 23.22 | **23.53** | 0-1 | 1 |
| | 50 | 25 | 23.28 | 23.23 | 23.43 | | 1 |
| | 50 | 50 | 23.37 | 23.45 | 23.43 | | 1 |
| | 100 | 0 | 23.33 | 23.22 | 23.20 | | 1 |
| 16QAM | 1 | 0 | 23.21 | 23.29 | 23.46 | 0-1 | 1 |
| | 1 | 50 | 23.20 | 23.30 | 23.45 | | 1 |
| | 1 | 99 | 23.20 | 23.50 | 23.45 | | 1 |
| | 50 | 0 | 22.35 | 22.34 | 22.50 | 0-2 | 2 |
| | 50 | 25 | 22.35 | 22.46 | 22.60 | | 2 |
| | 50 | 50 | 22.45 | 22.46 | 22.50 | | 2 |
| | 100 | 0 | 22.44 | 22.27 | 22.42 | | 2 |

**Table 9-23**
**LTE Band 25 (PCS) Conducted Powers - 15 MHz Bandwidth**

| LTE Band 25 (PCS) 15 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26115 (1857.5 MHz) | Mid Channel 26365 (1882.5 MHz) | High Channel 26615 (1907.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.40 | 24.49 | 24.44 | 0 | 0 |
| | 1 | 36 | 24.47 | 24.49 | 24.52 | | 0 |
| | 1 | 74 | 24.54 | 24.49 | 24.40 | | 0 |
| | 36 | 0 | 23.35 | 23.33 | 23.36 | 0-1 | 1 |
| | 36 | 18 | 23.34 | 23.44 | 23.36 | | 1 |
| | 36 | 37 | 23.34 | 23.34 | 23.36 | | 1 |
| | 75 | 0 | 23.22 | 23.49 | 23.35 | | 1 |
| 16QAM | 1 | 0 | 23.45 | 23.42 | 23.47 | 0-1 | 1 |
| | 1 | 36 | 23.43 | 23.53 | 23.49 | | 1 |
| | 1 | 74 | 23.42 | 23.53 | 23.38 | | 1 |
| | 36 | 0 | 22.49 | 22.34 | 22.46 | 0-2 | 2 |
| | 36 | 18 | 22.39 | 22.35 | 22.37 | | 2 |
| | 36 | 37 | 22.41 | 22.36 | 22.48 | | 2 |
| | 75 | 0 | 22.32 | 22.30 | 22.43 | | 2 |



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## Table 9-24
## LTE Band 25 (PCS) Conducted Powers - 10 MHz Bandwidth

| LTE Band 25 (PCS) 10 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26090 (1855.0 MHz) | Mid Channel 26365 (1882.5 MHz) | High Channel 26640 (1910.0 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.40 | 24.40 | 24.46 | 0 | 0 |
| | 1 | 25 | 24.47 | 24.40 | 24.44 | | 0 |
| | 1 | 49 | 24.36 | 24.44 | 24.43 | | 0 |
| | 25 | 0 | 23.28 | 23.34 | 23.39 | 0-1 | 1 |
| | 25 | 12 | 23.28 | 23.35 | 23.49 | | 1 |
| | 25 | 25 | 23.28 | 23.35 | 23.39 | | 1 |
| | 50 | 0 | 23.29 | 23.40 | 23.38 | | 1 |
| 16QAM | 1 | 0 | 23.50 | 23.50 | 23.38 | 0-1 | 1 |
| | 1 | 25 | 23.60 | 23.32 | 23.36 | | 1 |
| | 1 | 49 | 23.61 | 23.30 | 23.37 | | 1 |
| | 25 | 0 | 22.28 | 22.33 | 22.34 | 0-2 | 2 |
| | 25 | 12 | 22.39 | 22.34 | 22.45 | | 2 |
| | 25 | 25 | 22.39 | 22.35 | 22.36 | | 2 |
| | 50 | 0 | 22.35 | 22.33 | 22.41 | | 2 |

## Table 9-25
## LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth

| LTE Band 25 (PCS) 5 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26065 (1852.5 MHz) | Mid Channel 26365 (1882.5 MHz) | High Channel 26665 (1912.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.49 | 24.49 | 24.54 | 0 | 0 |
| | 1 | 12 | 24.47 | 24.59 | 24.52 | | 0 |
| | 1 | 24 | 24.55 | 24.59 | 24.49 | | 0 |
| | 12 | 0 | 23.31 | 23.50 | 23.49 | 0-1 | 1 |
| | 12 | 6 | 23.31 | 23.30 | 23.47 | | 1 |
| | 12 | 13 | 23.30 | 23.31 | 23.46 | | 1 |
| | 25 | 0 | 23.23 | 23.44 | 23.22 | | 1 |
| 16QAM | 1 | 0 | 23.60 | 23.25 | 23.43 | 0-1 | 1 |
| | 1 | 12 | 23.69 | 23.36 | 23.44 | | 1 |
| | 1 | 24 | 23.69 | 23.37 | 23.44 | | 1 |
| | 12 | 0 | 22.41 | 22.39 | 22.35 | 0-2 | 2 |
| | 12 | 6 | 22.42 | 22.39 | 22.35 | | 2 |
| | 12 | 13 | 22.39 | 22.32 | 22.46 | | 2 |
| | 25 | 0 | 22.32 | 22.40 | 22.47 | | 2 |




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## Table 9-26
## LTE Band 25 (PCS) Conducted Powers - 3 MHz Bandwidth

| LTE Band 25 (PCS) 3 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26055 (1851.5 MHz) | Mid Channel 26365 (1882.5 MHz) | High Channel 26675 (1913.5 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.57 | 24.46 | 24.40 | 0 | 0 |
| | 1 | 7 | 24.46 | 24.56 | 24.46 | | 0 |
| | 1 | 14 | 24.45 | 24.56 | 24.43 | | 0 |
| | 8 | 0 | 23.56 | 23.45 | 23.39 | 0-1 | 1 |
| | 8 | 4 | 23.46 | 23.58 | 23.38 | | 1 |
| | 8 | 7 | 23.56 | 23.49 | 23.37 | | 1 |
| | 15 | 0 | 23.48 | 23.41 | 23.30 | | 1 |
| 16QAM | 1 | 0 | 23.65 | 23.32 | 23.69 | 0-1 | 1 |
| | 1 | 7 | 23.64 | 23.32 | 23.58 | | 1 |
| | 1 | 14 | 23.64 | 23.35 | 23.47 | | 1 |
| | 8 | 0 | 22.31 | 22.26 | 22.39 | 0-2 | 2 |
| | 8 | 4 | 22.32 | 22.39 | 22.31 | | 2 |
| | 8 | 7 | 22.40 | 22.48 | 22.35 | | 2 |
| | 15 | 0 | 22.23 | 22.46 | 22.48 | | 2 |

## Table 9-27
## LTE Band 25 (PCS) Conducted Powers -1.4 MHz Bandwidth

| LTE Band 25 (PCS) 1.4 MHz Bandwidth | | | | | | | |
|---|---|---|---|---|---|---|---|
| Modulation | RB Size | RB Offset | Low Channel 26047 (1850.7 MHz) | Mid Channel 26365 (1882.5 MHz) | High Channel 26683 (1914.3 MHz) | MPR Allowed per 3GPP [dB] | MPR [dB] |
| | | | Conducted Power [dBm] | | | | |
| QPSK | 1 | 0 | 24.48 | 24.53 | 24.43 | 0 | 0 |
| | 1 | 2 | 24.44 | 24.52 | 24.37 | | 0 |
| | 1 | 5 | 24.53 | 24.51 | 24.24 | | 0 |
| | 3 | 0 | 24.61 | 24.50 | 24.59 | | 0 |
| | 3 | 2 | 24.60 | 24.22 | 24.47 | | 0 |
| | 3 | 3 | 24.58 | 24.40 | 24.23 | | 0 |
| | 6 | 0 | 23.54 | 23.41 | 23.38 | 0-1 | 1 |
| 16QAM | 1 | 0 | 23.62 | 23.11 | 23.30 | 0-1 | 1 |
| | 1 | 2 | 23.40 | 23.05 | 23.40 | | 1 |
| | 1 | 5 | 23.35 | 23.06 | 23.39 | | 1 |
| | 3 | 0 | 23.38 | 23.36 | 23.38 | | 1 |
| | 3 | 2 | 23.28 | 23.20 | 23.48 | | 1 |
| | 3 | 3 | 23.37 | 23.36 | 23.58 | | 1 |
| | 6 | 0 | 22.51 | 22.20 | 22.29 | 0-2 | 2 |




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## 9.4 WLAN Conducted Powers

**Table 9-28**
**2.4 GHz WLAN Maximum Average RF Power**

| 2.4GHz Conducted Power [dBm] | | | | |
|---|---|---|---|---|
| Freq [MHz] | Channel | IEEE Transmission Mode | | |
| | | 802.11b | 802.11g | 802.11n |
| 2412 | 1 | **18.55** | 15.60 | 15.25 |
| 2437 | 6 | 18.54 | 16.69 | 16.15 |
| 2462 | 11 | 18.25 | 14.40 | 14.17 |

**Table 9-29**
**5 GHz WLAN Maximum Average RF Power**

| 5GHz (20MHz) Conducted Power [dBm] | | | |
|---|---|---|---|
| Freq [MHz] | Channel | IEEE Transmission Mode | |
| | | 802.11a | 802.11n |
| 5180 | 36 | 14.03 | 13.83 |
| 5200 | 40 | 15.70 | 15.69 |
| 5220 | 44 | 15.72 | 15.70 |
| 5240 | 48 | **15.76** | 15.67 |
| 5260 | 52 | 15.58 | 15.61 |
| 5280 | 56 | 15.60 | 15.61 |
| 5300 | 60 | **15.64** | 15.55 |
| 5320 | 64 | 13.94 | 13.52 |
| 5500 | 100 | 13.59 | 13.51 |
| 5520 | 104 | 15.40 | 15.38 |
| 5580 | 116 | 15.54 | 15.49 |
| 5660 | 132 | **15.54** | 15.54 |
| 5700 | 140 | 15.50 | 15.50 |
| 5745 | 149 | 15.38 | 15.36 |
| 5785 | 157 | **15.56** | 15.44 |
| 5825 | 165 | 13.94 | 13.52 |




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**Table 9-30**
**2.4 GHz WLAN Reduced Average RF Power**

| 2.4GHz Conducted Power [dBm] | | | | |
|---|---|---|---|---|
| Freq [MHz] | Channel | IEEE Transmission Mode | | |
| | | 802.11b | 802.11g | 802.11n |
| 2412 | 1 | 15.46 | 14.35 | 14.35 |
| 2417 | 2 | N/A | 15.42 | 15.38 |
| 2437 | 6 | **15.60** | 15.62 | 15.63 |
| 2457 | 10 | N/A | 15.51 | 15.51 |
| 2462 | 11 | 15.59 | 13.26 | 13.27 |

**Table 9-31**

**5 GHz WLAN Reduced Average RF Power**

| 5GHz (20MHz) Conducted Power [dBm] | | | |
|---|---|---|---|
| Freq [MHz] | Channel | IEEE Transmission Mode | |
| | | 802.11a | 802.11n |
| 5180 | 36 | 10.61 | 10.35 |
| 5200 | 40 | **11.81** | 11.84 |
| 5220 | 44 | 11.69 | 11.73 |
| 5240 | 48 | 11.74 | 11.69 |
| 5260 | 52 | **11.90** | 11.87 |
| 5280 | 56 | 11.86 | 11.78 |
| 5300 | 60 | 11.82 | 11.86 |
| 5320 | 64 | 10.33 | 10.45 |
| 5500 | 100 | 10.02 | 10.04 |
| 5520 | 104 | 11.73 | 11.79 |
| 5580 | 116 | **11.94** | 11.82 |
| 5660 | 132 | 11.86 | 11.99 |
| 5700 | 140 | 11.94 | 11.88 |
| 5745 | 149 | 11.91 | 11.79 |
| 5785 | 157 | **12.05** | 11.98 |
| 5805 | 161 | 10.35 | 10.15 |
| 5825 | 165 | 10.33 | 10.45 |

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.




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- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The bolded data rate and channel above were tested for SAR.

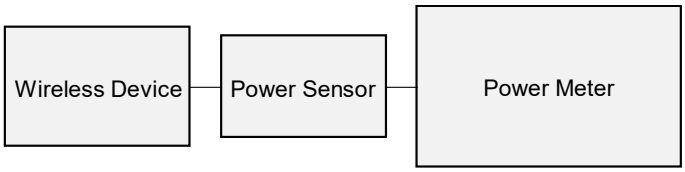


**Figure 9-3**
**Power Measurement Setup**

## 9.5 Bluetooth Conducted Powers

**Table 9-32**
**Bluetooth Average RF Power**

| Frequency [MHz] | Data Rate [Mbps] | Channel No. | Avg Conducted Power | |
|---|---|---|---|---|
| | | | [dBm] | [mW] |
| 2402 | 1.0 | 0 | 8.77 | 7.540 |
| 2441 | 1.0 | 39 | **9.49** | 8.900 |
| 2480 | 1.0 | 78 | 7.91 | 6.186 |
| 2402 | 2.0 | 0 | 8.14 | 6.515 |
| 2441 | 2.0 | 39 | 8.87 | 7.703 |
| 2480 | 2.0 | 78 | 7.29 | 5.359 |
| 2402 | 3.0 | 0 | 8.31 | 6.770 |
| 2441 | 3.0 | 39 | 8.95 | 7.846 |
| 2480 | 3.0 | 78 | 7.36 | 5.440 |

Note: The bolded data rates and channel above were tested for SAR.



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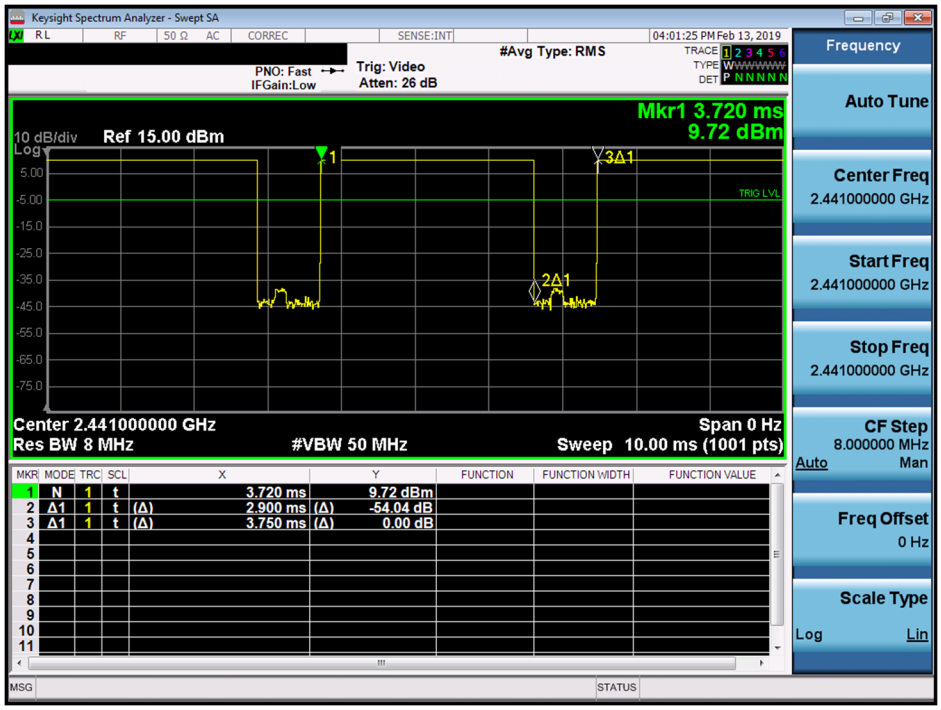
**Figure 9-4**
**Bluetooth Transmission Plot**




**Equation 9-1**
**Bluetooth Duty Cycle Calculation**

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.90ms}{3.75ms} * 100\% = 77.3\%$$

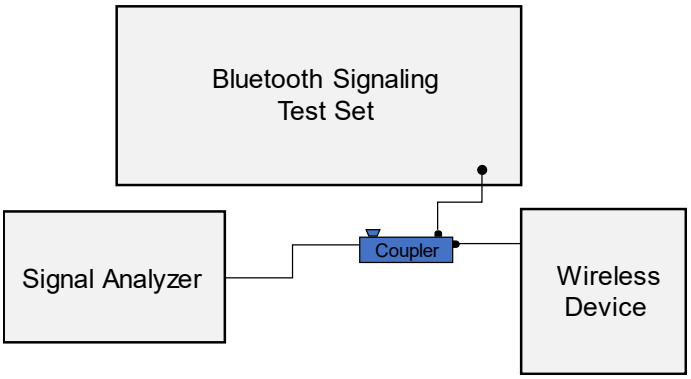



**Figure 9-5**
**Power Measurement Setup**

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# 10 SYSTEM VERIFICATION

## 10.1 Tissue Verification

**Table 10-1**
**Measured Tissue Properties**

| Calibrated for Tests Performed on: | Tissue Type | Tissue Temp During Calibration (˚C) | Measured Frequency (MHz) | Measured Conductivity, σ (S/m) | Measured Dielectric Constant, ε | TARGET Conductivity, σ (S/m) | TARGET Dielectric Constant, ε | % dev σ | % dev ε |
|---|---|---|---|---|---|---|---|---|---|
| 2/14/2019 | 750H | 20.7 | 680 | 0.871 | 42.164 | 0.888 | 42.305 | -1.91% | -0.33% |
| | | | 695 | 0.876 | 42.098 | 0.889 | 42.227 | -1.46% | -0.31% |
| | | | 700 | 0.881 | 42.165 | 0.889 | 42.201 | -0.90% | -0.09% |
| | | | 710 | 0.883 | 42.129 | 0.890 | 42.149 | -0.79% | -0.05% |
| | | | 740 | 0.897 | 41.952 | 0.893 | 41.994 | 0.45% | -0.10% |
| | | | 755 | 0.899 | 41.906 | 0.894 | 41.916 | 0.56% | -0.02% |
| 2/11/2019 | 835H | 20.3 | 820 | 0.875 | 39.560 | 0.899 | 41.578 | -2.67% | -4.85% |
| | | | 835 | 0.881 | 39.523 | 0.900 | 41.500 | -2.11% | -4.76% |
| | | | 850 | 0.887 | 39.481 | 0.916 | 41.500 | -3.17% | -4.87% |
| 2/26/2019 | 1750H | 21.8 | 1710 | 1.314 | 39.241 | 1.348 | 40.142 | -2.52% | -2.24% |
| | | | 1750 | 1.337 | 39.206 | 1.371 | 40.079 | -2.48% | -2.18% |
| | | | 1790 | 1.355 | 39.135 | 1.394 | 40.016 | -2.80% | -2.20% |
| 2/26/2019 | 1900H | 21.8 | 1850 | 1.394 | 39.048 | 1.400 | 40.000 | -0.43% | -2.38% |
| | | | 1880 | 1.411 | 39.006 | 1.400 | 40.000 | 0.79% | -2.49% |
| | | | 1910 | 1.426 | 38.925 | 1.400 | 40.000 | 1.86% | -2.69% |
| 2/13/2019 | 2450H | 20.3 | 2400 | 1.795 | 38.630 | 1.756 | 39.289 | 2.22% | -1.68% |
| | | | 2450 | 1.836 | 38.552 | 1.800 | 39.200 | 2.00% | -1.65% |
| | | | 2500 | 1.873 | 38.461 | 1.855 | 39.136 | 0.97% | -1.72% |
| 3/2/2019 | 2450H | 21.9 | 2400 | 1.833 | 41.198 | 1.756 | 39.289 | 4.38% | 4.86% |
| | | | 2450 | 1.876 | 41.135 | 1.800 | 39.200 | 4.22% | 4.94% |
| | | | 2500 | 1.915 | 41.031 | 1.855 | 39.136 | 3.23% | 4.84% |
| 02/25/2019 | 5200H-5800H | 21.7 | 5180 | 4.510 | 35.649 | 4.635 | 36.009 | -2.70% | -1.00% |
| | | | 5200 | 4.546 | 35.621 | 4.655 | 35.986 | -2.34% | -1.01% |
| | | | 5220 | 4.563 | 35.646 | 4.676 | 35.963 | -2.42% | -0.88% |
| | | | 5240 | 4.582 | 35.642 | 4.696 | 35.940 | -2.43% | -0.83% |
| | | | 5260 | 4.595 | 35.550 | 4.717 | 35.917 | -2.59% | -1.02% |
| | | | 5280 | 4.611 | 35.461 | 4.737 | 35.894 | -2.66% | -1.21% |
| | | | 5300 | 4.645 | 35.406 | 4.758 | 35.871 | -2.37% | -1.30% |
| | | | 5320 | 4.677 | 35.409 | 4.778 | 35.849 | -2.11% | -1.23% |
| | | | 5500 | 4.867 | 35.123 | 4.963 | 35.643 | -1.93% | -1.46% |
| | | | 5520 | 4.893 | 35.088 | 4.983 | 35.620 | -1.81% | -1.49% |
| | | | 5540 | 4.922 | 35.032 | 5.004 | 35.597 | -1.64% | -1.59% |
| | | | 5560 | 4.948 | 34.974 | 5.024 | 35.574 | -1.51% | -1.69% |
| | | | 5580 | 4.974 | 34.977 | 5.045 | 35.551 | -1.41% | -1.61% |
| | | | 5600 | 4.996 | 34.982 | 5.065 | 35.529 | -1.36% | -1.54% |
| | | | 5620 | 5.022 | 34.945 | 5.086 | 35.506 | -1.26% | -1.58% |
| | | | 5640 | 5.038 | 34.889 | 5.106 | 35.483 | -1.33% | -1.67% |
| | | | 5660 | 5.066 | 34.840 | 5.127 | 35.460 | -1.19% | -1.75% |
| | | | 5680 | 5.092 | 34.809 | 5.147 | 35.437 | -1.07% | -1.77% |
| | | | 5700 | 5.128 | 34.793 | 5.168 | 35.414 | -0.77% | -1.75% |
| | | | 5745 | 5.165 | 34.727 | 5.214 | 35.363 | -0.94% | -1.80% |
| | | | 5765 | 5.182 | 34.704 | 5.234 | 35.340 | -0.99% | -1.80% |
| | | | 5785 | 5.218 | 34.672 | 5.255 | 35.317 | -0.70% | -1.83% |
| | | | 5800 | 5.252 | 34.619 | 5.270 | 35.300 | -0.34% | -1.93% |
| | | | 5805 | 5.259 | 34.610 | 5.275 | 35.294 | -0.30% | -1.94% |
| | | | 5825 | 5.276 | 34.602 | 5.296 | 35.271 | -0.38% | -1.90% |




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| Calibrated for Tests Performed on: | Tissue Type | Tissue Temp During Calibration (˚C) | Measured Frequency (MHz) | Measured Conductivity, σ (S/m) | Measured Dielectric Constant, ε | TARGET Conductivity, σ (S/m) | TARGET Dielectric Constant, ε | % dev σ | % dev ε |
|---|---|---|---|---|---|---|---|---|---|
| 2/25/2019 | 750B | 19.8 | 680 | 0.916 | 54.005 | 0.958 | 55.804 | -4.38% | -3.22% |
| | | | 695 | 0.924 | 53.972 | 0.959 | 55.745 | -3.65% | -3.18% |
| | | | 700 | 0.927 | 53.962 | 0.959 | 55.726 | -3.34% | -3.17% |
| | | | 710 | 0.932 | 53.942 | 0.960 | 55.687 | -2.92% | -3.13% |
| | | | 740 | 0.943 | 53.874 | 0.963 | 55.570 | -2.08% | -3.05% |
| | | | 755 | 0.947 | 53.838 | 0.964 | 55.512 | -1.76% | -3.02% |
| 2/20/2019 | 835B | 21.2 | 820 | 0.943 | 53.083 | 0.969 | 55.258 | -2.68% | -3.94% |
| | | | 835 | 0.957 | 52.932 | 0.970 | 55.200 | -1.34% | -4.11% |
| | | | 850 | 0.971 | 52.769 | 0.988 | 55.154 | -1.72% | -4.32% |
| 3/6/2019 | 835B | 21.4 | 820 | 0.948 | 53.490 | 0.969 | 55.258 | -2.17% | -3.20% |
| | | | 835 | 0.963 | 53.334 | 0.970 | 55.200 | -0.72% | -3.38% |
| | | | 850 | 0.979 | 53.174 | 0.988 | 55.154 | -0.91% | -3.59% |
| 2/20/2019 | 1750B | 21.7 | 1710 | 1.410 | 52.659 | 1.463 | 53.537 | -3.62% | -1.64% |
| | | | 1750 | 1.457 | 52.518 | 1.488 | 53.432 | -2.08% | -1.71% |
| | | | 1790 | 1.495 | 52.430 | 1.514 | 53.326 | -1.25% | -1.68% |
| 3/3/2019 | 1750B | 22.0 | 1710 | 1.485 | 51.614 | 1.463 | 53.537 | 1.50% | -3.59% |
| | | | 1750 | 1.530 | 51.428 | 1.488 | 53.432 | 2.82% | -3.75% |
| | | | 1790 | 1.573 | 51.254 | 1.514 | 53.326 | 3.90% | -3.89% |
| 2/14/2019 | 1900B | 23.4 | 1850 | 1.506 | 52.497 | 1.520 | 53.300 | -0.92% | -1.51% |
| | | | 1880 | 1.536 | 52.388 | 1.520 | 53.300 | 1.05% | -1.71% |
| | | | 1910 | 1.571 | 52.335 | 1.520 | 53.300 | 3.36% | -1.81% |
| 2/20/2019 | 1900B | 22.0 | 1850 | 1.508 | 52.765 | 1.520 | 53.300 | -0.79% | -1.00% |
| | | | 1880 | 1.540 | 52.674 | 1.520 | 53.300 | 1.32% | -1.17% |
| | | | 1910 | 1.573 | 52.536 | 1.520 | 53.300 | 3.49% | -1.43% |
| 2/25/2019 | 2450B | 21.5 | 2400 | 1.967 | 51.870 | 1.902 | 52.767 | 3.42% | -1.70% |
| | | | 2450 | 2.028 | 51.750 | 1.950 | 52.700 | 4.00% | -1.80% |
| | | | 2500 | 2.085 | 51.592 | 2.021 | 52.636 | 3.17% | -1.98% |
| 2/27/2019 | 2450B | 20.9 | 2400 | 1.992 | 53.444 | 1.902 | 52.767 | 4.73% | 1.28% |
| | | | 2450 | 2.037 | 53.357 | 1.950 | 52.700 | 4.46% | 1.25% |
| | | | 2500 | 2.082 | 53.325 | 2.021 | 52.636 | 3.02% | 1.31% |
| 02/22/2019 | 5200B-5800B | 21.5 | 5180 | 5.356 | 48.136 | 5.276 | 49.041 | 1.52% | -1.85% |
| | | | 5200 | 5.386 | 48.077 | 5.299 | 49.014 | 1.64% | -1.91% |
| | | | 5220 | 5.416 | 48.031 | 5.323 | 48.987 | 1.75% | -1.95% |
| | | | 5240 | 5.451 | 47.979 | 5.346 | 48.960 | 1.96% | -2.00% |
| | | | 5260 | 5.468 | 47.943 | 5.369 | 48.933 | 1.84% | -2.02% |
| | | | 5280 | 5.483 | 47.937 | 5.393 | 48.906 | 1.67% | -1.98% |
| | | | 5300 | 5.521 | 47.884 | 5.416 | 48.879 | 1.94% | -2.04% |
| | | | 5320 | 5.543 | 47.859 | 5.439 | 48.851 | 1.91% | -2.03% |
| | | | 5500 | 5.798 | 47.478 | 5.650 | 48.607 | 2.62% | -2.32% |
| | | | 5520 | 5.833 | 47.466 | 5.673 | 48.580 | 2.82% | -2.29% |
| | | | 5540 | 5.889 | 47.400 | 5.696 | 48.553 | 3.39% | -2.37% |
| | | | 5560 | 5.914 | 47.344 | 5.720 | 48.526 | 3.39% | -2.44% |
| | | | 5580 | 5.931 | 47.343 | 5.743 | 48.499 | 3.27% | -2.38% |
| | | | 5600 | 5.942 | 47.297 | 5.766 | 48.471 | 3.05% | -2.42% |
| | | | 5620 | 5.980 | 47.260 | 5.790 | 48.444 | 3.28% | -2.44% |
| | | | 5640 | 6.031 | 47.188 | 5.813 | 48.417 | 3.75% | -2.54% |
| | | | 5660 | 6.056 | 47.109 | 5.837 | 48.390 | 3.75% | -2.65% |
| | | | 5680 | 6.092 | 47.111 | 5.860 | 48.363 | 3.96% | -2.59% |
| | | | 5700 | 6.110 | 47.098 | 5.883 | 48.336 | 3.86% | -2.56% |
| | | | 5745 | 6.181 | 46.995 | 5.936 | 48.275 | 4.13% | -2.65% |
| | | | 5765 | 6.219 | 46.923 | 5.959 | 48.248 | 4.36% | -2.75% |
| | | | 5785 | 6.241 | 46.918 | 5.982 | 48.220 | 4.33% | -2.70% |
| | | | 5800 | 6.268 | 46.896 | 6.000 | 48.200 | 4.47% | -2.71% |
| | | | 5805 | 6.280 | 46.885 | 6.006 | 48.193 | 4.56% | -2.71% |
| | | | 5825 | 6.314 | 46.875 | 6.029 | 48.166 | 4.73% | -2.68% |

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.




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## 10.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix E.

**Table 10-2**
**System Verification Results**

| System Verification TARGET & MEASURED | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAR System # | Tissue Frequency (MHz) | Tissue Type | Date | Amb. Temp (°C) | Liquid Temp (°C) | Input Power (W) | Source SN | Probe SN | Measured $SAR_{1g}$ (W/kg) | 1 W Target $SAR_{1g}$ (W/kg) | 1 W Normalized $SAR_{1g}$ (W/kg) | $Deviation_{1g}$ (%) |
| G | 750 | HEAD | 02/14/2019 | 22.9 | 20.7 | 0.200 | 1054 | 7410 | 1.710 | 8.370 | 8.550 | 2.15% |
| G | 835 | HEAD | 02/11/2019 | 21.1 | 20.3 | 0.200 | 4d133 | 7410 | 1.910 | 9.430 | 9.550 | 1.27% |
| D | 1750 | HEAD | 02/26/2019 | 23.4 | 21.8 | 0.100 | 1148 | 7357 | 3.520 | 36.400 | 35.200 | -3.30% |
| D | 1900 | HEAD | 02/26/2019 | 23.4 | 21.8 | 0.100 | 5d080 | 7357 | 4.280 | 39.800 | 42.800 | 7.54% |
| H | 2450 | HEAD | 02/13/2019 | 20.9 | 20.3 | 0.100 | 797 | 7409 | 5.510 | 52.700 | 55.100 | 4.55% |
| E | 2450 | HEAD | 03/02/2019 | 20.5 | 20.3 | 0.100 | 981 | 3589 | 5.320 | 52.300 | 53.200 | 1.72% |
| H | 5250 | HEAD | 02/25/2019 | 21.6 | 21.1 | 0.050 | 1191 | 7409 | 3.790 | 78.900 | 75.800 | -3.93% |
| H | 5600 | HEAD | 02/25/2019 | 21.6 | 21.1 | 0.050 | 1191 | 7409 | 4.050 | 83.600 | 81.000 | -3.11% |
| H | 5750 | HEAD | 02/25/2019 | 21.6 | 21.0 | 0.050 | 1191 | 7409 | 3.850 | 79.100 | 77.000 | -2.65% |
| E | 750 | BODY | 02/25/2019 | 21.8 | 19.8 | 0.200 | 1003 | 3589 | 1.730 | 8.580 | 8.650 | 0.82% |
| D | 835 | BODY | 02/20/2019 | 21.7 | 21.2 | 0.200 | 4d047 | 7357 | 1.960 | 9.710 | 9.800 | 0.93% |
| D | 835 | BODY | 03/06/2019 | 22.3 | 21.4 | 0.200 | 4d132 | 7357 | 2.080 | 9.670 | 10.400 | 7.55% |
| G | 1750 | BODY | 02/20/2019 | 22.6 | 21.8 | 0.100 | 1148 | 7410 | 3.780 | 37.000 | 37.800 | 2.16% |
| G | 1750 | BODY | 03/03/2019 | 20.7 | 21.5 | 0.100 | 1148 | 7410 | 3.760 | 37.000 | 37.600 | 1.62% |
| J | 1900 | BODY | 02/14/2019 | 21.1 | 21.9 | 0.100 | 5d080 | 7488 | 4.040 | 39.200 | 40.400 | 3.06% |
| J | 1900 | BODY | 02/20/2019 | 20.3 | 21.0 | 0.100 | 5d149 | 7488 | 4.200 | 39.400 | 42.000 | 6.60% |
| K | 2450 | BODY | 02/25/2019 | 22.6 | 21.0 | 0.100 | 981 | 3319 | 5.160 | 50.900 | 51.600 | 1.38% |
| L | 2450 | BODY | 02/27/2019 | 23.0 | 20.0 | 0.100 | 797 | 7308 | 5.030 | 51.100 | 50.300 | -1.57% |
| L | 5250 | BODY | 02/22/2019 | 22.6 | 20.8 | 0.050 | 1191 | 7308 | 3.640 | 77.000 | 72.800 | -5.45% |
| L | 5600 | BODY | 02/22/2019 | 22.6 | 20.8 | 0.050 | 1191 | 7308 | 3.850 | 79.200 | 77.000 | -2.78% |
| L | 5750 | BODY | 02/22/2019 | 22.6 | 20.8 | 0.050 | 1191 | 7308 | 3.600 | 76.100 | 72.000 | -5.39% |

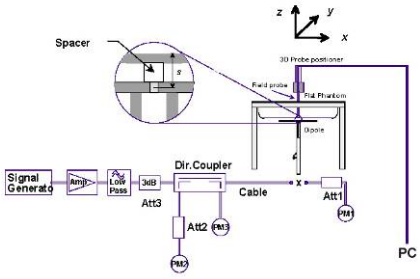


**Figure 10-1**
**System Verification Setup Diagram**

**Figure 10-2**
**System Verification Setup Photo**




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# 11 SAR DATA SUMMARY

## 11.1 Standalone Head SAR Data

**Table 11-1**
**GSM 850 Head SAR**

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode/Band | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | # of Time Slots | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 836.60 | 190 | GSM 850 | GSM | 33.7 | 33.70 | 0.00 | Right | Cheek | 00831 | 1 | 1:8.3 | 0.416 | 1.000 | 0.416 | A1 |
| 836.60 | 190 | GSM 850 | GSM | 33.7 | 33.70 | 0.05 | Right | Tilt | 00831 | 1 | 1:8.3 | 0.283 | 1.000 | 0.283 | |
| 836.60 | 190 | GSM 850 | GSM | 33.7 | 33.70 | -0.19 | Left | Cheek | 00831 | 1 | 1:8.3 | 0.333 | 1.000 | 0.333 | |
| 836.60 | 190 | GSM 850 | GSM | 33.7 | 33.70 | -0.19 | Left | Tilt | 00831 | 1 | 1:8.3 | 0.241 | 1.000 | 0.241 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.07 | Right | Cheek | 00831 | 3 | 1:2.76 | 0.388 | 1.028 | 0.399 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.06 | Right | Tilt | 00831 | 3 | 1:2.76 | 0.254 | 1.028 | 0.261 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.09 | Left | Cheek | 00831 | 3 | 1:2.76 | 0.294 | 1.028 | 0.302 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.09 | Left | Tilt | 00831 | 3 | 1:2.76 | 0.211 | 1.028 | 0.217 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | |

**Table 11-2**
**GSM 1900 Head SAR**

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode/Band | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | # of Time Slots | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1880.00 | 661 | GSM 1900 | GSM | 30.7 | 30.70 | -0.02 | Right | Cheek | 00823 | 1 | 1:8.3 | 0.233 | 1.000 | 0.233 | |
| 1880.00 | 661 | GSM 1900 | GSM | 30.7 | 30.70 | 0.06 | Right | Tilt | 00823 | 1 | 1:8.3 | 0.091 | 1.000 | 0.091 | |
| 1880.00 | 661 | GSM 1900 | GSM | 30.7 | 30.70 | 0.07 | Left | Cheek | 00823 | 1 | 1:8.3 | 0.335 | 1.000 | 0.335 | |
| 1880.00 | 661 | GSM 1900 | GSM | 30.7 | 30.70 | 0.07 | Left | Tilt | 00823 | 1 | 1:8.3 | 0.134 | 1.000 | 0.134 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | 0.04 | Right | Cheek | 00823 | 4 | 1:2.076 | 0.304 | 1.038 | 0.316 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | 0.12 | Right | Tilt | 00823 | 4 | 1:2.076 | 0.112 | 1.038 | 0.116 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | 0.06 | Left | Cheek | 00823 | 4 | 1:2.076 | 0.400 | 1.038 | 0.415 | A2 |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | 0.01 | Left | Tilt | 00823 | 4 | 1:2.076 | 0.155 | 1.038 | 0.161 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | |




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## Table 11-3
## UMTS 850 Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode/Band | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | (W/kg) | | (W/kg) | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.02 | Right | Cheek | 00815 | 1:1 | 0.453 | 1.045 | 0.473 | A3 |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.06 | Right | Tilt | 00815 | 1:1 | 0.283 | 1.045 | 0.296 | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | 0.13 | Left | Cheek | 00815 | 1:1 | 0.344 | 1.045 | 0.359 | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.13 | Left | Tilt | 00815 | 1:1 | 0.257 | 1.045 | 0.269 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | |

## Table 11-4
## UMTS 1750 Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode/Band | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | -0.08 | Right | Cheek | 00823 | 1:1 | 0.474 | 1.042 | 0.494 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | 0.13 | Right | Tilt | 00823 | 1:1 | 0.334 | 1.042 | 0.348 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | 0.06 | Left | Cheek | 00823 | 1:1 | 0.552 | 1.042 | 0.575 | A4 |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | -0.02 | Left | Tilt | 00823 | 1:1 | 0.379 | 1.042 | 0.395 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | |

## Table 11-5
## UMTS 1900 Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode/Band | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | 0.08 | Right | Cheek | 00823 | 1:1 | 0.442 | 1.012 | 0.447 | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | 0.14 | Right | Tilt | 00823 | 1:1 | 0.164 | 1.012 | 0.166 | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | 0.06 | Left | Cheek | 00823 | 1:1 | 0.588 | 1.012 | **0.595** | A5 |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | 0.01 | Left | Tilt | 00823 | 1:1 | 0.241 | 1.012 | 0.244 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | |




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## Table 11-6
## LTE Band 71 Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Side | Test Position | Modulation | RB Size | RB Offset | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.06 | 0 | Right | Cheek | QPSK | 1 | 0 | 00831 | 1:1 | 0.294 | 1.021 | 0.300 | A6 |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | -0.09 | 1 | Right | Cheek | QPSK | 50 | 25 | 00831 | 1:1 | 0.240 | 1.005 | 0.241 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.01 | 0 | Right | Tilt | QPSK | 1 | 0 | 00831 | 1:1 | 0.130 | 1.021 | 0.133 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | 0.07 | 1 | Right | Tilt | QPSK | 50 | 25 | 00831 | 1:1 | 0.116 | 1.005 | 0.117 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.12 | 0 | Left | Cheek | QPSK | 1 | 0 | 00831 | 1:1 | 0.234 | 1.021 | 0.239 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | -0.11 | 1 | Left | Cheek | QPSK | 50 | 25 | 00831 | 1:1 | 0.191 | 1.005 | 0.192 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.13 | 0 | Left | Tilt | QPSK | 1 | 0 | 00831 | 1:1 | 0.119 | 1.021 | 0.121 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | 0.06 | 1 | Left | Tilt | QPSK | 50 | 25 | 00831 | 1:1 | 0.102 | 1.005 | 0.103 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-7
## LTE Band 12 Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Side | Test Position | Modulation | RB Size | RB Offset | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | 0.00 | 0 | Right | Cheek | QPSK | 1 | 25 | 00831 | 1:1 | 0.506 | 1.016 | 0.514 | A7 |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | -0.03 | 1 | Right | Cheek | QPSK | 25 | 12 | 00831 | 1:1 | 0.407 | 1.019 | 0.415 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | -0.06 | 0 | Right | Tilt | QPSK | 1 | 25 | 00831 | 1:1 | 0.270 | 1.016 | 0.274 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.19 | 1 | Right | Tilt | QPSK | 25 | 12 | 00831 | 1:1 | 0.207 | 1.019 | 0.211 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | 0.04 | 0 | Left | Cheek | QPSK | 1 | 25 | 00831 | 1:1 | 0.445 | 1.016 | 0.452 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | -0.15 | 1 | Left | Cheek | QPSK | 25 | 12 | 00831 | 1:1 | 0.334 | 1.019 | 0.340 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | -0.16 | 0 | Left | Tilt | QPSK | 1 | 25 | 00831 | 1:1 | 0.270 | 1.016 | 0.274 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | -0.14 | 1 | Left | Tilt | QPSK | 25 | 12 | 00831 | 1:1 | 0.195 | 1.019 | 0.199 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-8
## LTE Band 26 (Cell) Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Side | Test Position | Modulation | RB Size | RB Offset | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | -0.11 | 0 | Right | Cheek | QPSK | 1 | 0 | 00815 | 1:1 | 0.541 | 1.050 | 0.568 | A8 |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | 0.10 | 1 | Right | Cheek | QPSK | 36 | 18 | 00815 | 1:1 | 0.373 | 1.023 | 0.382 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | 0.03 | 0 | Right | Tilt | QPSK | 1 | 0 | 00815 | 1:1 | 0.342 | 1.050 | 0.359 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | -0.02 | 1 | Right | Tilt | QPSK | 36 | 18 | 00815 | 1:1 | 0.221 | 1.023 | 0.226 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | 0.12 | 0 | Left | Cheek | QPSK | 1 | 0 | 00815 | 1:1 | 0.420 | 1.050 | 0.441 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | 0.10 | 1 | Left | Cheek | QPSK | 36 | 18 | 00815 | 1:1 | 0.286 | 1.023 | 0.293 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | 0.02 | 0 | Left | Tilt | QPSK | 1 | 0 | 00815 | 1:1 | 0.316 | 1.050 | 0.332 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | 0.20 | 1 | Left | Tilt | QPSK | 36 | 18 | 00815 | 1:1 | 0.203 | 1.023 | 0.208 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |




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## Table 11-9
## LTE Band 66 (AWS) Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Side | Test Position | Modulation | RB Size | RB Offset | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | 0.17 | 0 | Right | Cheek | QPSK | 1 | 50 | 00823 | 1:1 | 0.405 | 1.005 | 0.407 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.11 | 1 | Right | Cheek | QPSK | 50 | 0 | 00823 | 1:1 | 0.316 | 1.012 | 0.320 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | -0.02 | 0 | Right | Tilt | QPSK | 1 | 50 | 00823 | 1:1 | 0.350 | 1.005 | 0.352 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.05 | 1 | Right | Tilt | QPSK | 50 | 0 | 00823 | 1:1 | 0.272 | 1.012 | 0.275 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | 0.01 | 0 | Left | Cheek | QPSK | 1 | 50 | 00823 | 1:1 | 0.574 | 1.005 | 0.577 | A9 |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.07 | 1 | Left | Cheek | QPSK | 50 | 0 | 00823 | 1:1 | 0.456 | 1.012 | 0.461 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | -0.10 | 0 | Left | Tilt | QPSK | 1 | 50 | 00823 | 1:1 | 0.310 | 1.005 | 0.312 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.15 | 1 | Left | Tilt | QPSK | 50 | 0 | 00823 | 1:1 | 0.267 | 1.012 | 0.270 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-10
## LTE Band 25 (PCS) Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Side | Test Position | Modulation | RB Size | RB Offset | Device Serial Number | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | -0.11 | 0 | Right | Cheek | QPSK | 1 | 99 | 00823 | 1:1 | 0.357 | 1.026 | 0.366 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.02 | 1 | Right | Cheek | QPSK | 50 | 0 | 00823 | 1:1 | 0.285 | 1.040 | 0.296 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | 0.12 | 0 | Right | Tilt | QPSK | 1 | 99 | 00823 | 1:1 | 0.157 | 1.026 | 0.161 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.13 | 1 | Right | Tilt | QPSK | 50 | 0 | 00823 | 1:1 | 0.123 | 1.040 | 0.128 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | 0.04 | 0 | Left | Cheek | QPSK | 1 | 99 | 00823 | 1:1 | 0.552 | 1.026 | 0.566 | A10 |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | -0.10 | 1 | Left | Cheek | QPSK | 50 | 0 | 00823 | 1:1 | 0.483 | 1.040 | 0.502 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | -0.03 | 0 | Left | Tilt | QPSK | 1 | 99 | 00823 | 1:1 | 0.212 | 1.026 | 0.218 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.03 | 1 | Left | Tilt | QPSK | 50 | 0 | 00823 | 1:1 | 0.162 | 1.040 | 0.168 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-11
## DTS Head SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | Data Rate (Mbps) | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | W/kg | (W/kg) | | | (W/kg) | |
| 2437 | 6 | 802.11b | DSSS | 22 | 16.0 | 15.60 | 0.14 | Right | Cheek | 00898 | 1 | 99.9 | 0.769 | 0.516 | 1.096 | 1.001 | 0.566 | |
| 2437 | 6 | 802.11b | DSSS | 22 | 16.0 | 15.60 | -0.13 | Right | Tilt | 00898 | 1 | 99.9 | 0.750 | 0.537 | 1.096 | 1.001 | 0.589 | |
| 2412 | 1 | 802.11b | DSSS | 22 | 16.0 | 15.46 | -0.08 | Left | Cheek | 00898 | 1 | 99.9 | 1.669 | 1.020 | 1.132 | 1.001 | 1.156 | |
| 2437 | 6 | 802.11b | DSSS | 22 | 16.0 | 15.60 | 0.13 | Left | Cheek | 00898 | 1 | 99.9 | 1.375 | 1.080 | 1.096 | 1.001 | 1.185 | |
| 2462 | 11 | 802.11b | DSSS | 22 | 16.0 | 15.59 | -0.13 | Left | Cheek | 00898 | 1 | 99.9 | 1.644 | 1.090 | 1.099 | 1.001 | **1.199** | A11 |
| 2437 | 6 | 802.11b | DSSS | 22 | 16.0 | 15.60 | 0.07 | Left | Tilt | 00898 | 1 | 99.9 | 1.116 | 0.726 | 1.096 | 1.001 | 0.796 | |
| 2462 | 11 | 802.11b | DSSS | 22 | 16.0 | 15.59 | -0.18 | Left | Cheek | 00898 | 1 | 99.9 | 1.691 | 1.090 | 1.099 | 1.001 | **1.199** | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

Note: Blue entry represents variability measurement.




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# Table 11-12
# NII Head SAR

| FREQUENCY MHz | FREQUENCY Ch. | Mode | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Side | Test Position | Device Serial Number | Data Rate (Mbps) | Duty Cycle (%) | Peak SAR of Area Scan W/kg | SAR (1g) (W/kg) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) (W/kg) | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5200 | 40 | 802.11a | OFDM | 20 | 12.5 | 11.81 | 0.05 | Right | Cheek | 00906 | 6 | 99.1 | 1.189 | 0.561 | 1.172 | 1.009 | 0.663 | |
| 5200 | 40 | 802.11a | OFDM | 20 | 12.5 | 11.81 | 0.04 | Right | Tilt | 00906 | 6 | 99.1 | 1.066 | - | 1.172 | 1.009 | - | |
| 5200 | 40 | 802.11a | OFDM | 20 | 12.5 | 11.81 | 0.14 | Left | Cheek | 00906 | 6 | 99.1 | 2.583 | 1.050 | 1.172 | 1.009 | 1.242 | |
| 5220 | 44 | 802.11a | OFDM | 20 | 12.5 | 11.69 | -0.09 | Left | Cheek | 00906 | 6 | 99.1 | 2.550 | 1.040 | 1.205 | 1.009 | 1.264 | |
| 5240 | 48 | 802.11a | OFDM | 20 | 12.5 | 11.74 | 0.13 | Left | Cheek | 00906 | 6 | 99.1 | 2.570 | 1.010 | 1.191 | 1.009 | 1.214 | |
| 5180 | 36 | 802.11a | OFDM | 20 | 11.0 | 10.61 | 0.18 | Left | Cheek | 00906 | 6 | 99.1 | 1.821 | 0.765 | 1.094 | 1.009 | 0.844 | |
| 5200 | 40 | 802.11a | OFDM | 20 | 12.5 | 11.81 | 0.14 | Left | Tilt | 00906 | 6 | 99.1 | 2.142 | 0.858 | 1.172 | 1.009 | 1.015 | |
| 5240 | 48 | 802.11a | OFDM | 20 | 12.5 | 11.74 | 0.14 | Left | Tilt | 00906 | 6 | 99.1 | 2.141 | 0.834 | 1.191 | 1.009 | 1.002 | |
| 5260 | 52 | 802.11a | OFDM | 20 | 12.5 | 11.90 | 0.12 | Right | Cheek | 00906 | 6 | 99.1 | 1.481 | 0.707 | 1.148 | 1.009 | 0.819 | |
| 5280 | 56 | 802.11a | OFDM | 20 | 12.5 | 11.86 | 0.14 | Right | Cheek | 00906 | 6 | 99.1 | 1.150 | 0.678 | 1.159 | 1.009 | 0.793 | |
| 5260 | 52 | 802.11a | OFDM | 20 | 12.5 | 11.90 | 0.17 | Right | Tilt | 00906 | 6 | 99.1 | 1.216 | 0.640 | 1.148 | 1.009 | 0.741 | |
| 5260 | 52 | 802.11a | OFDM | 20 | 12.5 | 11.90 | -0.14 | Left | Cheek | 00906 | 6 | 99.1 | 2.422 | 1.060 | 1.148 | 1.009 | 1.228 | |
| 5280 | 56 | 802.11a | OFDM | 20 | 12.5 | 11.86 | 0.07 | Left | Cheek | 00906 | 6 | 99.1 | 2.693 | 1.090 | 1.159 | 1.009 | **1.275** | A12 |
| 5300 | 60 | 802.11a | OFDM | 20 | 12.5 | 11.82 | 0.06 | Left | Cheek | 00906 | 6 | 99.1 | 2.509 | 1.080 | 1.169 | 1.009 | 1.274 | |
| 5320 | 64 | 802.11a | OFDM | 20 | 11.0 | 10.33 | 0.19 | Left | Cheek | 00906 | 6 | 99.1 | 1.844 | 0.779 | 1.167 | 1.009 | 0.917 | |
| 5260 | 52 | 802.11a | OFDM | 20 | 12.5 | 11.90 | 0.13 | Left | Tilt | 00906 | 6 | 99.1 | 2.153 | 0.862 | 1.148 | 1.009 | 0.998 | |
| 5280 | 56 | 802.11a | OFDM | 20 | 12.5 | 11.86 | 0.13 | Left | Tilt | 00906 | 6 | 99.1 | 2.087 | 0.842 | 1.159 | 1.009 | 0.985 | |
| 5280 | 56 | 802.11a | OFDM | 20 | 12.5 | 11.86 | 0.17 | Left | Cheek | 00906 | 6 | 99.1 | 2.210 | 1.030 | 1.159 | 1.009 | 1.205 | |
| 5580 | 116 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.00 | Right | Cheek | 00906 | 6 | 99.1 | 1.969 | 0.919 | 1.138 | 1.009 | 1.055 | |
| 5700 | 140 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.10 | Right | Cheek | 00906 | 6 | 99.1 | 2.095 | 0.977 | 1.138 | 1.009 | 1.122 | |
| 5580 | 116 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.10 | Right | Tilt | 00906 | 6 | 99.1 | 1.763 | 0.850 | 1.138 | 1.009 | 0.976 | |
| 5700 | 140 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.20 | Right | Tilt | 00906 | 6 | 99.1 | 1.848 | 0.887 | 1.138 | 1.009 | 1.018 | |
| 5580 | 116 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.12 | Left | Cheek | 00906 | 6 | 99.1 | 2.593 | 0.997 | 1.138 | 1.009 | 1.145 | |
| 5700 | 140 | 802.11a | OFDM | 20 | 12.5 | 11.94 | -0.16 | Left | Cheek | 00906 | 6 | 99.1 | 2.434 | 0.937 | 1.138 | 1.009 | 1.076 | |
| 5580 | 116 | 802.11a | OFDM | 20 | 12.5 | 11.94 | -0.10 | Left | Tilt | 00906 | 6 | 99.1 | 2.143 | 0.862 | 1.138 | 1.009 | 0.990 | |
| 5700 | 140 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.14 | Left | Tilt | 00906 | 6 | 99.1 | 2.181 | 0.833 | 1.138 | 1.009 | 0.956 | |
| 5580 | 116 | 802.11a | OFDM | 20 | 12.5 | 11.94 | 0.09 | Left | Cheek | 00906 | 6 | 99.1 | 2.245 | 0.970 | 1.138 | 1.009 | 1.114 | |
| 5745 | 149 | 802.11a | OFDM | 20 | 12.5 | 11.91 | 0.10 | Right | Cheek | 00906 | 6 | 99.1 | 1.957 | 0.946 | 1.146 | 1.009 | 1.094 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 12.5 | 12.05 | -0.19 | Right | Cheek | 00906 | 6 | 99.1 | 2.110 | 1.010 | 1.109 | 1.009 | 1.130 | |
| 5745 | 149 | 802.11a | OFDM | 20 | 12.5 | 11.91 | 0.14 | Right | Tilt | 00906 | 6 | 99.1 | 1.796 | 0.811 | 1.146 | 1.009 | 0.938 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 12.5 | 12.05 | 0.18 | Right | Tilt | 00906 | 6 | 99.1 | 1.959 | 0.904 | 1.109 | 1.009 | 1.012 | |
| 5745 | 149 | 802.11a | OFDM | 20 | 12.5 | 11.91 | 0.13 | Left | Cheek | 00906 | 6 | 99.1 | 2.395 | 0.925 | 1.146 | 1.009 | 1.070 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 12.5 | 12.05 | 0.20 | Left | Cheek | 00906 | 6 | 99.1 | 2.099 | 0.931 | 1.109 | 1.009 | 1.042 | |
| 5745 | 149 | 802.11a | OFDM | 20 | 12.5 | 11.91 | 0.15 | Left | Tilt | 00906 | 6 | 99.1 | 2.232 | 0.830 | 1.146 | 1.009 | 0.960 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 12.5 | 12.05 | 0.19 | Left | Tilt | 00906 | 6 | 99.1 | 1.722 | 0.790 | 1.109 | 1.009 | 0.884 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 12.5 | 12.05 | 0.00 | Right | Cheek | 00906 | 6 | 99.1 | 2.007 | 0.918 | 1.109 | 1.009 | 1.027 | |
| **ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population** | | | | | | | | **Head 1.6 W/kg (mW/g)** averaged over 1 gram | | | | | | | | | | |

Note: Blue entry represents variability measurement.




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## 11.2 Standalone Body-Worn SAR Data

### Table 11-13
### GSM/UMTS Body-Worn SAR Data

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number | # of Time Slots | Duty Cycle | Side | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 824.20 | 128 | GSM 850 | GSM | 33.7 | 33.53 | -0.05 | 10 mm | 00823 | 1 | 1:8.3 | back | 0.664 | 1.040 | 0.691 | A13 |
| 836.60 | 190 | GSM 850 | GSM | 33.7 | 33.70 | 0.02 | 10 mm | 00823 | 1 | 1:8.3 | back | 0.641 | 1.000 | 0.641 | |
| 848.80 | 251 | GSM 850 | GSM | 33.7 | 33.42 | 0.00 | 10 mm | 00823 | 1 | 1:8.3 | back | 0.604 | 1.067 | 0.644 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.02 | 10 mm | 00823 | 3 | 1:2.76 | back | 0.628 | 1.028 | 0.646 | |
| 1880.00 | 661 | GSM 1900 | GSM | 30.7 | 30.70 | -0.17 | 10 mm | 00815 | 1 | 1:8.3 | back | 0.325 | 1.000 | 0.325 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | -0.13 | 10 mm | 00815 | 4 | 1:2.076 | back | 0.382 | 1.038 | 0.397 | A15 |
| 826.40 | 4132 | UMTS 850 | RMC | 24.7 | 24.53 | -0.02 | 10 mm | 00823 | N/A | 1:1 | back | 0.726 | 1.040 | 0.755 | A17 |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.12 | 10 mm | 00823 | N/A | 1:1 | back | 0.714 | 1.045 | 0.746 | |
| 846.60 | 4233 | UMTS 850 | RMC | 24.7 | 24.48 | -0.08 | 10 mm | 00823 | N/A | 1:1 | back | 0.654 | 1.052 | 0.688 | |
| 1712.40 | 1312 | UMTS 1750 | RMC | 24.7 | 24.60 | -0.08 | 10 mm | 00807 | N/A | 1:1 | back | 0.708 | 1.023 | 0.724 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | 0.00 | 10 mm | 00807 | N/A | 1:1 | back | 0.757 | 1.042 | 0.789 | |
| 1752.60 | 1513 | UMTS 1750 | RMC | 24.7 | 24.61 | -0.01 | 10 mm | 00807 | N/A | 1:1 | back | 0.768 | 1.021 | 0.784 | A18 |
| 1852.40 | 9262 | UMTS 1900 | RMC | 24.7 | 24.55 | -0.21 | 10 mm | 00815 | N/A | 1:1 | back | 0.600 | 1.035 | 0.621 | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | -0.13 | 10 mm | 00815 | N/A | 1:1 | back | 0.657 | 1.012 | 0.665 | |
| 1907.60 | 9538 | UMTS 1900 | RMC | 24.7 | 24.46 | -0.20 | 10 mm | 00815 | N/A | 1:1 | back | 0.684 | 1.057 | 0.723 | A20 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | |

### Table 11-14
### LTE Body-Worn SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.04 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | back | 1:1 | 0.414 | 1.021 | 0.423 | A21 |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | 0.02 | 1 | 00831 | QPSK | 50 | 25 | 10 mm | back | 1:1 | 0.350 | 1.005 | 0.352 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | -0.03 | 0 | 00831 | QPSK | 1 | 25 | 10 mm | back | 1:1 | 0.726 | 1.016 | 0.738 | A22 |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.02 | 1 | 00831 | QPSK | 25 | 12 | 10 mm | back | 1:1 | 0.552 | 1.019 | 0.562 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | -0.09 | 0 | 00807 | QPSK | 1 | 0 | 10 mm | back | 1:1 | 0.737 | 1.050 | 0.774 | A23 |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | -0.17 | 1 | 00807 | QPSK | 36 | 18 | 10 mm | back | 1:1 | 0.505 | 1.023 | 0.517 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | 0.03 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | back | 1:1 | 0.879 | 1.005 | 0.883 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 24.7 | 24.50 | -0.07 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | back | 1:1 | 0.891 | 1.047 | **0.933** | A24 |
| 1770.00 | 132572 | High | LTE Band 66 (AWS) | 20 | 24.7 | 24.55 | 0.04 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | back | 1:1 | 0.791 | 1.035 | 0.819 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.11 | 1 | 00831 | QPSK | 50 | 0 | 10 mm | back | 1:1 | 0.694 | 1.012 | 0.702 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 23.7 | 23.61 | 0.03 | 1 | 00831 | QPSK | 100 | 0 | 10 mm | back | 1:1 | 0.688 | 1.021 | 0.702 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | -0.13 | 0 | 00815 | QPSK | 1 | 99 | 10 mm | back | 1:1 | 0.561 | 1.026 | 0.576 | A26 |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.00 | 1 | 00815 | QPSK | 50 | 0 | 10 mm | back | 1:1 | 0.450 | 1.040 | 0.468 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |




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## Table 11-15
## DTS Body-Worn SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | W/kg | (W/kg) | | | (W/kg) | |
| 2412 | 1 | 802.11b | DSSS | 22 | 19.0 | 18.55 | 0.15 | 10 mm | 00906 | 1 | back | 99.9 | 0.615 | 0.425 | 1.109 | 1.001 | **0.472** | A28 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-16
## NII Body-Worn SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | W/kg | (W/kg) | | | (W/kg) | |
| 5300 | 60 | 802.11a | OFDM | 20 | 16.0 | 15.64 | -0.15 | 10 mm | 00906 | 6 | back | 99.1 | 1.386 | 0.639 | 1.086 | 1.009 | 0.700 | |
| 5520 | 104 | 802.11a | OFDM | 20 | 16.0 | 15.40 | 0.03 | 10 mm | 00906 | 6 | back | 99.1 | 1.490 | 0.615 | 1.148 | 1.009 | 0.712 | |
| 5660 | 132 | 802.11a | OFDM | 20 | 16.0 | 15.54 | -0.11 | 10 mm | 00906 | 6 | back | 99.1 | 1.531 | 0.639 | 1.112 | 1.009 | **0.717** | A29 |
| 5700 | 140 | 802.11a | OFDM | 20 | 16.0 | 15.50 | -0.03 | 10 mm | 00906 | 6 | back | 99.1 | 1.528 | 0.631 | 1.122 | 1.009 | 0.714 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 16.0 | 15.56 | 0.01 | 10 mm | 00906 | 6 | back | 99.1 | 1.492 | 0.618 | 1.107 | 1.009 | 0.690 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-17
## DSS Body-Worn SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | SAR (1g) | Scaling Factor (Cond Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | (W/kg) | | | (W/kg) | |
| 2441 | 39 | Bluetooth | FHSS | 10.0 | 9.49 | -0.12 | 10 mm | 00906 | 1 | back | 77.3 | 0.049 | 1.125 | 1.294 | **0.071** | A31 |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | |




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## 11.3 Standalone Hotspot SAR Data

**Table 11-18**
**GPRS/UMTS Hotspot SAR Data**

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number | # of GPRS Slots | Duty Cycle | Side | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 824.20 | 128 | GSM 850 | GPRS | 29.7 | 29.61 | 0.08 | 10 mm | 00823 | 3 | 1:2.76 | back | 0.640 | 1.021 | 0.653 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.02 | 10 mm | 00823 | 3 | 1:2.76 | back | 0.628 | 1.028 | 0.646 | |
| 848.80 | 251 | GSM 850 | GPRS | 29.7 | 29.59 | 0.05 | 10 mm | 00823 | 3 | 1:2.76 | back | 0.599 | 1.026 | 0.615 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.03 | 10 mm | 00823 | 3 | 1:2.76 | front | 0.440 | 1.028 | 0.452 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.05 | 10 mm | 00823 | 3 | 1:2.76 | bottom | 0.215 | 1.028 | 0.221 | |
| 824.20 | 128 | GSM 850 | GPRS | 29.7 | 29.61 | -0.13 | 10 mm | 00823 | 3 | 1:2.76 | right | 0.673 | 1.021 | 0.687 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | -0.01 | 10 mm | 00823 | 3 | 1:2.76 | right | 0.762 | 1.028 | 0.783 | A14 |
| 848.80 | 251 | GSM 850 | GPRS | 29.7 | 29.59 | -0.14 | 10 mm | 00823 | 3 | 1:2.76 | right | 0.734 | 1.026 | 0.753 | |
| 836.60 | 190 | GSM 850 | GPRS | 29.7 | 29.58 | 0.12 | 10 mm | 00823 | 3 | 1:2.76 | left | 0.383 | 1.028 | 0.394 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | -0.13 | 10 mm | 00815 | 4 | 1:2.076 | back | 0.382 | 1.038 | 0.397 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | -0.14 | 10 mm | 00815 | 4 | 1:2.076 | front | 0.388 | 1.038 | 0.403 | A16 |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | 0.16 | 10 mm | 00815 | 4 | 1:2.076 | bottom | 0.265 | 1.038 | 0.275 | |
| 1880.00 | 661 | GSM 1900 | GPRS | 25.7 | 25.54 | -0.11 | 10 mm | 00815 | 4 | 1:2.076 | left | 0.357 | 1.038 | 0.371 | |
| 826.40 | 4132 | UMTS 850 | RMC | 24.7 | 24.53 | -0.02 | 10 mm | 00823 | N/A | 1:1 | back | 0.726 | 1.040 | 0.755 | A17 |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.12 | 10 mm | 00823 | N/A | 1:1 | back | 0.714 | 1.045 | 0.746 | |
| 846.60 | 4233 | UMTS 850 | RMC | 24.7 | 24.48 | -0.08 | 10 mm | 00823 | N/A | 1:1 | back | 0.654 | 1.052 | 0.688 | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | 0.02 | 10 mm | 00823 | N/A | 1:1 | front | 0.524 | 1.045 | 0.548 | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | 0.00 | 10 mm | 00823 | N/A | 1:1 | bottom | 0.246 | 1.045 | 0.257 | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.02 | 10 mm | 00823 | N/A | 1:1 | right | 0.658 | 1.045 | 0.688 | |
| 836.60 | 4183 | UMTS 850 | RMC | 24.7 | 24.51 | -0.02 | 10 mm | 00823 | N/A | 1:1 | left | 0.412 | 1.045 | 0.431 | |
| 1712.40 | 1312 | UMTS 1750 | RMC | 24.7 | 24.60 | -0.08 | 10 mm | 00807 | N/A | 1:1 | back | 0.708 | 1.023 | 0.724 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | 0.00 | 10 mm | 00807 | N/A | 1:1 | back | 0.757 | 1.042 | 0.789 | |
| 1752.60 | 1513 | UMTS 1750 | RMC | 24.7 | 24.61 | -0.01 | 10 mm | 00807 | N/A | 1:1 | back | 0.768 | 1.021 | 0.784 | |
| 1712.40 | 1312 | UMTS 1750 | RMC | 24.7 | 24.60 | 0.15 | 10 mm | 00807 | N/A | 1:1 | front | 0.820 | 1.023 | 0.839 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | -0.03 | 10 mm | 00807 | N/A | 1:1 | front | 0.888 | 1.042 | 0.925 | A19 |
| 1752.60 | 1513 | UMTS 1750 | RMC | 24.7 | 24.61 | -0.03 | 10 mm | 00807 | N/A | 1:1 | front | 0.870 | 1.021 | 0.888 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | 0.00 | 10 mm | 00807 | N/A | 1:1 | bottom | 0.507 | 1.042 | 0.528 | |
| 1732.40 | 1412 | UMTS 1750 | RMC | 24.7 | 24.52 | -0.03 | 10 mm | 00807 | N/A | 1:1 | left | 0.481 | 1.042 | 0.501 | |
| 1852.40 | 9262 | UMTS 1900 | RMC | 24.7 | 24.55 | -0.21 | 10 mm | 00815 | N/A | 1:1 | back | 0.600 | 1.035 | 0.621 | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | -0.13 | 10 mm | 00815 | N/A | 1:1 | back | 0.657 | 1.012 | 0.665 | |
| 1907.60 | 9538 | UMTS 1900 | RMC | 24.7 | 24.46 | -0.20 | 10 mm | 00815 | N/A | 1:1 | back | 0.684 | 1.057 | 0.723 | A20 |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | -0.02 | 10 mm | 00815 | N/A | 1:1 | front | 0.638 | 1.012 | 0.646 | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | -0.12 | 10 mm | 00815 | N/A | 1:1 | bottom | 0.414 | 1.012 | 0.419 | |
| 1880.00 | 9400 | UMTS 1900 | RMC | 24.7 | 24.65 | -0.06 | 10 mm | 00815 | N/A | 1:1 | left | 0.494 | 1.012 | 0.500 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | |




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## Table 11-19
## LTE Band 71 Hotspot SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.04 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | back | 1:1 | 0.414 | 1.021 | 0.423 | A21 |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | 0.02 | 1 | 00831 | QPSK | 50 | 25 | 10 mm | back | 1:1 | 0.350 | 1.005 | 0.352 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.13 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | front | 1:1 | 0.257 | 1.021 | 0.262 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | -0.02 | 1 | 00831 | QPSK | 50 | 25 | 10 mm | front | 1:1 | 0.226 | 1.005 | 0.227 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | 0.04 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | bottom | 1:1 | 0.091 | 1.021 | 0.093 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | 0.10 | 1 | 00831 | QPSK | 50 | 25 | 10 mm | bottom | 1:1 | 0.075 | 1.005 | 0.075 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | 0.10 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | right | 1:1 | 0.247 | 1.021 | 0.252 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | -0.07 | 1 | 00831 | QPSK | 50 | 25 | 10 mm | right | 1:1 | 0.241 | 1.005 | 0.242 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 24.7 | 24.61 | -0.03 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | left | 1:1 | 0.175 | 1.021 | 0.179 | |
| 680.50 | 133297 | Mid | LTE Band 71 | 20 | 23.7 | 23.68 | 0.09 | 1 | 00831 | QPSK | 50 | 25 | 10 mm | left | 1:1 | 0.159 | 1.005 | 0.160 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | | |

## Table 11-20
## LTE Band 12 Hotspot SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | -0.03 | 0 | 00831 | QPSK | 1 | 25 | 10 mm | back | 1:1 | 0.726 | 1.016 | 0.738 | A22 |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.02 | 1 | 00831 | QPSK | 25 | 12 | 10 mm | back | 1:1 | 0.552 | 1.019 | 0.562 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | 0.06 | 0 | 00831 | QPSK | 1 | 25 | 10 mm | front | 1:1 | 0.505 | 1.016 | 0.513 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.03 | 1 | 00831 | QPSK | 25 | 12 | 10 mm | front | 1:1 | 0.372 | 1.019 | 0.379 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | 0.12 | 0 | 00831 | QPSK | 1 | 25 | 10 mm | bottom | 1:1 | 0.129 | 1.016 | 0.131 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.11 | 1 | 00831 | QPSK | 25 | 12 | 10 mm | bottom | 1:1 | 0.101 | 1.019 | 0.103 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | 0.02 | 0 | 00831 | QPSK | 1 | 25 | 10 mm | right | 1:1 | 0.366 | 1.016 | 0.372 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.02 | 1 | 00831 | QPSK | 25 | 12 | 10 mm | right | 1:1 | 0.275 | 1.019 | 0.280 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 24.7 | 24.63 | 0.05 | 0 | 00831 | QPSK | 1 | 25 | 10 mm | left | 1:1 | 0.381 | 1.016 | 0.387 | |
| 707.50 | 23095 | Mid | LTE Band 12 | 10 | 23.7 | 23.62 | 0.06 | 1 | 00831 | QPSK | 25 | 12 | 10 mm | left | 1:1 | 0.297 | 1.019 | 0.303 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | | |




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## Table 11-21
## LTE Band 26 (Cell) Hotspot SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | -0.09 | 0 | 00807 | QPSK | 1 | 0 | 10 mm | back | 1:1 | 0.737 | 1.050 | 0.774 | A23 |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | -0.17 | 1 | 00807 | QPSK | 36 | 18 | 10 mm | back | 1:1 | 0.505 | 1.023 | 0.517 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | -0.05 | 0 | 00807 | QPSK | 1 | 0 | 10 mm | front | 1:1 | 0.568 | 1.050 | 0.596 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | 0.09 | 1 | 00807 | QPSK | 36 | 18 | 10 mm | front | 1:1 | 0.395 | 1.023 | 0.404 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | -0.03 | 0 | 00807 | QPSK | 1 | 0 | 10 mm | bottom | 1:1 | 0.254 | 1.050 | 0.267 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | -0.06 | 1 | 00807 | QPSK | 36 | 18 | 10 mm | bottom | 1:1 | 0.181 | 1.023 | 0.185 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | -0.04 | 0 | 00807 | QPSK | 1 | 0 | 10 mm | right | 1:1 | 0.666 | 1.050 | 0.699 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | 0.08 | 1 | 00807 | QPSK | 36 | 18 | 10 mm | right | 1:1 | 0.452 | 1.023 | 0.462 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 24.7 | 24.49 | 0.05 | 0 | 00807 | QPSK | 1 | 0 | 10 mm | left | 1:1 | 0.408 | 1.050 | 0.428 | |
| 831.50 | 26865 | Mid | LTE Band 26 (Cell) | 15 | 23.7 | 23.60 | -0.12 | 1 | 00807 | QPSK | 36 | 18 | 10 mm | left | 1:1 | 0.277 | 1.023 | 0.283 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | | |

## Table 11-22
## LTE Band 66 (AWS) Hotspot SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | 0.03 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | back | 1:1 | 0.879 | 1.005 | 0.883 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 24.7 | 24.50 | -0.07 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | back | 1:1 | 0.891 | 1.047 | 0.933 | |
| 1770.00 | 132572 | High | LTE Band 66 (AWS) | 20 | 24.7 | 24.55 | 0.04 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | back | 1:1 | 0.791 | 1.035 | 0.819 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.11 | 1 | 00831 | QPSK | 50 | 0 | 10 mm | back | 1:1 | 0.694 | 1.012 | 0.702 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 23.7 | 23.61 | 0.03 | 1 | 00831 | QPSK | 100 | 0 | 10 mm | back | 1:1 | 0.688 | 1.021 | 0.702 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | -0.06 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | front | 1:1 | 0.958 | 1.005 | 0.963 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 24.7 | 24.50 | 0.06 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | front | 1:1 | 1.040 | 1.047 | 1.089 | A25 |
| 1770.00 | 132572 | High | LTE Band 66 (AWS) | 20 | 24.7 | 24.55 | 0.08 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | front | 1:1 | 0.841 | 1.035 | 0.870 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | 0.03 | 1 | 00831 | QPSK | 50 | 0 | 10 mm | front | 1:1 | 0.748 | 1.012 | 0.757 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 23.7 | 23.61 | -0.11 | 1 | 00831 | QPSK | 100 | 0 | 10 mm | front | 1:1 | 0.755 | 1.021 | 0.771 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | -0.05 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | bottom | 1:1 | 0.561 | 1.005 | 0.564 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | -0.03 | 1 | 00831 | QPSK | 50 | 0 | 10 mm | bottom | 1:1 | 0.419 | 1.012 | 0.424 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 24.7 | 24.68 | -0.10 | 0 | 00831 | QPSK | 1 | 50 | 10 mm | left | 1:1 | 0.451 | 1.005 | 0.453 | |
| 1720.00 | 132072 | Low | LTE Band 66 (AWS) | 20 | 23.7 | 23.65 | -0.08 | 1 | 00831 | QPSK | 50 | 0 | 10 mm | left | 1:1 | 0.322 | 1.012 | 0.326 | |
| 1745.00 | 132322 | Mid | LTE Band 66 (AWS) | 20 | 24.7 | 24.50 | 0.06 | 0 | 00831 | QPSK | 1 | 0 | 10 mm | front | 1:1 | 0.977 | 1.047 | 1.023 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | | |

Note: Blue entry represents variability measurement.




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## Table 11-23
## LTE Band 25 (PCS) Hotspot SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | | Mode | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | MPR [dB] | Device Serial Number | Modulation | RB Size | RB Offset | Spacing | Side | Duty Cycle | SAR (1g) | Scaling Factor | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | | | | (W/kg) | | (W/kg) | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | -0.13 | 0 | 00815 | QPSK | 1 | 99 | 10 mm | back | 1:1 | 0.561 | 1.026 | 0.576 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.00 | 1 | 00815 | QPSK | 50 | 0 | 10 mm | back | 1:1 | 0.450 | 1.040 | 0.468 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | -0.12 | 0 | 00815 | QPSK | 1 | 99 | 10 mm | front | 1:1 | 0.598 | 1.026 | 0.614 | |
| 1882.50 | 26365 | Mid | LTE Band 25 (PCS) | 20 | 24.7 | 24.58 | -0.18 | 0 | 00815 | QPSK | 1 | 0 | 10 mm | front | 1:1 | 0.645 | 1.028 | 0.663 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 24.7 | 24.56 | -0.12 | 0 | 00815 | QPSK | 1 | 50 | 10 mm | front | 1:1 | 0.647 | 1.033 | 0.668 | A27 |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.01 | 1 | 00815 | QPSK | 50 | 0 | 10 mm | front | 1:1 | 0.459 | 1.040 | 0.477 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | 0.15 | 0 | 00815 | QPSK | 1 | 99 | 10 mm | bottom | 1:1 | 0.397 | 1.026 | 0.407 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | 0.10 | 1 | 00815 | QPSK | 50 | 0 | 10 mm | bottom | 1:1 | 0.320 | 1.040 | 0.333 | |
| 1860.00 | 26140 | Low | LTE Band 25 (PCS) | 20 | 24.7 | 24.59 | -0.07 | 0 | 00815 | QPSK | 1 | 99 | 10 mm | left | 1:1 | 0.475 | 1.026 | 0.487 | |
| 1905.00 | 26590 | High | LTE Band 25 (PCS) | 20 | 23.7 | 23.53 | -0.09 | 1 | 00815 | QPSK | 50 | 0 | 10 mm | left | 1:1 | 0.431 | 1.040 | 0.448 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |

## Table 11-24
## WLAN Hotspot SAR

| MEASUREMENT RESULTS | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY | | Mode | Service | Bandwidth [MHz] | Maximum Allowed Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Spacing | Device Serial Number | Data Rate (Mbps) | Side | Duty Cycle (%) | Peak SAR of Area Scan | SAR (1g) | Scaling Factor (Power) | Scaling Factor (Duty Cycle) | Reported SAR (1g) | Plot # |
| MHz | Ch. | | | | | | | | | | | | W/kg | (W/kg) | | | (W/kg) | |
| 2412 | 1 | 802.11b | DSSS | 22 | 19.0 | 18.55 | 0.15 | 10 mm | 00906 | 1 | back | 99.9 | 0.615 | 0.425 | 1.109 | 1.001 | **0.472** | A28 |
| 2412 | 1 | 802.11b | DSSS | 22 | 19.0 | 18.55 | -0.01 | 10 mm | 00906 | 1 | front | 99.9 | 0.569 | 0.381 | 1.109 | 1.001 | 0.423 | |
| 2412 | 1 | 802.11b | DSSS | 22 | 19.0 | 18.55 | 0.09 | 10 mm | 00906 | 1 | top | 99.9 | 0.228 | - | 1.109 | 1.001 | - | |
| 2412 | 1 | 802.11b | DSSS | 22 | 19.0 | 18.55 | -0.06 | 10 mm | 00906 | 1 | right | 99.9 | 0.305 | - | 1.109 | 1.001 | - | |
| 5240 | 48 | 802.11a | OFDM | 20 | 16.0 | 15.76 | 0.04 | 10 mm | 00906 | 6 | back | 99.1 | 1.459 | 0.656 | 1.057 | 1.009 | 0.700 | |
| 5240 | 48 | 802.11a | OFDM | 20 | 16.0 | 15.76 | 0.01 | 10 mm | 00906 | 6 | front | 99.1 | 1.064 | 0.549 | 1.057 | 1.009 | 0.586 | |
| 5240 | 48 | 802.11a | OFDM | 20 | 16.0 | 15.76 | 0.02 | 10 mm | 00906 | 6 | top | 99.1 | 0.711 | - | 1.057 | 1.009 | - | |
| 5200 | 40 | 802.11a | OFDM | 20 | 16.0 | 15.70 | 0.19 | 10 mm | 00906 | 6 | right | 99.1 | 1.582 | 0.785 | 1.072 | 1.009 | **0.849** | A30 |
| 5220 | 44 | 802.11a | OFDM | 20 | 16.0 | 15.72 | 0.04 | 10 mm | 00906 | 6 | right | 99.1 | 1.554 | 0.771 | 1.067 | 1.009 | 0.830 | |
| 5240 | 48 | 802.11a | OFDM | 20 | 16.0 | 15.76 | -0.02 | 10 mm | 00906 | 6 | right | 99.1 | 1.563 | 0.748 | 1.057 | 1.009 | 0.798 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 16.0 | 15.56 | 0.01 | 10 mm | 00906 | 6 | back | 99.1 | 1.492 | 0.618 | 1.107 | 1.009 | 0.690 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 16.0 | 15.56 | -0.02 | 10 mm | 00906 | 6 | front | 99.1 | 1.085 | 0.515 | 1.107 | 1.009 | 0.575 | |
| 5785 | 157 | 802.11a | OFDM | 20 | 16.0 | 15.56 | 0.19 | 10 mm | 00906 | 6 | top | 99.1 | 0.733 | - | 1.107 | 1.009 | - | |
| 5785 | 157 | 802.11a | OFDM | 20 | 16.0 | 15.56 | -0.02 | 10 mm | 00906 | 6 | right | 99.1 | 1.409 | 0.626 | 1.107 | 1.009 | 0.699 | |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | | |




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## 11.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01v01r04, variability SAR tests were performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v02r01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D01v03r01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.
4. GPRS was additionally evaluated for head and body-worn exposure conditions to address possible VoIP scenarios.

UMTS Notes:

1. UMTS mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01v03r01.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.




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LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 8.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

WLAN Notes:

1. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g evaluations, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.6.5 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg for 1g evaluations. See Section 8.6.6 for more information.
4. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

Bluetooth Notes

1. Bluetooth SAR was measured with the device connected to a call box with hopping disabled with DH5 operation and Tx Tests test mode type. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100% transmission duty factor to determine compliance. See Section 9.5 for the time domain plot and calculation for the duty factor of the device.




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# 12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

## 12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

## 12.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

## 12.3 Head SAR Simultaneous Transmission Analysis

**Table 12-1**
**Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)**

| Simult Tx | Configuration | GSM 850 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | GSM 1900 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | | | 1 | 2 | 1+2 |
| Head SAR | Right Cheek | 0.416 | 0.566 | 0.982 | Head SAR | Right Cheek | 0.233 | 0.566 | 0.799 |
| | Right Tilt | 0.283 | 0.589 | 0.872 | | Right Tilt | 0.091 | 0.589 | 0.680 |
| | Left Cheek | 0.333 | 1.199 | 1.532 | | Left Cheek | 0.335 | 1.199 | 1.534 |
| | Left Tilt | 0.241 | 0.796 | 1.037 | | Left Tilt | 0.134 | 0.796 | 0.930 |

| Simult Tx | Configuration | GPRS 850 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | GPRS 1900 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.399 | 0.566 | 0.965 | Head SAR | Right Cheek | 0.316 | 0.566 | 0.882 | N/A |
| | Right Tilt | 0.261 | 0.589 | 0.850 | | Right Tilt | 0.116 | 0.589 | 0.705 | N/A |
| | Left Cheek | 0.302 | 1.199 | 1.501 | | Left Cheek | 0.415 | 1.199 | See Note 1 | 0.02 |
| | Left Tilt | 0.217 | 0.796 | 1.013 | | Left Tilt | 0.161 | 0.796 | 0.957 | N/A |

| Simult Tx | Configuration | UMTS 850 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | UMTS 1750 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.473 | 0.566 | 1.039 | Head SAR | Right Cheek | 0.494 | 0.566 | 1.060 | N/A |
| | Right Tilt | 0.296 | 0.589 | 0.885 | | Right Tilt | 0.348 | 0.589 | 0.937 | N/A |
| | Left Cheek | 0.359 | 1.199 | 1.558 | | Left Cheek | 0.575 | 1.199 | See Note 1 | 0.02 |
| | Left Tilt | 0.269 | 0.796 | 1.065 | | Left Tilt | 0.395 | 0.796 | 1.191 | N/A |

| Simult Tx | Configuration | UMTS 1900 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.447 | 0.566 | 1.013 | N/A |
| | Right Tilt | 0.166 | 0.589 | 0.755 | N/A |
| | Left Cheek | 0.595 | 1.199 | See Note 1 | 0.03 |
| | Left Tilt | 0.244 | 0.796 | 1.040 | N/A |




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| Simult Tx | Configuration | LTE Band 71 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | LTE Band 12 SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.300 | 0.566 | 0.866 | Head SAR | Right Cheek | 0.514 | 0.566 | 1.080 | N/A |
| | Right Tilt | 0.133 | 0.589 | 0.722 | | Right Tilt | 0.274 | 0.589 | 0.863 | N/A |
| | Left Cheek | 0.239 | 1.199 | 1.438 | | Left Cheek | 0.452 | 1.199 | See Note 1 | 0.03 |
| | Left Tilt | 0.121 | 0.796 | 0.917 | | Left Tilt | 0.274 | 0.796 | 1.070 | N/A |

| Simult Tx | Configuration | LTE Band 26 (Cell) SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR | Simult Tx | Configuration | LTE Band 66 (AWS) SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.568 | 0.566 | 1.134 | N/A | Head SAR | Right Cheek | 0.407 | 0.566 | 0.973 | N/A |
| | Right Tilt | 0.359 | 0.589 | 0.948 | N/A | | Right Tilt | 0.352 | 0.589 | 0.941 | N/A |
| | Left Cheek | 0.441 | 1.199 | See Note 1 | 0.04 | | Left Cheek | 0.577 | 1.199 | See Note 1 | 0.03 |
| | Left Tilt | 0.332 | 0.796 | 1.128 | N/A | | Left Tilt | 0.312 | 0.796 | 1.108 | N/A |

| Simult Tx | Configuration | LTE Band 25 (PCS) SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.366 | 0.566 | 0.932 | N/A |
| | Right Tilt | 0.161 | 0.589 | 0.750 | N/A |
| | Left Cheek | 0.566 | 1.199 | See Note 1 | 0.02 |
| | Left Tilt | 0.218 | 0.796 | 1.014 | N/A |

## Table 12-2
## Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

| Simult Tx | Configuration | GSM 850 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR | Simult Tx | Configuration | GSM 1900 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.416 | 1.130 | 1.546 | N/A | Head SAR | Right Cheek | 0.233 | 1.130 | 1.363 | N/A |
| | Right Tilt | 0.283 | 1.018 | 1.301 | N/A | | Right Tilt | 0.091 | 1.018 | 1.109 | N/A |
| | Left Cheek | 0.333 | 1.275 | See Note 1 | 0.03 | | Left Cheek | 0.335 | 1.275 | See Note 1 | 0.02 |
| | Left Tilt | 0.241 | 1.015 | 1.256 | N/A | | Left Tilt | 0.134 | 1.015 | 1.149 | N/A |

| Simult Tx | Configuration | GPRS 850 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | GPRS 1900 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.399 | 1.130 | 1.529 | Head SAR | Right Cheek | 0.316 | 1.130 | 1.446 | N/A |
| | Right Tilt | 0.261 | 1.018 | 1.279 | | Right Tilt | 0.116 | 1.018 | 1.134 | N/A |
| | Left Cheek | 0.302 | 1.275 | 1.577 | | Left Cheek | 0.415 | 1.275 | See Note 1 | 0.02 |
| | Left Tilt | 0.217 | 1.015 | 1.232 | | Left Tilt | 0.161 | 1.015 | 1.176 | N/A |

| Simult Tx | Configuration | UMTS 850 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR | Simult Tx | Configuration | UMTS 1750 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.473 | 1.130 | See Note 1 | 0.03 | Head SAR | Right Cheek | 0.494 | 1.130 | See Note 1 | 0.03 |
| | Right Tilt | 0.296 | 1.018 | 1.314 | N/A | | Right Tilt | 0.348 | 1.018 | 1.366 | N/A |
| | Left Cheek | 0.359 | 1.275 | See Note 1 | 0.03 | | Left Cheek | 0.575 | 1.275 | See Note 1 | 0.02 |
| | Left Tilt | 0.269 | 1.015 | 1.284 | N/A | | Left Tilt | 0.395 | 1.015 | 1.410 | N/A |




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| Simult Tx | Configuration | UMTS 1900 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.447 | 1.130 | 1.577 | N/A |
| | Right Tilt | 0.166 | 1.018 | 1.184 | N/A |
| | Left Cheek | 0.595 | 1.275 | See Note 1 | 0.03 |
| | Left Tilt | 0.244 | 1.015 | 1.259 | N/A |

| Simult Tx | Configuration | LTE Band 71 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | Simult Tx | Configuration | LTE Band 12 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.300 | 1.130 | 1.430 | Head SAR | Right Cheek | 0.514 | 1.130 | See Note 1 | 0.03 |
| | Right Tilt | 0.133 | 1.018 | 1.151 | | Right Tilt | 0.274 | 1.018 | 1.292 | N/A |
| | Left Cheek | 0.239 | 1.275 | 1.514 | | Left Cheek | 0.452 | 1.275 | See Note 1 | 0.03 |
| | Left Tilt | 0.121 | 1.015 | 1.136 | | Left Tilt | 0.274 | 1.015 | 1.289 | N/A |

| Simult Tx | Configuration | LTE Band 26 (Cell) SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR | Simult Tx | Configuration | LTE Band 66 (AWS) SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 | | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.568 | 1.130 | See Note 1 | 0.03 | Head SAR | Right Cheek | 0.407 | 1.130 | 1.537 | N/A |
| | Right Tilt | 0.359 | 1.018 | 1.377 | N/A | | Right Tilt | 0.352 | 1.018 | 1.370 | N/A |
| | Left Cheek | 0.441 | 1.275 | See Note 1 | 0.04 | | Left Cheek | 0.577 | 1.275 | See Note 1 | 0.03 |
| | Left Tilt | 0.332 | 1.015 | 1.347 | N/A | | Left Tilt | 0.312 | 1.015 | 1.327 | N/A |

| Simult Tx | Configuration | LTE Band 25 (PCS) SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Head SAR | Right Cheek | 0.366 | 1.130 | 1.496 | N/A |
| | Right Tilt | 0.161 | 1.018 | 1.179 | N/A |
| | Left Cheek | 0.566 | 1.275 | See Note 1 | 0.03 |
| | Left Tilt | 0.218 | 1.015 | 1.233 | N/A |

Notes:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.6 for detailed SPLS ratio analysis.




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## 12.4 Body-Worn Simultaneous Transmission Analysis

**Table 12-3**
**Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.0 cm)**

| Exposure Condition | Mode | 2G/3G/4G SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Body-Worn | GSM/GPRS 850 | 0.691 | 0.472 | 1.163 |
| | GSM/GPRS 1900 | 0.397 | 0.472 | 0.869 |
| | UMTS 850 | 0.755 | 0.472 | 1.227 |
| | UMTS 1750 | 0.789 | 0.472 | 1.261 |
| | UMTS 1900 | 0.723 | 0.472 | 1.195 |
| | LTE Band 71 | 0.423 | 0.472 | 0.895 |
| | LTE Band 12 | 0.738 | 0.472 | 1.210 |
| | LTE Band 26 (Cell) | 0.774 | 0.472 | 1.246 |
| | LTE Band 66 (AWS) | 0.933 | 0.472 | 1.405 |
| | LTE Band 25 (PCS) | 0.576 | 0.472 | 1.048 |

**Table 12-4**
**Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Body-Worn at 1.0 cm)**

| Exposure Condition | Mode | 2G/3G/4G SAR (W/kg) | Bluetooth SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Body-Worn | GSM/GPRS 850 | 0.691 | 0.071 | 0.762 |
| | GSM/GPRS 1900 | 0.397 | 0.071 | 0.468 |
| | UMTS 850 | 0.755 | 0.071 | 0.826 |
| | UMTS 1750 | 0.789 | 0.071 | 0.860 |
| | UMTS 1900 | 0.723 | 0.071 | 0.794 |
| | LTE Band 71 | 0.423 | 0.071 | 0.494 |
| | LTE Band 12 | 0.738 | 0.071 | 0.809 |
| | LTE Band 26 (Cell) | 0.774 | 0.071 | 0.845 |
| | LTE Band 66 (AWS) | 0.933 | 0.071 | 1.004 |
| | LTE Band 25 (PCS) | 0.576 | 0.071 | 0.647 |



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**Table 12-5**
**Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 1.0 cm)**

| Exposure Condition | Mode | 2G/3G/4G SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Body-Worn | GSM/GPRS 850 | 0.691 | 0.717 | 1.408 | N/A |
| | GSM/GPRS 1900 | 0.397 | 0.717 | 1.114 | N/A |
| | UMTS 850 | 0.755 | 0.717 | 1.472 | N/A |
| | UMTS 1750 | 0.789 | 0.717 | **1.506** | N/A |
| | UMTS 1900 | 0.723 | 0.717 | 1.440 | N/A |
| | LTE Band 71 | 0.423 | 0.717 | 1.140 | N/A |
| | LTE Band 12 | 0.738 | 0.717 | 1.455 | N/A |
| | LTE Band 26 (Cell) | 0.774 | 0.717 | 1.491 | N/A |
| | LTE Band 66 (AWS) | 0.933 | 0.717 | See Note 1 | 0.02 |
| | LTE Band 25 (PCS) | 0.576 | 0.717 | 1.293 | N/A |

**Table 12-6**
**Simultaneous Transmission Scenario with 2.4 GHz Bluetooth and 5 GHz WLAN (Body-Worn at 1.0 cm)**

| Exposure Condition | Mode | 2G/3G/4G SAR (W/kg) | Bluetooth SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | | | SPLSR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1+2 | 1+3 | 1+2+3 | 1+2 | 1+3 | 2+3 |
| Body-Worn | GSM/GPRS 850 | 0.691 | 0.071 | 0.717 | 0.762 | 1.408 | 1.479 | N/A | N/A | N/A |
| | GSM/GPRS 1900 | 0.397 | 0.071 | 0.717 | 0.468 | 1.114 | 1.185 | N/A | N/A | N/A |
| | UMTS 850 | 0.755 | 0.071 | 0.717 | 0.826 | 1.472 | 1.543 | N/A | N/A | N/A |
| | UMTS 1750 | 0.789 | 0.071 | 0.717 | 0.860 | 1.506 | **1.577** | N/A | N/A | N/A |
| | UMTS 1900 | 0.723 | 0.071 | 0.717 | 0.794 | 1.440 | 1.511 | N/A | N/A | N/A |
| | LTE Band 71 | 0.423 | 0.071 | 0.717 | 0.494 | 1.140 | 1.211 | N/A | N/A | N/A |
| | LTE Band 12 | 0.738 | 0.071 | 0.717 | 0.809 | 1.455 | 1.526 | N/A | N/A | N/A |
| | LTE Band 26 (Cell) | 0.774 | 0.071 | 0.717 | 0.845 | 1.491 | 1.562 | N/A | N/A | N/A |
| | LTE Band 66 (AWS) | 0.933 | 0.071 | 0.717 | 1.004 | See Note 1 | See Note 1 | 0.01 | 0.02 | 0.04 |
| | LTE Band 25 (PCS) | 0.576 | 0.071 | 0.717 | 0.647 | 1.293 | 1.364 | N/A | N/A | N/A |

Notes:
1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.6 for detailed SPLS ratio analysis.




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## 12.5 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v02r01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("-").

(*) For test positions that were not required to be evaluated for WLAN SAR per FCC KDB publication 248227, the worst case WLAN SAR result for the applicable exposure conditions was used for simultaneous transmission analysis.

**Table 12-7**
**Simultaneous Transmission Scenario with 2.4 GHz WLAN (Hotspot at 1.0 cm)**

| Exposure Condition | Mode | 2G/3G/4G SAR (W/kg) | 2.4 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Hotspot SAR | GPRS 850 | 0.783 | 0.472 | 1.255 |
| | GPRS 1900 | 0.403 | 0.472 | 0.875 |
| | UMTS 850 | 0.755 | 0.472 | 1.227 |
| | UMTS 1750 | 0.925 | 0.472 | 1.397 |
| | UMTS 1900 | 0.723 | 0.472 | 1.195 |
| | LTE Band 71 | 0.423 | 0.472 | 0.895 |
| | LTE Band 12 | 0.738 | 0.472 | 1.210 |
| | LTE Band 26 (Cell) | 0.774 | 0.472 | 1.246 |
| | LTE Band 66 (AWS) | 1.089 | 0.472 | **1.561** |
| | LTE Band 25 (PCS) | 0.668 | 0.472 | 1.140 |

**Table 12-8**
**Simultaneous Transmission Scenario with 5 GHz WLAN (Hotspot at 1.0 cm)**

| Exposure Condition | Mode | 2G/3G/4G SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Hotspot SAR | GPRS 850 | 0.783 | 0.849 | See Table Below |
| | GPRS 1900 | 0.403 | 0.849 | 1.252 |
| | UMTS 850 | 0.755 | 0.849 | See Table Below |
| | UMTS 1750 | 0.925 | 0.849 | See Table Below |
| | UMTS 1900 | 0.723 | 0.849 | 1.572 |
| | LTE Band 71 | 0.423 | 0.849 | 1.272 |
| | LTE Band 12 | 0.738 | 0.849 | **1.587** |
| | LTE Band 26 (Cell) | 0.774 | 0.849 | See Table Below |
| | LTE Band 66 (AWS) | 1.089 | 0.849 | See Table Below |
| | LTE Band 25 (PCS) | 0.668 | 0.849 | 1.517 |



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| Simult Tx | Configuration | GPRS 850 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Hotspot SAR | Back | 0.653 | 0.700 | 1.353 | N/A |
| | Front | 0.452 | 0.586 | 1.038 | N/A |
| | Top | - | 0.849* | 0.849 | N/A |
| | Bottom | 0.221 | - | 0.221 | N/A |
| | Right | 0.783 | 0.849 | See Note 1 | 0.03 |
| | Left | 0.394 | - | 0.394 | N/A |

| Simult Tx | Configuration | UMTS 850 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Hotspot SAR | Back | 0.755 | 0.700 | 1.455 |
| | Front | 0.548 | 0.586 | 1.134 |
| | Top | - | 0.849* | 0.849 |
| | Bottom | 0.257 | - | 0.257 |
| | Right | 0.688 | 0.849 | **1.537** |
| | Left | 0.431 | - | 0.431 |

| Simult Tx | Configuration | UMTS 1750 SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Hotspot SAR | Back | 0.789 | 0.700 | 1.489 |
| | Front | 0.925 | 0.586 | **1.511** |
| | Top | - | 0.849* | 0.849 |
| | Bottom | 0.528 | - | 0.528 |
| | Right | - | 0.849 | 0.849 |
| | Left | 0.501 | - | 0.501 |

| Simult Tx | Configuration | LTE Band 26 (Cell) SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| Hotspot SAR | Back | 0.774 | 0.700 | 1.474 |
| | Front | 0.596 | 0.586 | 1.182 |
| | Top | - | 0.849* | 0.849 |
| | Bottom | 0.267 | - | 0.267 |
| | Right | 0.699 | 0.849 | **1.548** |
| | Left | 0.428 | - | 0.428 |

| Simult Tx | Configuration | LTE Band 66 (AWS) SAR (W/kg) | 5 GHz WLAN SAR (W/kg) | Σ SAR (W/kg) | SPLSR |
|---|---|---|---|---|---|
| | | 1 | 2 | 1+2 | 1+2 |
| Hotspot SAR | Back | 0.933 | 0.700 | See Note 1 | 0.20 |
| | Front | 1.089 | 0.586 | See Note 1 | 0.20 |
| | Top | - | 0.849* | **0.849** | N/A |
| | Bottom | 0.564 | - | 0.564 | N/A |
| | Right | - | 0.849 | **0.849** | N/A |
| | Left | 0.453 | - | 0.453 | N/A |

Notes:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.6 for detailed SPLS ratio analysis.




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## 12.6 SPLSR Evaluation and Analysis

Per FCC KDB Publication 447498 D01v06, when the sum of the standalone transmitters is more than 1.6 W/kg for 1g, the SAR sum to peak locations can be analyzed to determine SAR distribution overlaps. When the SAR peak to location ratio (shown below) for each pair of antennas is
≤ 0.04 for 1g, simultaneous SAR evaluation is not required. The distance between the transmitters was calculated using the following formula.

$$\text{Distance}_{Tx1-Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2} \text{ (Head)}$$

$$\text{Distance}_{Tx1-Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \text{ (Body-Worn, Hotspot)}$$

$$\text{SPLS Ratio} = \frac{(SAR_1 + SAR_2)^{1.5}}{R_i}$$

### 12.6.1 Right Cheek SPLSR Evaluation and Analysis

**Table 12-9**
**Peak SAR Locations for Right Cheek**

| Mode/Band | x (mm) | y (mm) | z (mm) | Reported SAR (W/kg) |
|---|---|---|---|---|
| 5 GHz WLAN | -0.31 | -285.81 | -169.11 | 1.130 |
| UMTS 850 | 60.39 | -268.25 | -175.40 | 0.473 |
| UMTS 1750 | 65.85 | -253.81 | -174.83 | 0.494 |
| LTE B12 | 63.05 | -256.52 | -174.19 | 0.514 |
| LTE B26 | 60.98 | -266.21 | -175.24 | 0.568 |

**Table 12-10**
**Right Cheek SAR to Peak Location Separation Ratio Calculations**

| Antenna Pair | | Standalone SAR (W/kg) | | Standalone SAR Sum (W/kg) | Peak SAR Separation Distance (mm) | SPLS Ratio | Plot Number |
|---|---|---|---|---|---|---|---|
| Ant "a" | Ant "b" | a | b | a+b | $D_{a-b}$ | $(a+b)^{1.5}/D_{a-b}$ | |
| UMTS 850 | 5 GHz WLAN | 0.473 | 1.130 | 1.603 | 63.50 | 0.03 | 1 |
| UMTS 1750 | 5 GHz WLAN | 0.494 | 1.130 | 1.624 | 73.71 | 0.03 | 2 |
| LTE B12 | 5 GHz WLAN | 0.514 | 1.130 | 1.644 | 69.99 | 0.03 | 3 |
| LTE B26 | 5 GHz WLAN | 0.568 | 1.130 | 1.698 | 64.64 | 0.03 | 4 |




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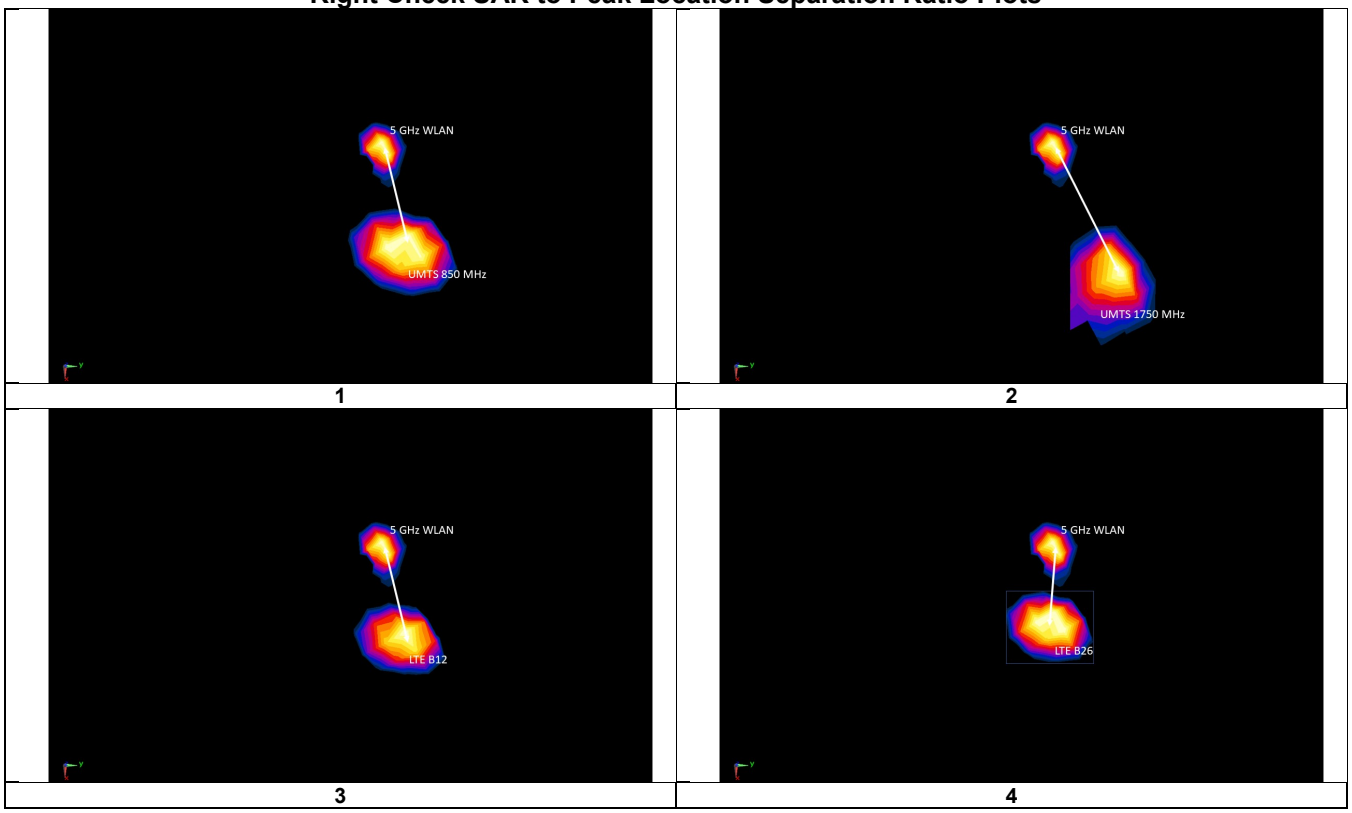
**Table 12-11**
**Right Cheek SAR to Peak Location Separation Ratio Plots**




## 12.6.2 Left Cheek SPLSR Evaluation and Analysis

**Table 12-12**
**Peak SAR Locations for Left Cheek**

| Mode/Band | x (mm) | y (mm) | z (mm) | Reported SAR (W/kg) |
|---|---|---|---|---|
| 2.4 GHz WLAN | 32.24 | 332.52 | -174.24 | 1.199 |
| 5 GHz WLAN | 27.19 | 335.28 | -174.44 | 1.275 |
| GSM 850 | 58.47 | 275.46 | -177.42 | 0.333 |
| GSM 1900 | 66.11 | 251.37 | -173.98 | 0.335 |
| GPRS 1900 | 66.10 | 251.37 | -173.98 | 0.415 |
| UMTS 850 | 59.07 | 273.42 | -177.30 | 0.359 |
| UMTS 1750 | 68.30 | 242.54 | -172.38 | 0.575 |
| UMTS 1900 | 73.82 | 248.85 | -171.81 | 0.595 |
| LTE Band 12 | 66.79 | 275.12 | -176.57 | 0.452 |
| LTE Band 26 | 58.55 | 281.76 | -177.50 | 0.441 |
| LTE Band 66 (AWS) | 64.53 | 250.49 | -174.08 | 0.577 |
| LTE Band 25 (PCS) | 71.46 | 246.72 | -172.08 | 0.566 |



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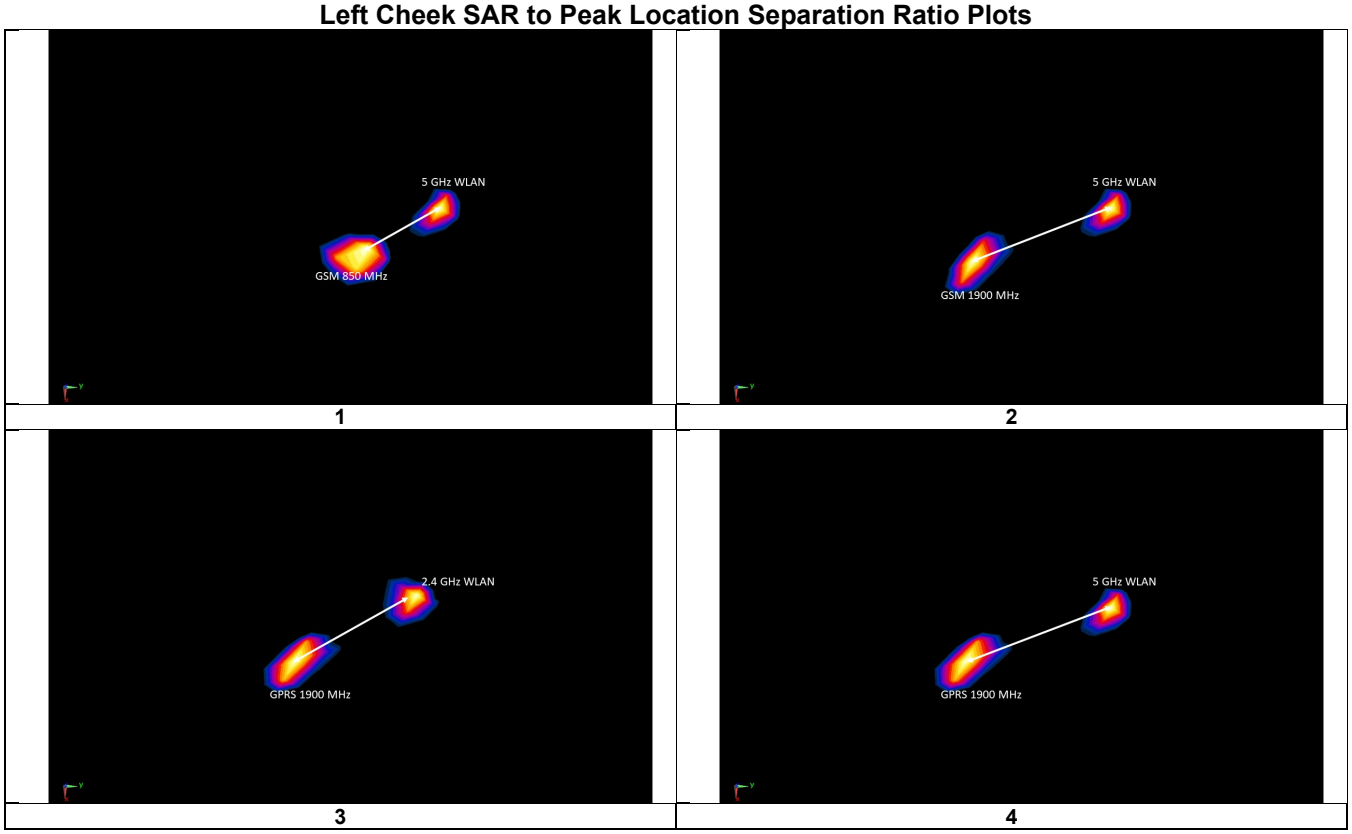
## Table 12-13
## Left Cheek SAR to Peak Location Separation Ratio Calculations

| Antenna Pair | | Standalone SAR (W/kg) | | Standalone SAR Sum (W/kg) | Peak SAR Separation Distance (mm) | SPLS Ratio | Plot Number |
|---|---|---|---|---|---|---|---|
| Ant "a" | Ant "b" | a | b | a+b | $D_{a-b}$ | $(a+b)^{1.5}/D_{a-b}$ | |
| GSM 850 | 5 GHz WLAN | 0.333 | 1.275 | 1.608 | 67.57 | 0.03 | 1 |
| GSM 1900 | 5 GHz WLAN | 0.335 | 1.275 | 1.61 | 92.50 | 0.02 | 2 |
| GPRS 1900 | 2.4 GHz WLAN | 0.415 | 1.199 | 1.614 | 87.93 | 0.02 | 3 |
| GPRS 1900 | 5 GHz WLAN | 0.415 | 1.275 | 1.69 | 92.49 | 0.02 | 4 |
| UMTS 850 | 5 GHz WLAN | 0.359 | 1.275 | 1.634 | 69.65 | 0.03 | 5 |
| UMTS 1750 | 2.4 GHz WLAN | 0.575 | 1.199 | 1.774 | 96.95 | 0.02 | 6 |
| UMTS 1750 | 5 GHz WLAN | 0.575 | 1.275 | 1.85 | 101.46 | 0.02 | 7 |
| UMTS 1900 | 2.4 GHz WLAN | 0.595 | 1.199 | 1.794 | 93.46 | 0.03 | 8 |
| UMTS 1900 | 5 GHz WLAN | 0.595 | 1.275 | 1.87 | 98.24 | 0.03 | 9 |
| LTE Band 12 | 2.4 GHz WLAN | 0.452 | 1.199 | 1.651 | 67.04 | 0.03 | 10 |
| LTE Band 12 | 5 GHz WLAN | 0.452 | 1.275 | 1.727 | 72.05 | 0.03 | 11 |
| LTE Band 26 | 2.4 GHz WLAN | 0.441 | 1.199 | 1.64 | 57.27 | 0.04 | 12 |
| LTE Band 26 | 5 GHz WLAN | 0.441 | 1.275 | 1.716 | 62.11 | 0.04 | 13 |
| LTE Band 66 (AWS) | 2.4 GHz WLAN | 0.577 | 1.199 | 1.776 | 88.16 | 0.03 | 14 |
| LTE Band 66 (AWS) | 5 GHz WLAN | 0.577 | 1.275 | 1.852 | 92.65 | 0.03 | 15 |
| LTE Band 25 (PCS) | 2.4 GHz WLAN | 0.566 | 1.199 | 1.765 | 94.36 | 0.02 | 16 |
| LTE Band 25 (PCS) | 5 GHz WLAN | 0.566 | 1.275 | 1.841 | 99.04 | 0.03 | 17 |

## Table 12-14
## Left Cheek SAR to Peak Location Separation Ratio Plots







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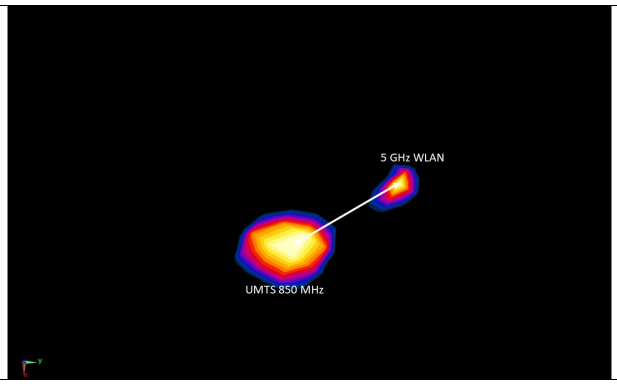
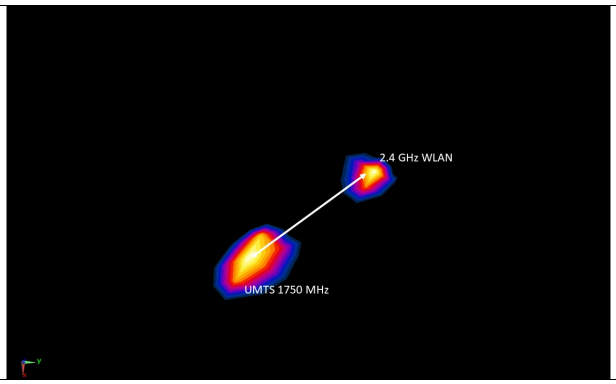
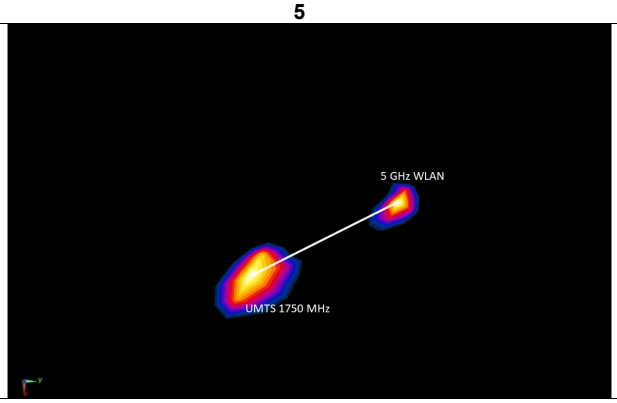


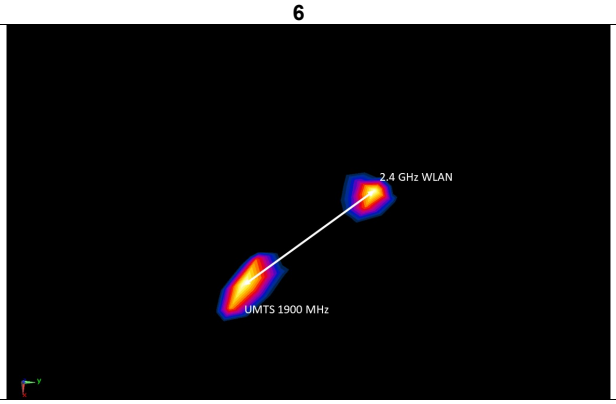

5



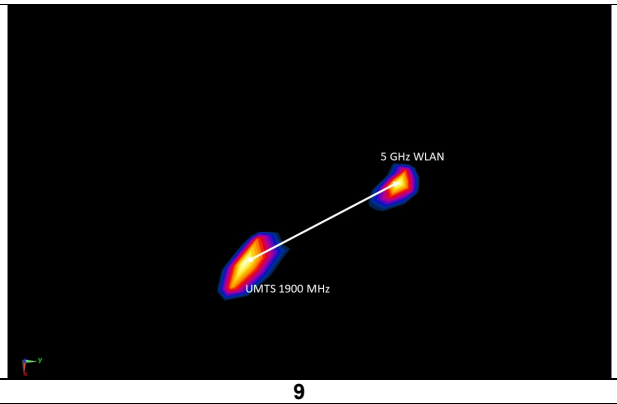

6



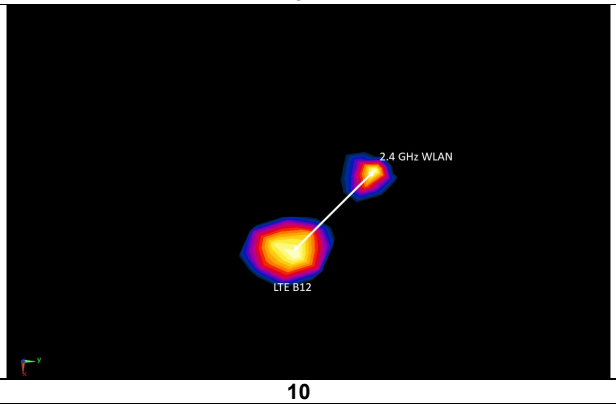

7




8




9

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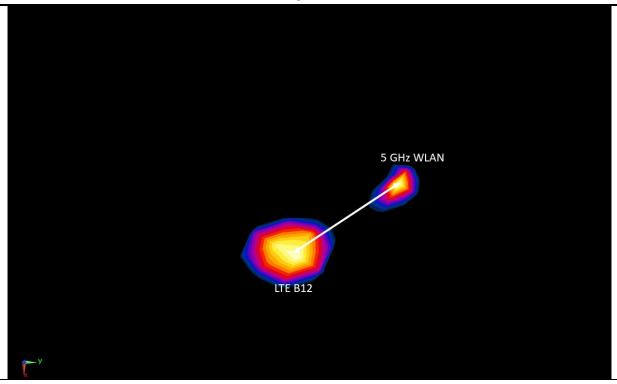


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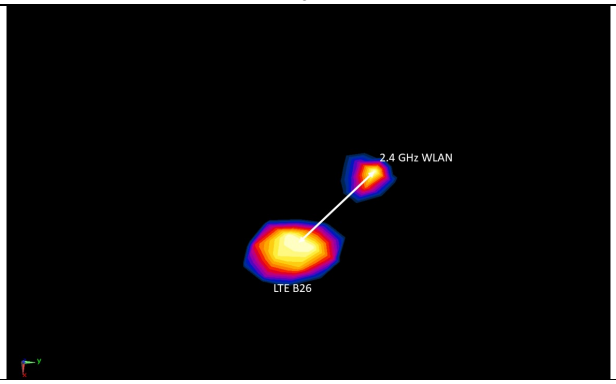


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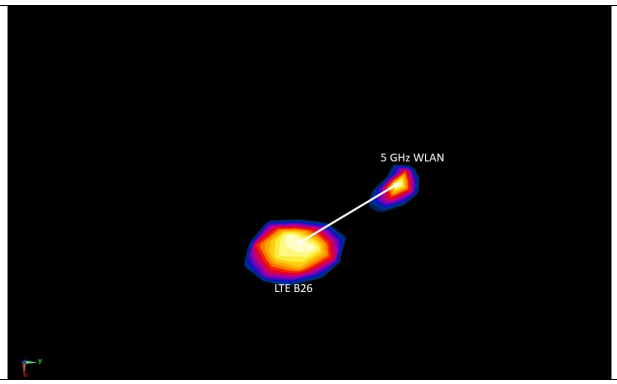


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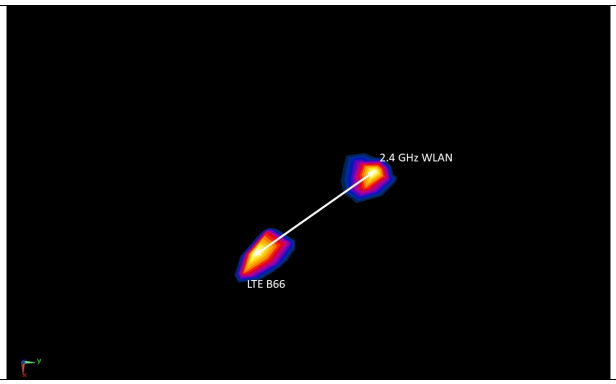


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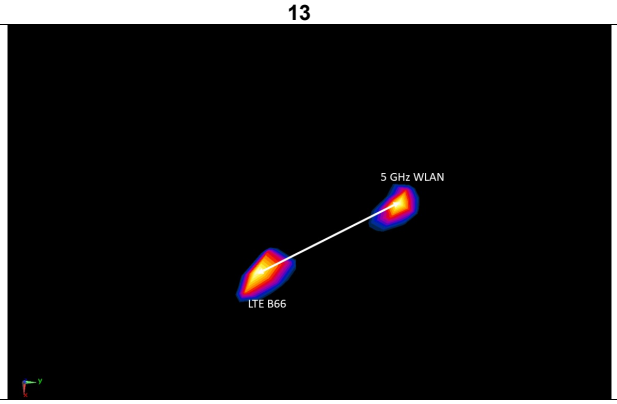


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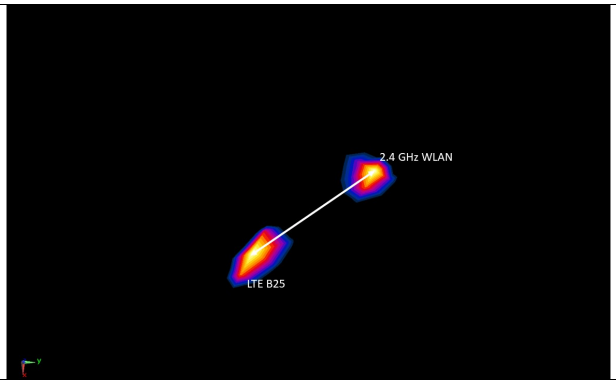


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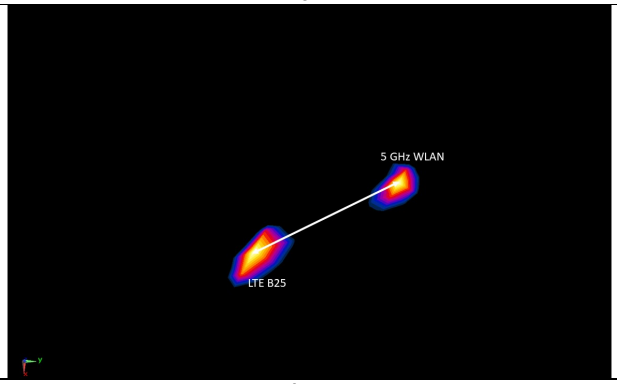


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## 12.6.3 Back Side SPLSR Evaluation and Analysis

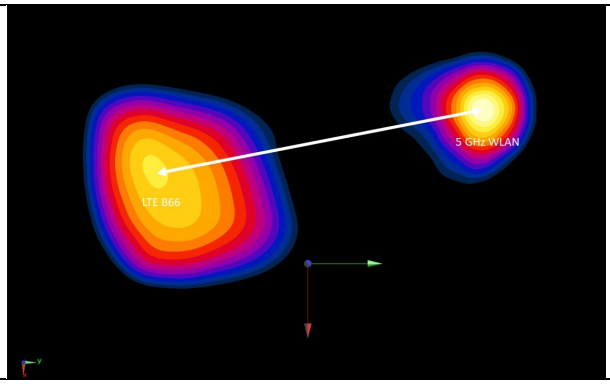
**Table 12-15**
**Peak SAR Locations for Body Back Side**

| Mode/Band | x (mm) | y (mm) | Reported SAR (W/kg) |
|---|---|---|---|
| 2.4 GHz Bluetooth | -51.20 | 52.00 | 0.071 |
| 5 GHz WLAN | -51.00 | 69.00 | 0.717 |
| LTE Band 66 (AWS) | -27.50 | -55.50 | 0.933 |

**Table 12-16**
**Back Side SAR to Peak Location Separation Ratio Calculations**

| Antenna Pair | | Standalone SAR (W/kg) | | Standalone SAR Sum (W/kg) | Peak SAR Separation Distance (mm) | SPLS Ratio | Plot Number |
|---|---|---|---|---|---|---|---|
| Ant "a" | Ant "b" | a | b | a+b | $D_{a-b}$ | $(a+b)^{1.5}/D_{a-b}$ | |
| LTE Band 66 (AWS) | 5 GHz WLAN | 0.933 | 0.717 | 1.65 | 126.70 | 0.02 | 1,2 |
| 2.4 GHz Bluetooth | 5 GHz WLAN | 0.071 | 0.717 | 0.788 | 17.00 | 0.04 | 2 |
| LTE Band 66 (AWS) | 2.4 GHz Bluetooth | 0.933 | 0.071 | 1.004 | 110.08 | 0.01 | |

**Table 12-17**
**Back Side SAR to Peak Location Separation Ratio Plots**

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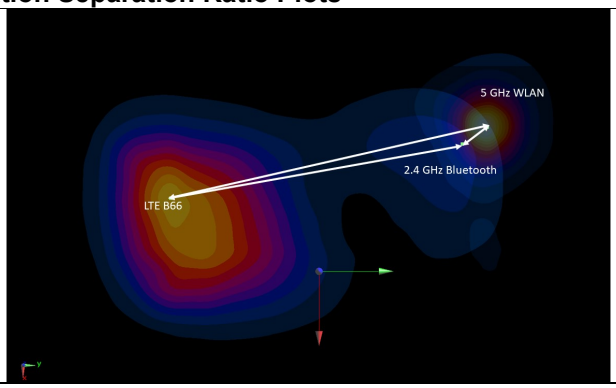


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## 12.6.4 Front Side SPLSR Evaluation and Analysis

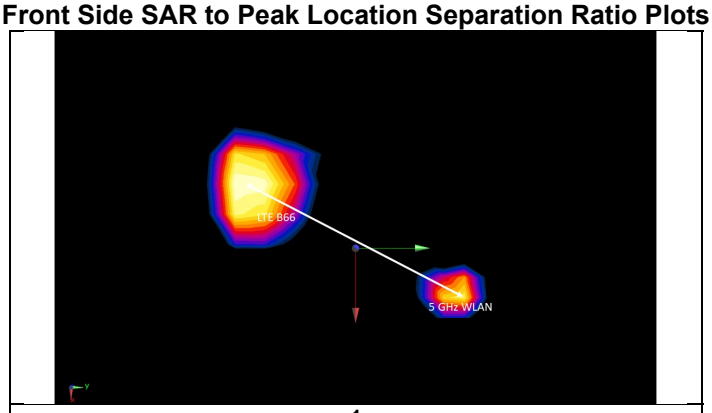
**Table 12-18**
**Peak SAR Locations for Hotspot Front Side**

| Mode/Band | x (mm) | y (mm) | Reported SAR (W/kg) |
|---|---|---|---|
| 5 GHz WLAN | 13.00 | 62.00 | 0.586 |
| LTE B66 (AWS) | -30.50 | -55.50 | 1.089 |

**Table 12-19**
**Front Side SAR to Peak Location Separation Ratio Calculations**

| Antenna Pair | | Standalone SAR (W/kg) | | Standalone SAR Sum (W/kg) | Peak SAR Separation Distance (mm) | SPLS Ratio | Plot Number |
|---|---|---|---|---|---|---|---|
| Ant "a" | Ant "b" | a | b | a+b | $D_{a-b}$ | $(a+b)^{1.5}/D_{a-b}$ | |
| LTE B66 (AWS) | 5 GHz WLAN | 1.089 | 0.586 | 1.675 | 125.29 | 0.02 | 1 |

**Table 12-20**
**Front Side SAR to Peak Location Separation Ratio Plots**

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### 12.6.5 Right Edge SPLSR Evaluation and Analysis

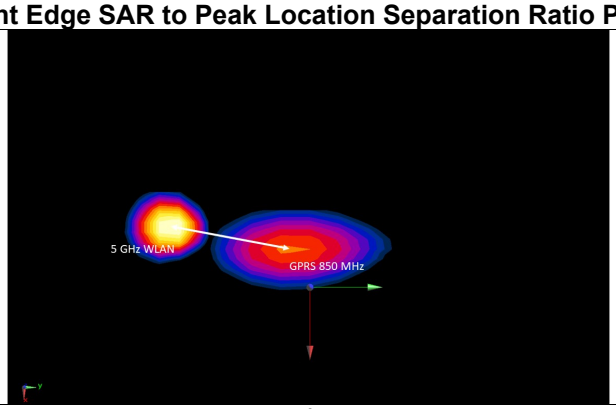
**Table 12-21**
**Peak SAR Locations for Hotspot Right Edge**

| Mode/Band | x (mm) | y (mm) | Reported SAR (W/kg) |
|---|---|---|---|
| 5 GHz WLAN | -30.50 | -64.00 | 0.849 |
| GPRS 850 | -19.50 | -2.50 | 0.783 |

**Table 12-22**
**Right Edge SAR to Peak Location Separation Ratio Calculations**

| Antenna Pair | | Standalone SAR (W/kg) | | Standalone SAR Sum (W/kg) | Peak SAR Separation Distance (mm) | SPLS Ratio | Plot Number |
|---|---|---|---|---|---|---|---|
| Ant "a" | Ant "b" | a | b | a+b | $D_{a-b}$ | $(a+b)^{1.5}/D_{a-b}$ | |
| GPRS 850 | 5 GHz WLAN | 0.783 | 0.849 | 1.632 | 62.48 | 0.03 | 1 |

**Table 12-23**
**Right Edge SAR to Peak Location Separation Ratio Plots**

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## 12.7 Simultaneous Transmission Conclusion

The above numerical summed SAR results and SPLSR analysis are sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE 1528- 2013 Section 6.3.4.1.




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# 13 SAR MEASUREMENT VARIABILITY

## 13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

**Table 13-1**
**Head SAR Measurement Variability Results**

| HEAD VARIABILITY RESULTS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Band | FREQUENCY | | Mode/Band | Service | Side | Test Position | Data Rate (Mbps) | Measured SAR (1g) | 1st Repeated SAR (1g) | Ratio | 2nd Repeated SAR (1g) | Ratio | 3rd Repeated SAR (1g) | Ratio |
| | MHz | Ch. | | | | | | (W/kg) | (W/kg) | | (W/kg) | | (W/kg) | |
| 2450 | 2462.00 | 11 | 802.11b, 22 MHz Bandwidth | DSSS | Left | Cheek | 1 | 1.090 | 1.090 | 1.00 | N/A | N/A | N/A | N/A |
| 5250 | 5280.00 | 56 | 802.11a, 20 MHz Bandwidth | OFDM | Left | Cheek | 6 | 1.090 | 1.030 | 1.06 | N/A | N/A | N/A | N/A |
| 5600 | 5580.00 | 116 | 802.11a, 20 MHz Bandwidth | OFDM | Left | Cheek | 6 | 0.997 | 0.970 | 1.03 | N/A | N/A | N/A | N/A |
| 5750 | 5785.00 | 157 | 802.11a, 20 MHz Bandwidth | OFDM | Right | Cheek | 6 | 1.010 | 0.918 | 1.10 | N/A | N/A | N/A | N/A |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | Head<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | | |

**Table 13-2**
**Body SAR Measurement Variability Results**

| BODY VARIABILITY RESULTS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Band | FREQUENCY | | Mode | Service | Side | Spacing | Measured SAR (1g) | 1st Repeated SAR (1g) | Ratio | 2nd Repeated SAR (1g) | Ratio | 3rd Repeated SAR (1g) | Ratio |
| | MHz | Ch. | | | | | (W/kg) | (W/kg) | | (W/kg) | | (W/kg) | |
| 1750 | 1745.00 | 132322 | LTE Band 66 (AWS), 20 MHz Bandwidth | QPSK, 1 RB, 0 RB Offset | front | 10 mm | 1.040 | 0.977 | 1.06 | N/A | N/A | N/A | N/A |
| ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak<br>Uncontrolled Exposure/General Population | | | | | Body<br>1.6 W/kg (mW/g)<br>averaged over 1 gram | | | | | | | | |




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## 13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.




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# 14 EQUIPMENT LIST

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| Agilent | 8594A | (9kHz-2.9GHz) Spectrum Analyzer | N/A | N/A | N/A | 3051A00187 |
| Agilent | E4438C | ESG Vector Signal Generator | 3/24/2017 | Biennial | 3/24/2019 | MY42082385 |
| Agilent | E4432B | ESG-D Series Signal Generator | 4/19/2018 | Annual | 4/19/2019 | US40053896 |
| Agilent | N5182A | MXG Vector Signal Generator | 4/18/2018 | Annual | 4/18/2019 | MY47420800 |
| Agilent | N5182A-506 | MXG Vector Signal Generator | 6/19/2018 | Annual | 6/19/2019 | MY48180366 |
| Agilent | 8753ES | S-Parameter Network Analyzer | 7/30/2018 | Annual | 7/30/2019 | MY40000670 |
| Agilent | 8753ES | S-Parameter Vector Network Analyzer | 8/30/2018 | Annual | 8/30/2019 | MY40003841 |
| Agilent | E5515C | Wireless Communications Test Set | 5/22/2018 | Biennial | 5/22/2020 | GB43193563 |
| Agilent | E5515C | Wireless Communications Test Set | 2/7/2018 | Triennial | 2/7/2021 | GB43304447 |
| Agilent | N4010A | Wireless Connectivity Test Set | N/A | N/A | N/A | GB46170464 |
| Agilent | N4010A | Wireless Connectivity Test Set | N/A | N/A | N/A | GB44450273 |
| Amplifier Research | 15S1G6 | Amplifier | CBT | N/A | CBT | 433972 |
| Amplifier Research | 15S1G6 | Amplifier | CBT | N/A | CBT | 433974 |
| Anritsu | ML2496A | Power Meter | 6/19/2018 | Annual | 6/19/2019 | 1306009 |
| Anritsu | MA2411B | Pulse Power Sensor | 10/30/2018 | Annual | 10/30/2019 | 1126066 |
| Anritsu | MT8821C | Radio Communication Analyzer | 11/6/2018 | Annual | 11/6/2019 | 6200901190 |
| Anritsu | MT8821C | Radio Communication Analyzer | 1/25/2019 | Annual | 1/25/2020 | 6261895213 |
| Anritsu | MA24106A | USB Power Sensor | 6/5/2018 | Annual | 6/5/2019 | 1231538 |
| Anritsu | MA24106A | USB Power Sensor | 6/5/2018 | Annual | 6/5/2019 | 1231535 |
| Anritsu | MA24106A | USB Power Sensor | 6/5/2018 | Annual | 6/5/2019 | 1244515 |
| Anritsu | MA24106A | USB Power Sensor | 7/16/2018 | Annual | 7/16/2019 | 1520505 |
| Anritsu | MT8862A | Wireless Connectivity Test Set | 7/3/2018 | Annual | 7/3/2019 | 6261782395 |
| COMTECH | AR85729-5/5759B | Solid State Amplifier | CBT | N/A | CBT | M3W1A00-1002 |
| COMTech | AR85729-5 | Solid State Amplifier | CBT | N/A | CBT | M1S5A00-009 |
| Control Company | 4040 | Therm./ Clock/ Humidity Monitor | 10/9/2018 | Biennial | 10/9/2020 | 181647811 |
| Control Company | 4040 | Therm./ Clock/ Humidity Monitor | 10/9/2018 | Biennial | 10/9/2020 | 181647802 |
| Control Company | 4040 | Therm./ Clock/ Humidity Monitor | 10/9/2018 | Biennial | 10/9/2020 | 181647812 |
| Control Company | 4352 | Ultra Long Stem Thermometer | 11/29/2018 | Biennial | 11/29/2020 | 181766816 |
| Control Company | 4352 | Ultra Long Stem Thermometer | 11/29/2018 | Biennial | 11/29/2020 | 181766817 |
| Control Company | 4352 | Ultra Long Stem Thermometer | 11/29/2018 | Biennial | 11/29/2020 | 181766801 |
| Control Company | 4352 | Ultra Long Stem Thermometer | 11/29/2018 | Biennial | 11/29/2020 | 181766777 |
| Keysight | 772D | Dual Directional Coupler | CBT | N/A | CBT | MY52180215 |
| Keysight Technologies | 85033E | Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm) | 6/4/2018 | Annual | 6/4/2019 | MY53401181 |
| MCL | BW-N6W5+ | 6dB Attenuator | CBT | N/A | CBT | 1139 |
| Mini Circuits | PWR-SEN-4GHS | USB Power Sensor | 3/30/2018 | Annual | 3/30/2019 | 11401010036 |
| MiniCircuits | SLP-2400+ | Low Pass Filter | CBT | N/A | CBT | R8979500903 |
| MiniCircuits | VLF-6000+ | Low Pass Filter | CBT | N/A | CBT | N/A |
| MiniCircuits | VLF-6000+ | Low Pass Filter | CBT | N/A | CBT | N/A |
| Mini-Circuits | BW-N20W5+ | DC to 18 GHz Precision Fixed 20 dB Attenuator | CBT | N/A | CBT | N/A |
| Mini-Circuits | NLP-1200+ | Low Pass Filter DC to 1000 MHz | CBT | N/A | CBT | N/A |
| Mini-Circuits | NLP-2950+ | Low Pass Filter DC to 2700 MHz | CBT | N/A | CBT | N/A |
| Mini-Circuits | BW-N20W5 | Power Attenuator | CBT | N/A | CBT | 1226 |
| Mitutoyo | CD-6"CSX | Digital Caliper | 4/18/2018 | Biennial | 4/18/2020 | 13264165 |
| Narda | 4014C-6 | 4 - 8 GHz SMA 6 dB Directional Coupler | CBT | N/A | CBT | N/A |
| Narda | 4772-3 | Attenuator (3dB) | CBT | N/A | CBT | 9406 |
| Narda | BW-S3W2 | Attenuator (3dB) | CBT | N/A | CBT | 120 |
| Narda | EHP-200AC | Electric & Magnetic Field Probe | 6/12/2018 | Annual | 6/12/2019 | 170WX70211 |
| Pasternack | PE2209-10 | Bidirectional Coupler | CBT | N/A | CBT | N/A |
| Pasternack | NC-100 | Torque Wrench | 4/18/2018 | Annual | 4/18/2019 | N/A |
| Pasternack | NC-100 | Torque Wrench | 4/18/2018 | Annual | 4/18/2019 | 1445 |
| Pasternack | NC-100 | Torque Wrench | 5/23/2018 | Biennial | 5/23/2020 | N/A |
| Rohde & Schwarz | CMU200 | Base Station Simulator | 5/18/2018 | Annual | 5/18/2019 | 109892 |
| Rohde & Schwarz | CMW500 | Radio Communication Tester | 11/5/2018 | Annual | 11/5/2019 | 140148 |
| Rohde & Schwarz | CMW500 | Radio Communication Tester | 11/14/2018 | Annual | 11/14/2019 | 100976 |
| Rohde & Schwarz | CMW500 | Wideband Radio Communication Tester | 1/30/2019 | Annual | 1/30/2020 | 162125 |
| SPEAG | D1750V2 | 1750 MHz SAR Dipole | 5/9/2017 | Biennial | 5/9/2019 | 1148 |
| SPEAG | D1900V2 | 1900 MHz SAR Dipole | 10/23/2018 | Annual | 10/23/2019 | 5d080 |
| SPEAG | D1900V2 | 1900 MHz SAR Dipole | 10/23/2018 | Annual | 10/23/2019 | 5d149 |
| SPEAG | D2450V2 | 2450 MHz SAR Dipole | 8/16/2018 | Annual | 8/16/2019 | 981 |
| SPEAG | D2450V2 | 2450 MHz SAR Dipole | 9/11/2017 | Biennial | 9/11/2019 | 797 |
| SPEAG | D5GHzV2 | 5 GHz SAR Dipole | 9/21/2016 | Triennial | 9/21/2019 | 1191 |
| SPEAG | D750V3 | 750 MHz Dipole | 3/7/2017 | Biennial | 3/7/2019 | 1054 |
| SPEAG | D750V3 | 750 MHz SAR Dipole | 1/15/2018 | Biennial | 1/15/2020 | 1003 |
| SPEAG | D835V2 | 835 MHz SAR Dipole | 10/19/2018 | Annual | 10/19/2019 | 4d047 |
| SPEAG | D835V2 | 835 MHz SAR Dipole | 1/22/2019 | Annual | 1/22/2020 | 4d132 |
| SPEAG | D835V2 | 835 MHz SAR Dipole | 10/19/2018 | Annual | 10/19/2019 | 4d133 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 3/7/2018 | Annual | 3/7/2019 | 1368 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 4/11/2018 | Annual | 4/11/2019 | 1407 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 6/18/2018 | Annual | 6/18/2019 | 1334 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 7/11/2018 | Annual | 7/11/2019 | 1322 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 10/3/2018 | Annual | 10/3/2019 | 1558 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 8/22/2018 | Annual | 8/22/2019 | 1450 |
| SPEAG | DAE4 | Dasy Data Acquisition Electronics | 1/15/2019 | Annual | 1/15/2020 | 1530 |
| SPEAG | DAK-3.5 | Dielectric Assessment Kit | 9/11/2018 | Annual | 9/11/2019 | 1091 |
| SPEAG | DAKS-3.5 | Portable Dielectric Assessment Kit | 8/22/2018 | Annual | 8/22/2019 | 1041 |
| SPEAG | ES3DV3 | SAR Probe | 3/13/2018 | Annual | 3/13/2019 | 3319 |
| SPEAG | EX3DV4 | SAR Probe | 4/18/2018 | Annual | 4/18/2019 | 7357 |
| SPEAG | EX3DV4 | SAR Probe | 6/25/2018 | Annual | 6/25/2019 | 7409 |
| SPEAG | EX3DV4 | SAR Probe | 7/20/2018 | Annual | 7/20/2019 | 7410 |
| SPEAG | EX3DV4 | SAR Probe | 8/23/2018 | Annual | 8/23/2019 | 7308 |
| SPEAG | EX3DV4 | SAR Probe | 1/24/2019 | Annual | 1/24/2020 | 7488 |
| SPEAG | EX3DV4 | SAR Probe | 1/25/2019 | Annual | 1/25/2020 | 3589 |

Note:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

2. Each equipment was used solely within its calibration period.




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# 15 MEASUREMENT UNCERTAINTIES

| a | c | d | e= f(d,k) | f | g | h = c x f/e | i = c x g/e | k |
|---|---|---|---|---|---|---|---|---|
| **Uncertainty Component** | **Tol. (± %)** | **Prob. Dist.** | **Div.** | **$c_i$ 1gm** | **$c_i$ 10 gms** | **1gm $u_i$ (± %)** | **10gms $u_i$ (± %)** | **$v_i$** |
| **Measurement System** | | | | | | | | |
| Probe Calibration | 6.55 | N | 1 | 1.0 | 1.0 | 6.6 | 6.6 | ∞ |
| Axial Isotropy | 0.25 | N | 1 | 0.7 | 0.7 | 0.2 | 0.2 | ∞ |
| Hemishperical Isotropy | 1.3 | N | 1 | 0.7 | 0.7 | 0.9 | 0.9 | ∞ |
| Boundary Effect | 2.0 | R | 1.73 | 1.0 | 1.0 | 1.2 | 1.2 | ∞ |
| Linearity | 0.3 | N | 1 | 1.0 | 1.0 | 0.3 | 0.3 | ∞ |
| System Detection Limits | 0.25 | R | 1.73 | 1.0 | 1.0 | 0.1 | 0.1 | ∞ |
| Readout Electronics | 0.3 | N | 1 | 1.0 | 1.0 | 0.3 | 0.3 | ∞ |
| Response Time | 0.8 | R | 1.73 | 1.0 | 1.0 | 0.5 | 0.5 | ∞ |
| Integration Time | 2.6 | R | 1.73 | 1.0 | 1.0 | 1.5 | 1.5 | ∞ |
| RF Ambient Conditions - Noise | 3.0 | R | 1.73 | 1.0 | 1.0 | 1.7 | 1.7 | ∞ |
| RF Ambient Conditions - Reflections | 3.0 | R | 1.73 | 1.0 | 1.0 | 1.7 | 1.7 | ∞ |
| Probe Positioner Mechanical Tolerance | 0.4 | R | 1.73 | 1.0 | 1.0 | 0.2 | 0.2 | ∞ |
| Probe Positioning w/ respect to Phantom | 6.7 | R | 1.73 | 1.0 | 1.0 | 3.9 | 3.9 | ∞ |
| Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation | 4.0 | R | 1.73 | 1.0 | 1.0 | 2.3 | 2.3 | ∞ |
| **Test Sample Related** | | | | | | | | |
| Test Sample Positioning | 2.7 | N | 1 | 1.0 | 1.0 | 2.7 | 2.7 | 35 |
| Device Holder Uncertainty | 1.67 | N | 1 | 1.0 | 1.0 | 1.7 | 1.7 | 5 |
| Output Power Variation - SAR drift measurement | 5.0 | R | 1.73 | 1.0 | 1.0 | 2.9 | 2.9 | ∞ |
| SAR Scaling | 0.0 | R | 1.73 | 1.0 | 1.0 | 0.0 | 0.0 | ∞ |
| **Phantom & Tissue Parameters** | | | | | | | | |
| Phantom Uncertainty (Shape & Thickness tolerances) | 7.6 | R | 1.73 | 1.0 | 1.0 | 4.4 | 4.4 | ∞ |
| Liquid Conductivity - measurement uncertainty | 4.2 | N | 1 | 0.78 | 0.71 | 3.3 | 3.0 | 10 |
| Liquid Permittivity - measurement uncertainty | 4.1 | N | 1 | 0.23 | 0.26 | 1.0 | 1.1 | 10 |
| Liquid Conductivity - Temperature Uncertainty | 3.4 | R | 1.73 | 0.78 | 0.71 | 1.5 | 1.4 | ∞ |
| Liquid Permittivity - Temperature Unceritainty | 0.6 | R | 1.73 | 0.23 | 0.26 | 0.1 | 0.1 | ∞ |
| Liquid Conductivity - deviation from target values | 5.0 | R | 1.73 | 0.64 | 0.43 | 1.8 | 1.2 | ∞ |
| Liquid Permittivity - deviation from target values | 5.0 | R | 1.73 | 0.60 | 0.49 | 1.7 | 1.4 | ∞ |
| **Combined Standard Uncertainty (k=1)** | | RSS | | | | 11.5 | 11.3 | 60 |
| **Expanded Uncertainty** (95% CONFIDENCE LEVEL) | | k=2 | | | | 23.0 | 22.6 | |




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REV 21.2 M
12/05/2018

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# 16 CONCLUSION

## 16.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]




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# APPENDIX A: SAR TEST DATA

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# PCTEST ENGINEERING LABORATORY, INC.

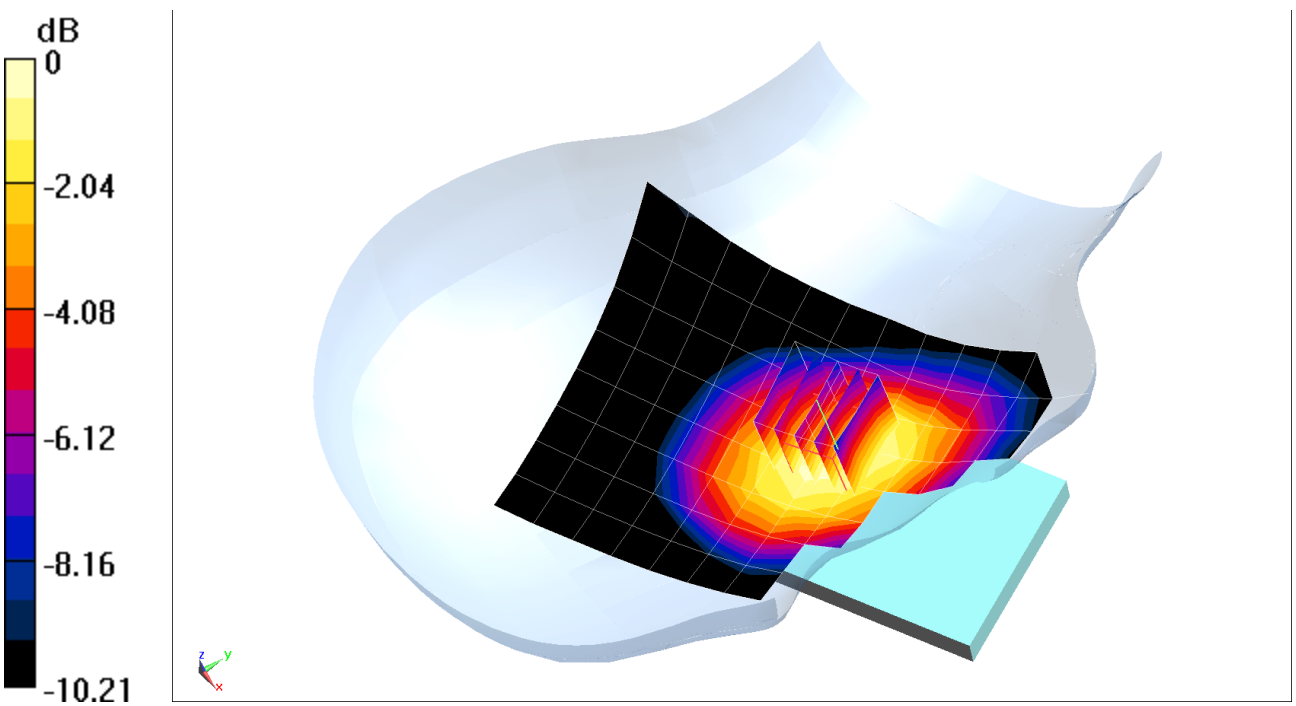
**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00831**

Communication System: UID 0, GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; $\sigma$ = 0.882 S/m; $\varepsilon_r$ = 39.519; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

Test Date: 02-11-2019; Ambient Temp: 21.1°C; Tissue Temp: 20.3°C

Probe: EX3DV4 - SN7410; ConvF(9.81, 9.81, 9.81) @ 836.6 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

**Mode: GSM 850, Right Head, Cheek, Mid.ch**
**Area Scan (9x15x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.41 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.544 W/kg
**SAR(1 g) = 0.416 W/kg**




0 dB = 0.492 W/kg = -3.08 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00823**

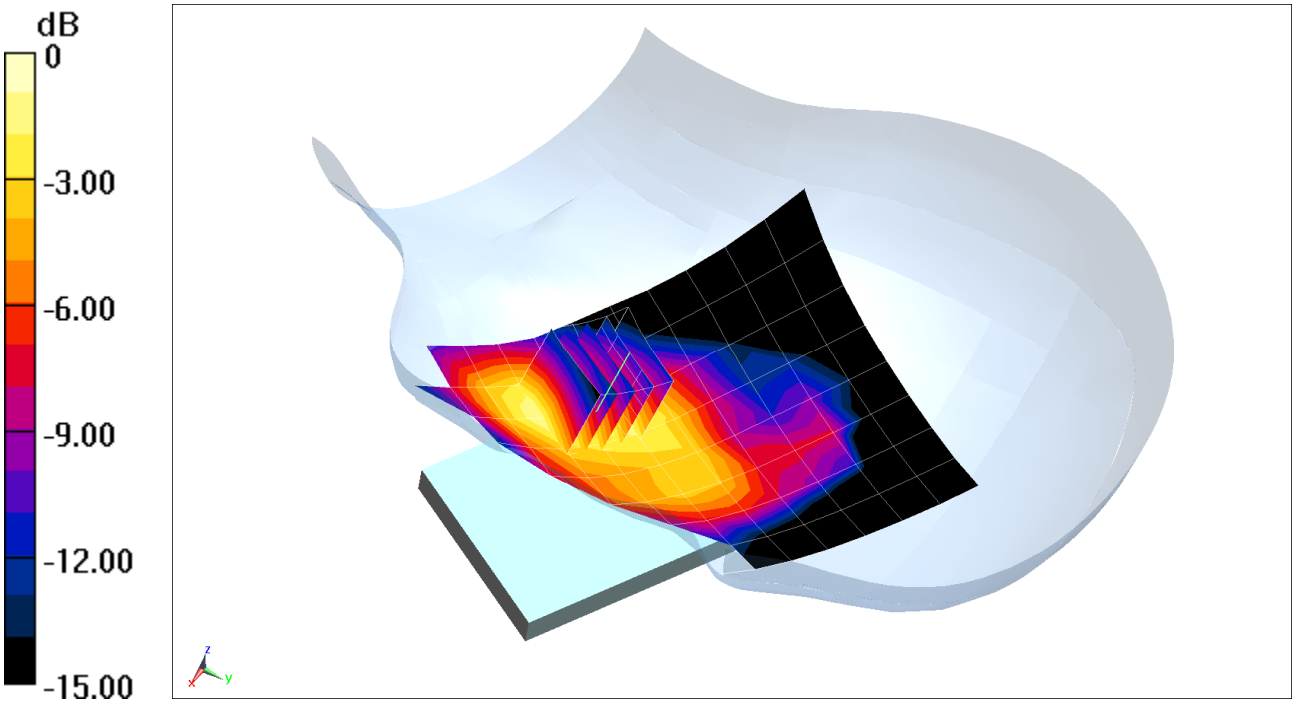
Communication System: UID 0, GSM GPRS; 4 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.076
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; $\sigma$ = 1.411 S/m; $\varepsilon_r$ = 39.006; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

Test Date: 02-26-19; Ambient Temp: 23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7357; ConvF(8.47, 8.47, 8.47) @ 1880 MHz; Calibrated: 4/18/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

## Mode: GPRS 1900, Left Head, Cheek, Mid.ch, 4 Tx slots

**Area Scan (9x15x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.15 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.668 W/kg
**SAR(1 g) = 0.400 W/kg**




0 dB = 0.542 W/kg = -2.66 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

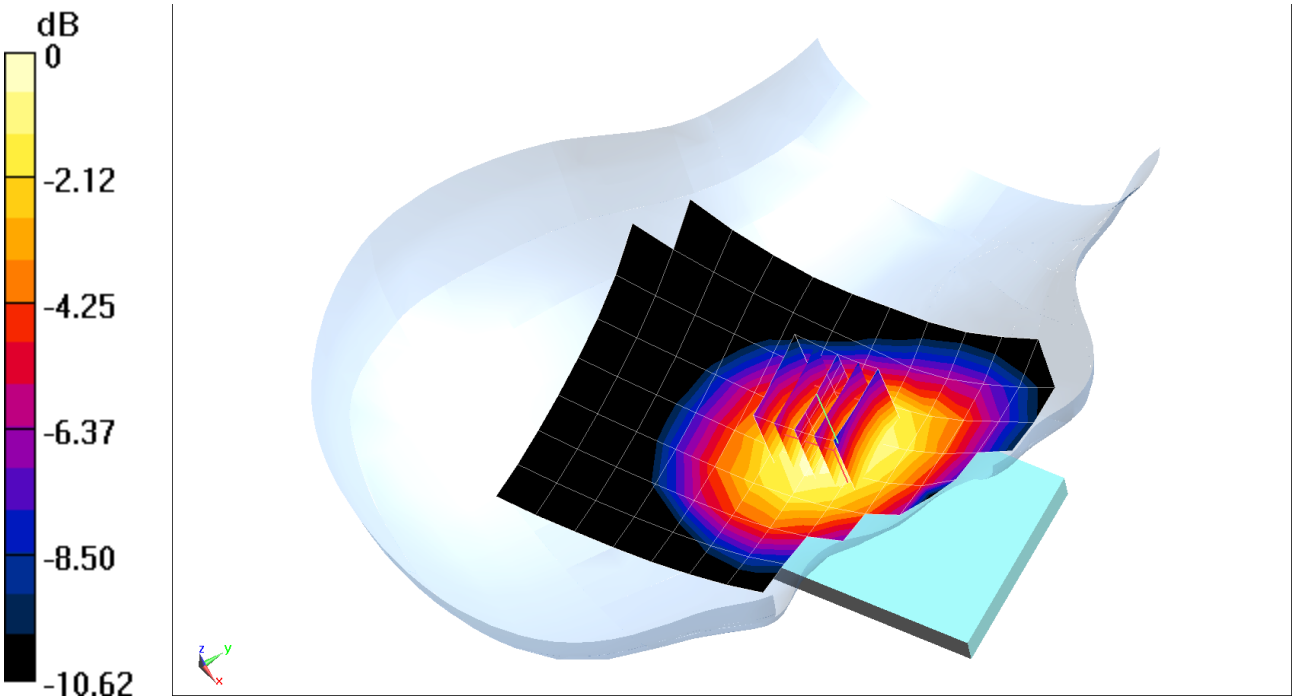
**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00815**

Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; $\sigma$ = 0.882 S/m; $\varepsilon_r$ = 39.519; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

Test Date: 02-11-2019; Ambient Temp: 21.1°C; Tissue Temp: 20.3°C

Probe: EX3DV4 - SN7410; ConvF(9.81, 9.81, 9.81) @ 836.6 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

**Mode: UMTS 850, Right Head, Cheek, Mid.ch**
**Area Scan (9x14x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.03 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.587 W/kg
**SAR(1 g) = 0.453 W/kg**




0 dB = 0.537 W/kg = -2.70 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00823**

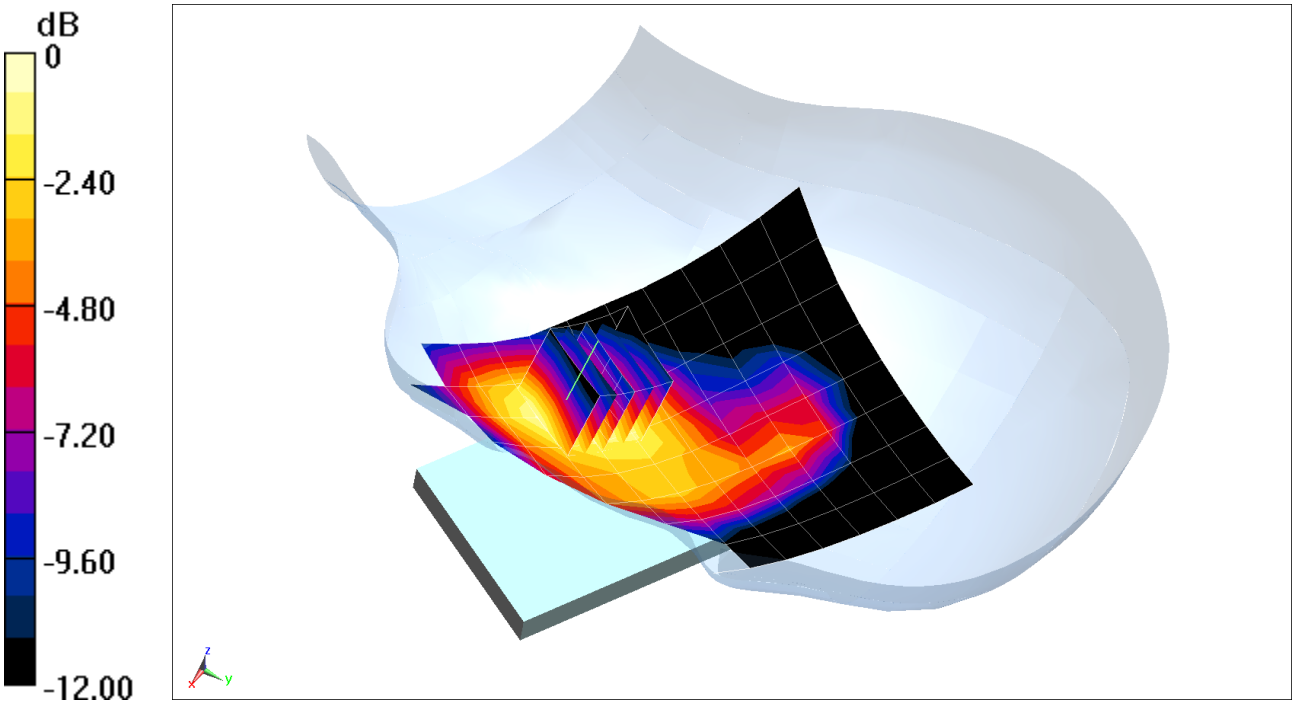
Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used (interpolated):
f = 1732.4 MHz; $\sigma$ = 1.327 S/m; $\varepsilon_r$ = 39.221; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

Test Date: 02-26-2019; Ambient Temp:23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7357; ConvF(8.8, 8.8, 8.8) @ 1732.4 MHz; Calibrated: 4/18/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

## Mode: UMTS 1750, Left Head, Cheek, Mid.ch

**Area Scan (9x15x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.76 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.834 W/kg
**SAR(1 g) = 0.552 W/kg**




0 dB = 0.705 W/kg = -1.52 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00823**

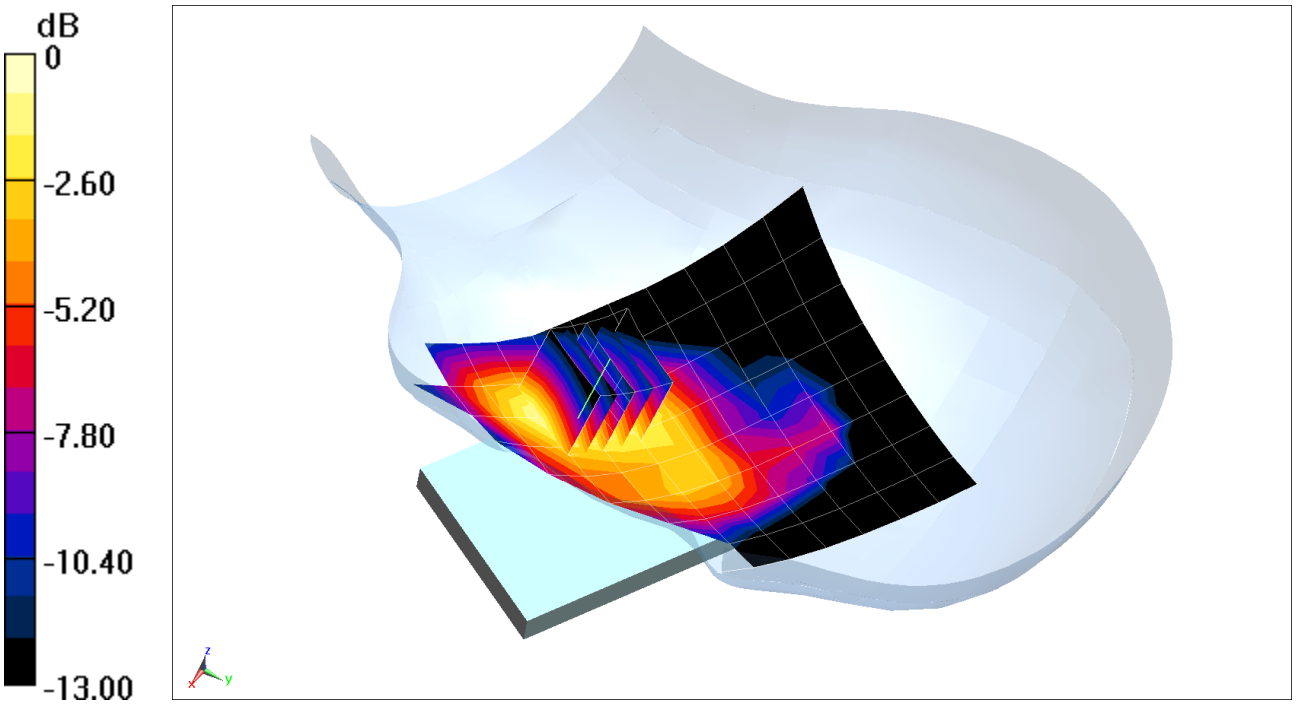
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; $\sigma$ = 1.411 S/m; $\varepsilon_r$ = 39.006; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

Test Date: 02-26-2019; Ambient Temp: 23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7357; ConvF(8.47, 8.47, 8.47) @ 1880 MHz; Calibrated: 4/18/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

## Mode: UMTS 1900, Left Head, Cheek, Mid.ch

**Area Scan (9x15x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.89 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.977 W/kg
**SAR(1 g) = 0.588 W/kg**




0 dB = 0.798 W/kg = -0.98 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00831**

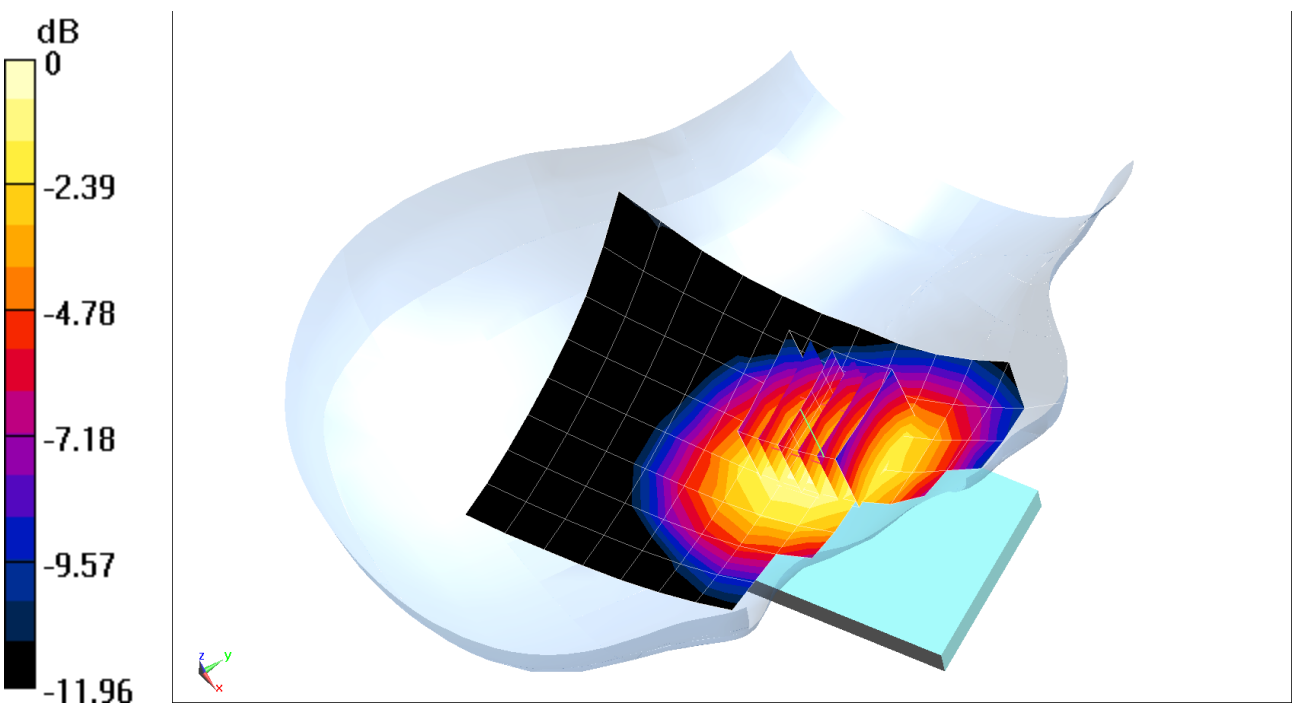
Communication System: UID 0, LTE Band 71; Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: 750 Head Medium parameters used (interpolated):
f = 680.5 MHz; $\sigma$ = 0.871 S/m; $\varepsilon_r$ = 42.162; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

Test Date: 02-14-2019; Ambient Temp: 22.9°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7410; ConvF(10.13, 10.13, 10.13) @ 680.5 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

**Mode: LTE Band 71, Right Head, Cheek, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

**Area Scan (9x15x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (6x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.87 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.385 W/kg
**SAR(1 g) = 0.294 W/kg**




0 dB = 0.345 W/kg = -4.62 dBW/kg

# PCTEST ENGINEERING LABORATORY, INC.

**DUT: ZNFX220TB; Type: Portable Handset; Serial: 00831**

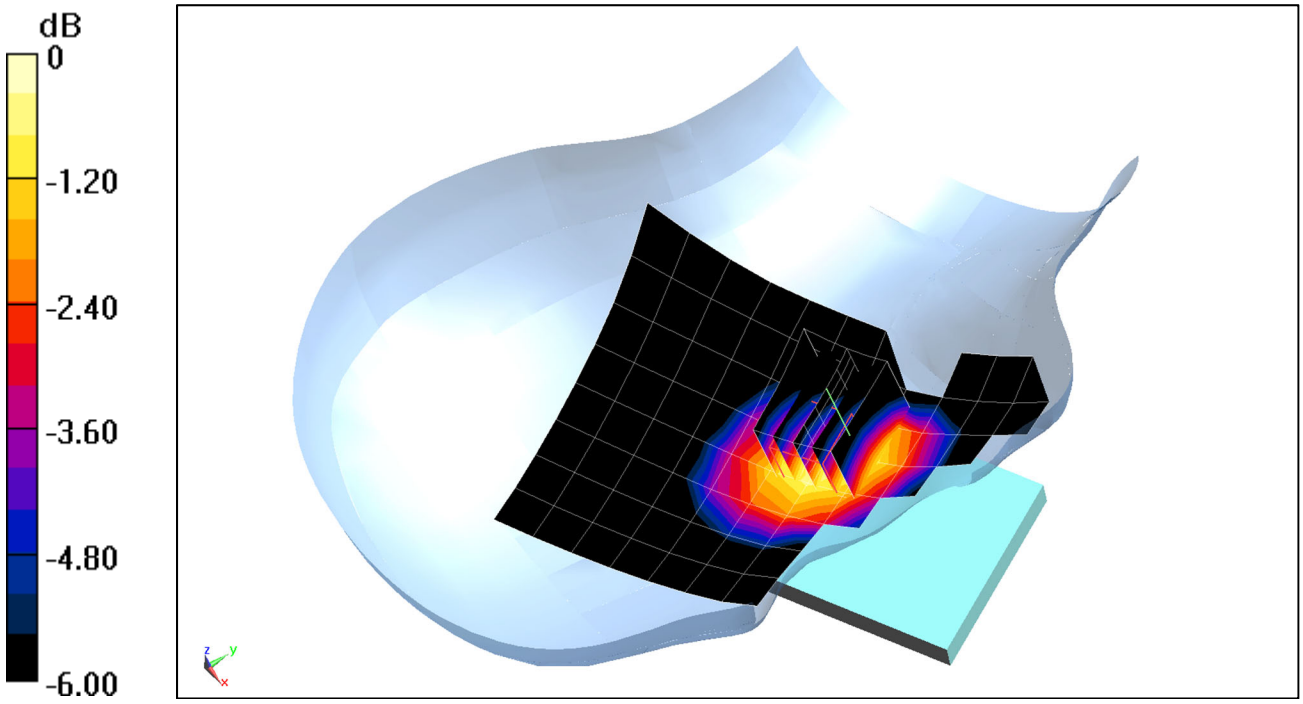
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Head Medium parameters used (interpolated):
f = 707.5 MHz; $\sigma$ = 0.883 S/m; $\varepsilon_r$ = 42.138; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

Test Date: 02-14-2019; Ambient Temp: 22.9°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7410; ConvF(10.13, 10.13, 10.13) @ 707.5 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

**Mode: LTE Band 12, Right Head, Cheek, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset**

**Area Scan (9x13x1):** Measurement grid: dx=15mm, dy=15mm
**Zoom Scan (6x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.80 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.679 W/kg
**SAR(1 g) = 0.506 W/kg**




0 dB = 0.602 W/kg = -2.20 dBW/kg