TESTING
NVLAP LAB CODE 600118-0

# SAR TEST REPORT

## No. I22Z62035-SEM05

**For**

**TCL Communication Ltd.**

**GSM/UMTS/LTE mobile phone**

**Model Name: T610K**

**with**

**Hardware Version: 05**

**Software Version: 7GS8**

**FCC ID: 2ACCJB194**

**Issued Date: 2023-1-9**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

**CTTL, Telecommunication Technology Labs, CAICT**

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512, Fax:+86(0)10-62304633-2504

Email: cttl_terminals@caict.ac.cn, website: www.caict.ac.cn

*©Copyright. All rights reserved by CTTL.*

# REPORT HISTORY

| Report Number | Revision | Issue Date | Description |
|---|---|---|---|
| I22Z62035-SEM05 | Rev.0 | 2022-12-30 | Initial creation of test report |
| I22Z62035-SEM05 | Rev.1 | 2023-1-9 | 1. Revise the tune up of LTE B13 power level A1&B1 and LTE B7 power level B1 on page30 .<br>2. Revise SAR results of LTE B7 on page54, LTE B13 on page55.<br>3. Revise the tune up of WIFI2.4G 802.11n-20M on page45. |

©Copyright. All rights reserved by CTTL.

# TABLE OF CONTENT

**1 TEST LABORATORY ..... 5**

1.1 TESTING LOCATION ..... 5
1.2 TESTING ENVIRONMENT ..... 5
1.3 PROJECT DATA ..... 5
1.4 SIGNATURE ..... 5

**2 STATEMENT OF COMPLIANCE ..... 6**

**3 CLIENT INFORMATION ..... 8**

3.1 APPLICANT INFORMATION ..... 8
3.2 MANUFACTURER INFORMATION ..... 8

**4 EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) ..... 9**

4.1 ABOUT EUT ..... 9
4.2 INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST ..... 10
4.3 INTERNAL IDENTIFICATION OF AE USED DURING THE TEST ..... 10

**5 TEST METHODOLOGY ..... 11**

5.1 APPLICABLE LIMIT REGULATIONS ..... 11
5.2 APPLICABLE MEASUREMENT STANDARDS ..... 11

**6 SPECIFIC ABSORPTION RATE (SAR) ..... 12**

6.1 INTRODUCTION ..... 12
6.2 SAR DEFINITION ..... 12

**7 TISSUE SIMULATING LIQUIDS ..... 13**

7.1 TARGETS FOR TISSUE SIMULATING LIQUID ..... 13
7.2 DIELECTRIC PERFORMANCE ..... 13

**8 SYSTEM VERIFICATION ..... 15**

8.1 SYSTEM SETUP ..... 15
8.2 SYSTEM VERIFICATION ..... 16

**9 MEASUREMENT PROCEDURES ..... 17**

9.1 TESTS TO BE PERFORMED ..... 17
9.2 GENERAL MEASUREMENT PROCEDURE ..... 19
9.3 WCDMA MEASUREMENT PROCEDURES FOR SAR ..... 20
9.4 SAR MEASUREMENT FOR LTE ..... 21
9.5 BLUETOOTH & WI-FI MEASUREMENT PROCEDURES FOR SAR ..... 23
9.6 POWER DRIFT ..... 23

**10 AREA SCAN BASED 1-G SAR ..... 24**

10.1 REQUIREMENT OF KDB ..... 24
10.2 FAST SAR ALGORITHMS ..... 24

©Copyright. All rights reserved by CTTL.

**11 CONDUCTED OUTPUT POWER ..... 25**

11.1 GSM MEASUREMENT RESULT ..... 25
11.2 WCDMA MEASUREMENT RESULT ..... 28
11.3 LTE MEASUREMENT RESULT ..... 30
11.4 WI-FI AND BT MEASUREMENT RESULT ..... 45

**12 SIMULTANEOUS TX SAR CONSIDERATIONS ..... 47**

12.1 INTRODUCTION ..... 47
12.2 TRANSMIT ANTENNA SEPARATION DISTANCES ..... 47
12.3 SAR MEASUREMENT POSITIONS ..... 47

**13 EVALUATION OF SIMULTANEOUS ..... 48**

**14 SAR TEST RESULT ..... 48**

14.1 SAR RESULTS FOR 2G/3G/4G ..... 49
14.2 WLAN EVALUATION FOR 2.4G ..... 58
14.3 WLAN EVALUATION FOR BT ..... 62

**15 SAR MEASUREMENT VARIABILITY ..... 63**

**16 MEASUREMENT UNCERTAINTY ..... 64**

16.1 MEASUREMENT UNCERTAINTY FOR NORMAL SAR TESTS (300MHZ~3GHZ) ..... 64
16.2 MEASUREMENT UNCERTAINTY FOR NORMAL SAR TESTS (3~6GHZ) ..... 65
16.3 MEASUREMENT UNCERTAINTY FOR FAST SAR TESTS (300MHZ~3GHZ) ..... 66
16.4 MEASUREMENT UNCERTAINTY FOR FAST SAR TESTS (3~6GHZ) ..... 67

**17 MAIN TEST INSTRUMENTS ..... 69**

**ANNEX A GRAPH RESULTS ..... 70**

**ANNEX B SYSTEM VERIFICATION RESULTS ..... 92**

**ANNEX C SAR MEASUREMENT SETUP ..... 101**

**ANNEX D POSITION OF THE WIRELESS DEVICE IN RELATION TO THE PHANTOM ..... 107**

**ANNEX E EQUIVALENT MEDIA RECIPES ..... 110**

**ANNEX F SYSTEM VALIDATION ..... 111**

**ANNEX G PROBE CALIBRATION CERTIFICATE ..... 112**

**ANNEX H DIPOLE CALIBRATION CERTIFICATE ..... 121**

**ANNEX I ACCREDITATION CERTIFICATE ..... 164**

©Copyright. All rights reserved by CTTL.

# 1 Test Laboratory

## 1.1 Testing Location

| | |
|---|---|
| Company Name: | CTTL |
| Address: | No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191. |

## 1.2 Testing Environment

| | |
|---|---|
| Temperature: | 18°C~25°C, |
| Relative humidity: | 30%~ 70% |
| Ground system resistance: | < 0.5 Ω |
| Ambient noise & Reflection: | < 0.012 W/kg |

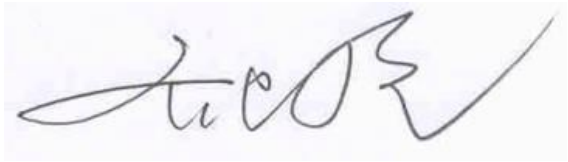
## 1.3 Project Data

| | |
|---|---|
| Project Leader: | Qi Dianyuan |
| Test Engineer: | Yao Juming |
| Testing Start Date: | December 12, 2022 |
| Testing End Date: | December 26, 2022 |

## 1.4 Signature

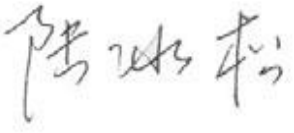
**Yao Juming**

**(Prepared this test report)**



**Qi Dianyuan**

**(Reviewed this test report)**



**Lu Bingsong**

**Deputy Director of the laboratory**

**(Approved this test report)**

©Copyright. All rights reserved by CTTL.

## 2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for TCL Communication Ltd. GSM/UMTS/LTE mobile phone T610K are as follows:

**Table 2.1: Highest Reported SAR (1g)**

| Technology Band | Head (Separation Distance 0mm) | Hotspot (Separation Distance 10mm) | Body-Worn (Separation Distance 15mm) | Equipment Class |
|---|---|---|---|---|
| GSM850 | **0.85** | **0.42** | **0.42** | PCE |
| GSM1900 | **0.13** | **0.91** | **0.89** | |
| WCDMA1900 | **0.20** | **1.11** | **1.11** | |
| WCDMA 850 | **0.44** | **0.44** | **0.44** | |
| LTE Band5 | **0.92** | **0.68** | **0.68** | |
| LTE Band7 | **0.19** | **1.06** | **1.06** | |
| LTE Band13 | **0.23** | **0.25** | **0.22** | |
| LTE Band41 | **0.08** | **1.07** | **1.07** | |
| WLAN 2.4GHz | **0.60** | **0.24** | **0.24** | DTS |
| WLAN 5GHz | **0.48** | **0.24** | **0.16** | NII |
| BT | **0.08** | **0.01** | **0.01** | DSS |

The SAR values found for the Mobile Phone are below the maximum recommended levels of 1.6 W/kg as averaged over any 1g tissue according to the ANSI C95.1-1992.

For body operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and which provides a minimum separation distance of 10 mm between this device and the body of the user. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output.

The measurement together with the test system set-up is described in annex C of this test report. A detailed description of the equipment under test can be found in chapter 4 of this test report. The highest reported SAR value is obtained at the case of **(Table 2.1),** and the values are**:**

**Head: 0.92 W/kg(1g)**

**Body: 1.11 W/kg(1g)**

Remark：

This device supports both LTE B38 and LTE B41.Since the supported frequency span for LTE B38 falls completely within the supports frequency span for LTE B41, both LTE bands have the same target power, and both LTE bands share the same transmission path; therefore, SAR was only assessed for LTE B41.

*©Copyright. All rights reserved by CTTL.*

**Table 2.2: The sum of SAR values for Main antenna + WiFi-2.4G**

| | Position | Main antenna | WiFi-2.4G | Sum |
|---|---|---|---|---|
| **Highest SAR value for Head** | Left head, Touch (LTE B5) | 0.78 | 0.60 | **1.38** |
| **Highest SAR value for Body** | Rear 10mm (W1900) | 1.11 | 0.24 | **1.35** |

**Table 2.3: The sum of SAR values for Main antenna + WiFi-5G +BT**

| | Position | Main antenna | WiFi-5G | BT | Sum |
|---|---|---|---|---|---|
| **Highest SAR value for Head** | Left head, Touch (LTE B5) | 0.78 | 0.46 | 0.08 | **1.32** |
| **Highest SAR value for Body** | Rear 10mm (W1900) | 1.11 | 0.16 | 0.01 | **1.28** |

**Conclusion:**

According to the above tables, the sum of reported SAR values is<1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

According to the above tables, the highest sum of reported SAR values is **1.38 W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

*©Copyright. All rights reserved by CTTL.*

# 3 Client Information

## 3.1 Applicant Information

| | |
|---|---|
| Company Name: | TCL Communication Ltd. |
| Address/Post: | 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong |
| Contact Person: | Annie Jiang |
| Contact Email: | nianxiang.jiang@tcl.com |
| Telephone: | +86 755 3661 1621 |
| Fax: | / |

## 3.2 Manufacturer Information

| | |
|---|---|
| Company Name: | TCL Communication Ltd. |
| Address/Post: | 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong |
| Contact Person: | Annie Jiang |
| Contact Email: | nianxiang.jiang@tcl.com |
| Telephone: | +86 755 3661 1621 |
| Fax: | / |

©Copyright. All rights reserved by CTTL.

# 4 Equipment Under Test (EUT) and Ancillary Equipment (AE)

## 4.1 About EUT

| | |
|---|---|
| Description: | GSM/UMTS/LTE mobile phone |
| Model name: | T610K |
| Operating mode(s): | GSM850/900/1800/1900, WCDMA B1/B2/B5/B8<br>LTE Band1/3/5/7/8/13/20/28/38/40/41,BT, Wi-Fi2.4G,WIFI5G |
| Tested Tx Frequency: | 824 – 849 MHz (GSM 850) |
| | 1850 – 1910 MHz (GSM 1900) |
| | 824 – 849 MHz (WCDMA 850 Band V) |
| | 1850 – 1910 MHz (WCDMA1900 Band II) |
| | 824.7 – 848.3 MHz (LTE Band 5) |
| | 2500 – 2570 MHz (LTE Band 7) |
| | 779.5 – 784.5 MHz (LTE Band 13) |
| | 2498.5 – 2687.5 MHz (LTE Band41) |
| | 2412 – 2462 MHz (Wi-Fi 2.4G) |
| | 2400 – 2483.5 MHz (Bluetooth) |
| | 5180 – 5240 MHz (Wi-Fi 5.2G) |
| | 5260 – 5320 MHz (Wi-Fi 5.3G) |
| | 5500 – 5720 MHz (Wi-Fi 5.5G) |
| | 5745 – 5825 MHz (Wi-Fi 5.8G) |
| GPRS/EGPRS Multislot Class: | 12 |
| Test device production information: | Production unit |
| Device type: | Portable device |
| Antenna type: | Integrated antenna |
| Hotspot mode: | Support |

©Copyright. All rights reserved by CTTL.

## 4.2 Internal Identification of EUT used during the test

| EUT ID* | IMEI | HW Version | SW Version |
|---|---|---|---|
| EUT1 | 861690060017924 | V2.0 | TMAF025G_0.01.01 |
| EUT2 | 861690060015159 | V2.0 | TMAF025G_0.01.01 |
| EUT3 | 861690060017650 | V2.0 | TMAF025G_0.01.01 |
| EUT4 | 861690060017858 | V2.0 | TMAF025G_0.01.01 |
| EUT5 | 861690060017817 | V2.0 | TMAF025G_0.01.01 |
| EUT6 | 861690060018195 | V2.0 | TMAF025G_0.01.01 |
| EUT7 | 861690060017643 | V2.0 | TMAF025G_0.01.01 |
| EUT8 | 861690060014830 | V2.0 | TMAF025G_0.01.01 |
| EUT9 | 861690060014848 | V2.0 | TMAF025G_0.01.01 |
| EUT10 | 861690060005895 | V2.0 | TMAF025G_0.01.01 |

*EUT ID: is used to identify the test sample in the lab internally.

**Note:** It is performed to test SAR with the EUT1~7 and conducted power with the EUT8~10.

## 4.3 Internal Identification of AE used during the test

| AE ID* | Description | Model | SN | Manufacturer |
|---|---|---|---|---|
| AE1 | Battery | RE001 | / | SUNWODA ELECTRONIC CO ., LTD |

*AE ID: is used to identify the test sample in the lab internally.

©Copyright. All rights reserved by CTTL.

# 5 TEST METHODOLOGY

## 5.1 Applicable Limit Regulations

**ANSI C95.1–1992:**IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

It specifies the maximum exposure limit of **1.6 W/kg** as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

## 5.2 Applicable Measurement Standards

**IEEE 1528–2013:** Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

**KDB447498 D01: General RF Exposure Guidance v06:** Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

**KDB648474 D04 Handset SAR v01r03:** SAR Evaluation Considerations for Wireless Handsets.

**KDB941225 D01 SAR test for 3G devices v03r01:** SAR Measurement Procedures for 3G Devices

**KDB941225 D05 SAR for LTE Devices v02r05:** SAR Evaluation Considerations for LTE Devices

**KDB941225 D06 Hotspot Mode SAR v02r01:** SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

**KDB248227 D01 802.11 Wi-Fi SAR v02r02:** SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

**KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04:** SAR Measurement Requirements for 100 MHz to 6 GHz.

**KDB865664 D02 RF Exposure Reporting v01r02:** RF Exposure Compliance Reporting and Documentation Considerations

*©Copyright. All rights reserved by CTTL.*

# 6 Specific Absorption Rate (SAR)

## 6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

## 6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy ( $dW$ ) absorbed by (dissipated in) an incremental mass ( $dm$ ) contained in a volume element ( $dv$ ) of a given density ( $\rho$ ) . The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, $\delta T$ is the temperature rise and $\delta t$ is the exposure duration, or related to the electrical field in the tissue by

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

Where: $\sigma$ is the conductivity of the tissue, $\rho$ is the mass density of tissue and $E$ is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

©Copyright. All rights reserved by CTTL.

# 7 Tissue Simulating Liquids

## 7.1 Targets for tissue simulating liquid

**Table 7.1: Targets for tissue simulating liquid**

| Frequency(MHz) | Liquid Type | Conductivity(σ) | ± 5%Range | Permittivity(ε) | ± 5%Range |
|---|---|---|---|---|---|
| 750 | Head | 0.89 | 0.85～0.93 | 41.94 | 39.8～44.0 |
| 835 | Head | 0.90 | 0.86～0.95 | 41.5 | 39.4～43.6 |
| 1800 | Head | 1.40 | 1.33～1.47 | 40.00 | 38.00～42.00 |
| 1900 | Head | 1.40 | 1.33～1.47 | 40.00 | 38.00～42.00 |
| 2450 | Head | 1.80 | 1.71～1.89 | 39.20 | 37.30～41.10 |
| 2600 | Head | 1.96 | 1.86～2.06 | 39.01 | 37.06～40.96 |
| 5250 | Head | 4.71 | 4.47～4.95 | 35.93 | 34.13～37.73 |
| 5600 | Head | 5.07 | 4.82～5.32 | 35.53 | 33.8～37.3 |
| 5750 | Head | 5.22 | 4.96～5.48 | 35.36 | 33.59～37.13 |

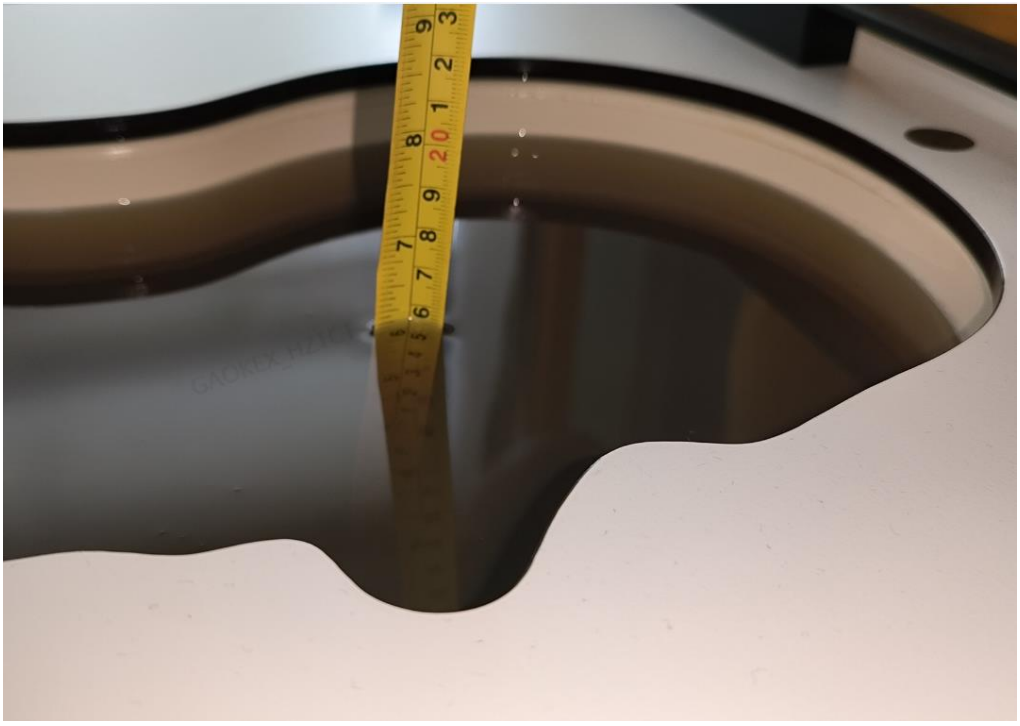
## 7.2 Dielectric Performance

**Table 7.2: Dielectric Performance of Tissue Simulating Liquid**

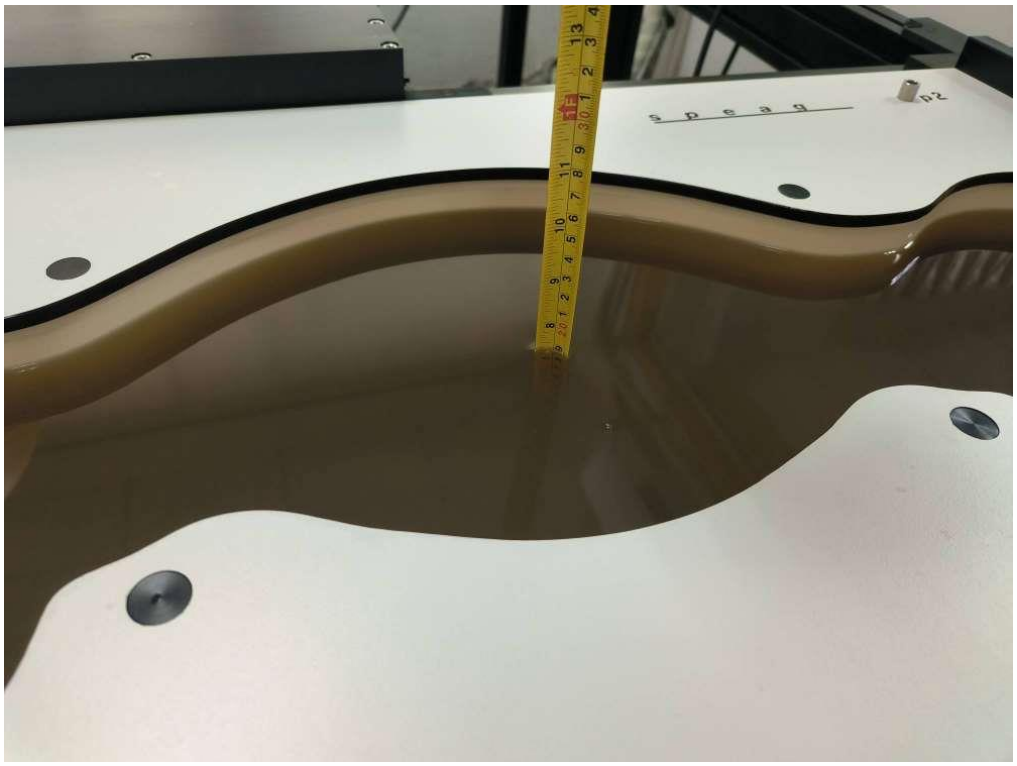
| Measurement Date yyyy/mm/dd | Frequency | Type | Permittivity ε | Drift (%) | Conductivity σ (S/m) | Drift (%) |
|---|---|---|---|---|---|---|
| 2022-12-12 | 750MHz | Head | 42.78 | 2.00 | 0.893 | 0.34 |
| 2022-12-15 | 835MHz | Head | 42.75 | 3.01 | 0.912 | 1.33 |
| 2022-12-19 | 1900MHz | Head | 40.56 | 1.40 | 1.403 | 0.21 |
| 2022-12-21 | 2450MHz | Head | 39.02 | -0.46 | 1.811 | 0.61 |
| 2022-12-22 | 2600MHz | Head | 38.87 | -0.36 | 1.92 | -2.04 |
| 2022-12-24 | 5250MHz | Head | 35.57 | -1.00 | 4.623 | -1.85 |
| 2022-12-25 | 5600MHz | Head | 35.38 | -0.42 | 4.87 | -3.94 |
| 2022-12-26 | 5750MHz | Head | 35.89 | 1.50 | 5.124 | -1.84 |

Note: The liquid temperature is 22.0℃

©Copyright. All rights reserved by CTTL.



**Picture 7-1 Liquid depth in the Head Phantom**



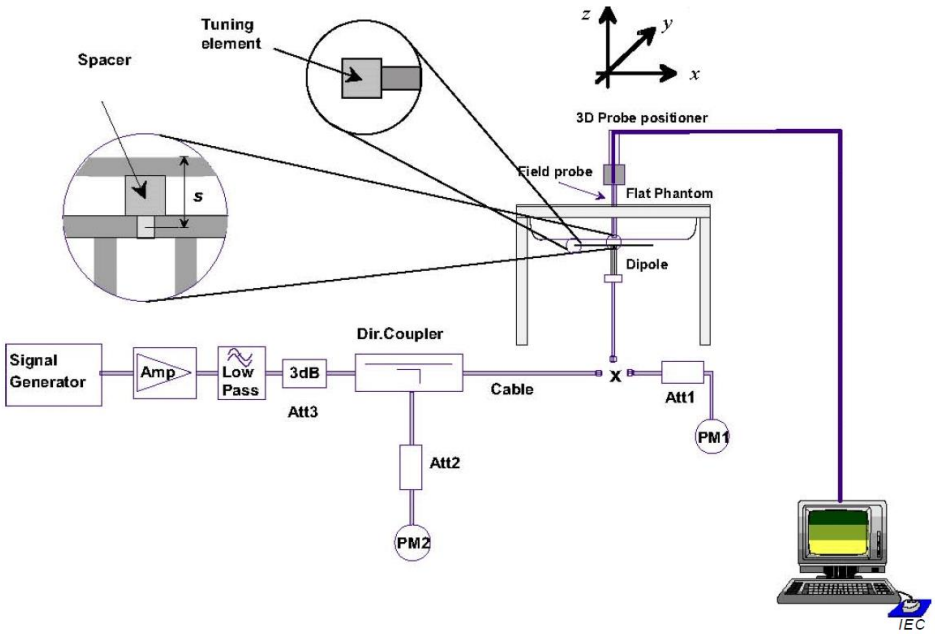
**Picture 7-2 Liquid depth in the Flat Phantom**

©Copyright. All rights reserved by CTTL.

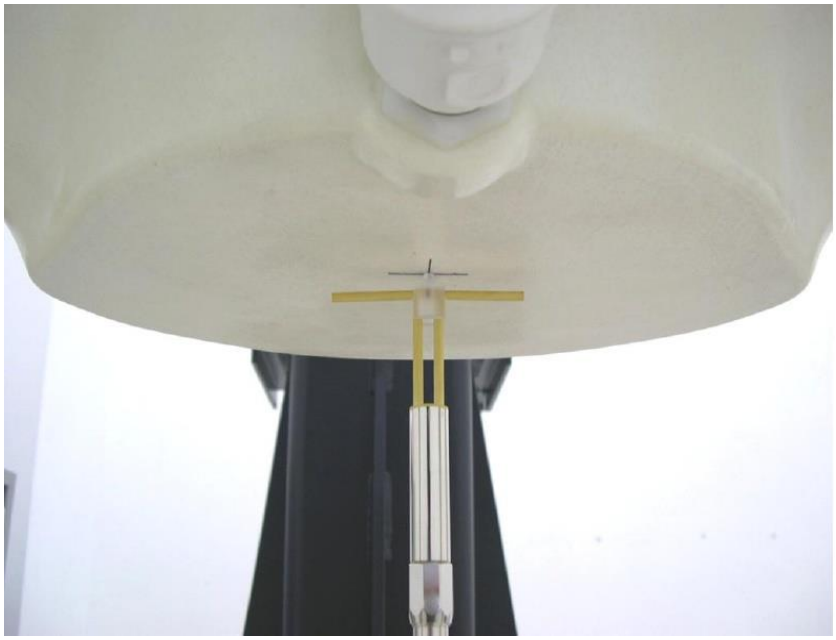
# 8 System verification

## 8.1 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:




**Picture 8.1 System Setup for System Evaluation**



**Picture 8.2 Photo of Dipole Setup**

©Copyright. All rights reserved by CTTL.

## 8.2 System Verification

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device.

The system verification results are required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR. The details are presented in annex B.

**Table 8.1: System Verification of Head**

| Measurement Date | Frequency | Target value (W/kg) | | Measured value (W/kg) | | Deviation | |
|---|---|---|---|---|---|---|---|
| (yyyy-mm-dd) | | 10 g Average | 1 g Average | 10 g Average | 1 g Average | 10 g Average | 1 g Average |
| 2022-12-12 | 750MHz | 5.64 | 8.63 | 5.56 | 8.72 | -1.42% | 1.04% |
| 2022-12-15 | 835MHz | 6.34 | 9.73 | 6.16 | 9.52 | -2.84% | -2.16% |
| 2022-12-19 | 1900MHz | 20.70 | 39.70 | 20.48 | 39.12 | -1.06% | -1.46% |
| 2022-12-21 | 2450MHz | 24.9 | 52.7 | 25.2 | 53.8 | 1.04% | 2.01% |
| 2022-12-22 | 2600MHz | 25.2 | 55.8 | 25.7 | 56.9 | 1.90% | 2.01% |
| 2022-12-24 | 5250MHz | 22.3 | 78.1 | 22.8 | 79.1 | 2.24% | 1.28% |
| 2022-12-25 | 5600MHz | 23.7 | 83.2 | 23.4 | 82.2 | -1.27% | -1.20% |
| 2022-12-26 | 5750MHz | 22.8 | 80.4 | 22.5 | 79.3 | -1.32% | -1.37% |

©Copyright. All rights reserved by CTTL.

# 9 Measurement Procedures

## 9.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in picture 9.1.

**Step 1**: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band ( $f_c$ ) for:

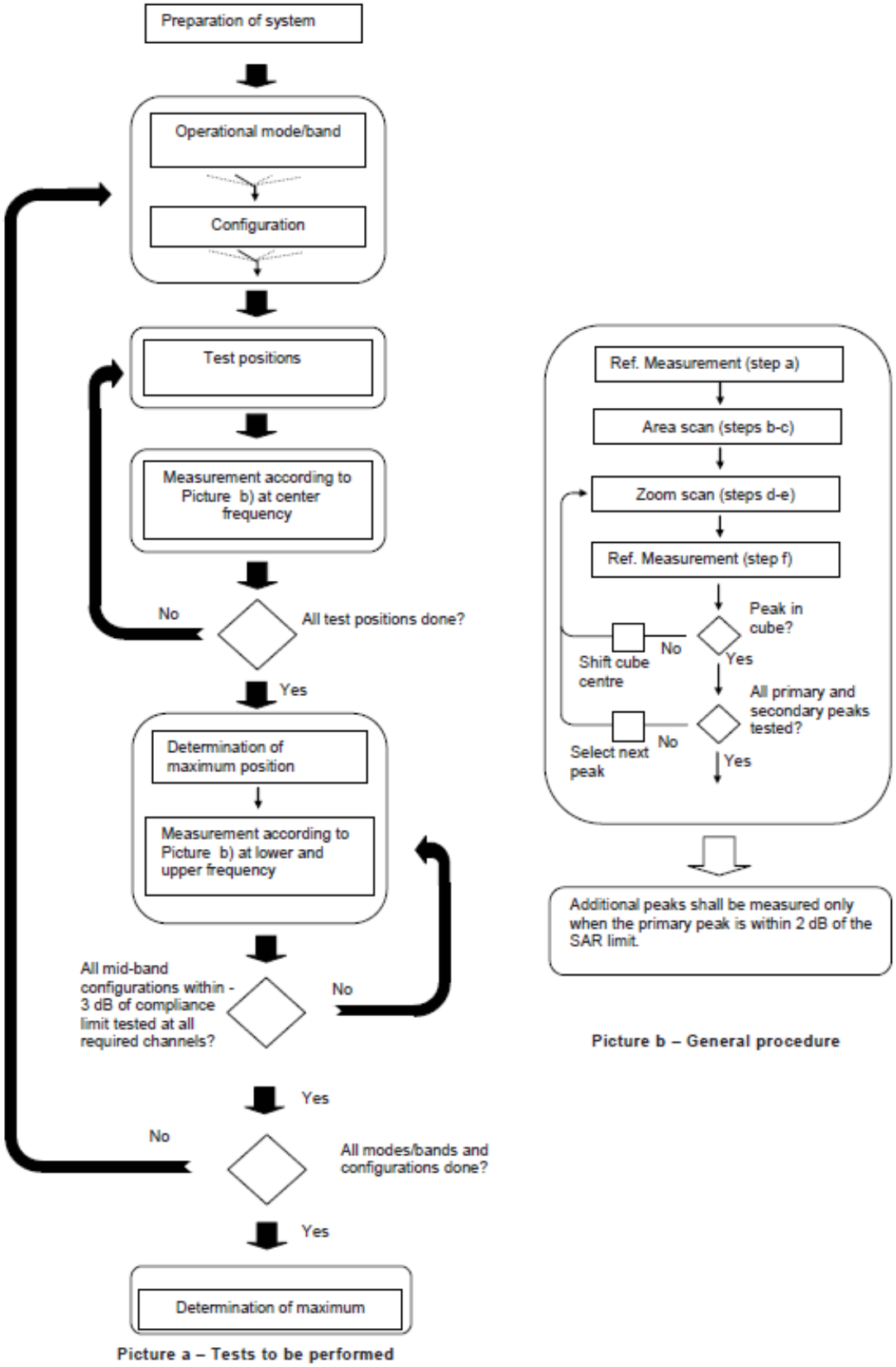
a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in annex D),
b) all configurations for each device position in a), e.g., antenna extended and retracted, and
c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

If more than three frequencies need to be tested according to 11.1 (i.e., $N_c > 3$), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

**Step 2**: For the condition providing highest peak spatial-average SAR determined in Step 1,perform all tests described in 9.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

**Step 3**: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.

©Copyright. All rights reserved by CTTL.




**Picture 9.1Block diagram of the tests to be performed**

©Copyright. All rights reserved by CTTL.

## 9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$</td><td>≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$</td><td>≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.<br>* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

©Copyright. All rights reserved by CTTL.

## 9.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

**For Release 5 HSDPA Data Devices:**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ （SF） | $\beta_c/\beta_d$ | $\beta_{hs}$ | CM/dB |
|---|---|---|---|---|---|---|
| 1 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 0.0 |
| 2 | 12/15 | 15/15 | 64 | 12/15 | 24/25 | 1.0 |
| 3 | 15/15 | 8/15 | 64 | 15/8 | 30/15 | 1.5 |
| 4 | 15/15 | 4/15 | 64 | 15/4 | 30/15 | 1.5 |

**For Release 6 HSPA Data Devices**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ （SF） | $\beta_c / \beta_d$ | $\beta_{hs}$ | $\beta_{ec}$ | $\beta_{ed}$ | $\beta_{ed}$ （SF） | $\beta_{ed}$ （codes） | CM (dB) | MPR (dB) | AG Index | E-TFCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/15 | 15/15 | 64 | 11/15 | 22/15 | 209/225 | 1039/225 | 4 | 1 | 1.5 | 1.5 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 12/15 | 4 | 1 | 1.5 | 1.5 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | $\beta_{ed1}$:47/15<br>$\beta_{ed2}$:47/15 | 4 | 2 | 1.5 | 1.5 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 4/15 | 56/75 | 4 | 1 | 1.5 | 1.5 | 17 | 71 |
| 5 | 15/15 | 15/15 | 64 | 15/15 | 24/15 | 30/15 | 134/15 | 4 | 1 | 1.5 | 1.5 | 21 | 81 |

**Rel.8 DC-HSDPA (Cat 24)**

SAR test exclusion for Rel.8 DC-HSDPA must satisfy the SAR test exclusion requirements of Rel.5 HSDPA. SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion.

©Copyright. All rights reserved by CTTL.

## 9.4 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Rohde & Rchwarz CMW500. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the CMW 500.
It is performed for conducted power and SAR based on the KDB941225 D05.
SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories and other use conditions. The procedures in the following subsections are applied separately to test each LTE frequency band.

1) QPSK with 1 RB allocation
   Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.
2) QPSK with 50% RB allocation
   The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.
3) QPSK with 100% RB allocation
   For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

## TDD test:

TDD testing is performed using guidance from FCC KDB 941225 D05 and the SAR test guidance provided in April 2013 TCB works hop notes. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211.

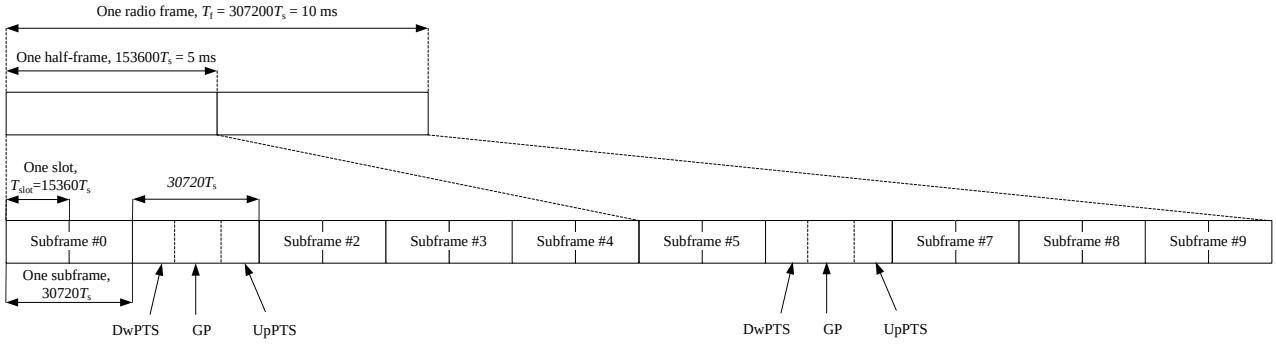



**Figure 9.2: Frame structure type 2 (for 5 ms switch-point periodicity)**

©Copyright. All rights reserved by CTTL.

**Table 9.1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)**

| Special subframe configuration | Normal cyclic prefix in downlink | | | Extended cyclic prefix in downlink | | |
|---|---|---|---|---|---|---|
| | DwPTS | UpPTS | | DwPTS | UpPTS | |
| | | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink | | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink |
| 0 | $6592 \cdot T_s$ | $2192 \cdot T_s$ | $2560 \cdot T_s$ | $7680 \cdot T_s$ | $2192 \cdot T_s$ | $2560 \cdot T_s$ |
| 1 | $19760 \cdot T_s$ | | | $20480 \cdot T_s$ | | |
| 2 | $21952 \cdot T_s$ | | | $23040 \cdot T_s$ | | |
| 3 | $24144 \cdot T_s$ | | | $25600 \cdot T_s$ | | |
| 4 | $26336 \cdot T_s$ | | | $7680 \cdot T_s$ | $4384 \cdot T_s$ | $5120 \cdot T_s$ |
| 5 | $6592 \cdot T_s$ | $4384 \cdot T_s$ | $5120 \cdot T_s$ | $20480 \cdot T_s$ | | |
| 6 | $19760 \cdot T_s$ | | | $23040 \cdot T_s$ | | |
| 7 | $21952 \cdot T_s$ | | | $12800 \cdot T_s$ | | |
| 8 | $24144 \cdot T_s$ | | | - | - | - |
| 9 | $13168 \cdot T_s$ | | | - | - | - |

**Table 9.2: Uplink-downlink configurations**

| Uplink-downlink configuration | Downlink-to-Uplink Switch-point periodicity | Subframe number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | 5 ms | D | S | U | U | U | D | S | U | U | U |
| 1 | 5 ms | D | S | U | U | D | D | S | U | U | D |
| 2 | 5 ms | D | S | U | D | D | D | S | U | D | D |
| 3 | 10 ms | D | S | U | U | U | D | D | D | D | D |
| 4 | 10 ms | D | S | U | U | D | D | D | D | D | D |
| 5 | 10 ms | D | S | U | D | D | D | D | D | D | D |
| 6 | 5 ms | D | S | U | U | U | D | S | U | U | D |

Duty factor is calculated by:

Duty factor = uplink frame*6+UpPTS*2/one frame length

= (30720.$T_s$ * 6+5120. $T_s$*2)/307200.$T_s$

= 0.633

©Copyright. All rights reserved by CTTL.

## 9.5 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. 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 that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a 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. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

## 9.6 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in section14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

©Copyright. All rights reserved by CTTL.

# 10 Area Scan Based 1-g SAR

## 10.1 Requirement of KDB

According to the KDB447498 D01, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-gSAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR (See Annex B). When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

## 10.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empirically determined by analyzing a large number of phones. The MOTOROLA FAST SAR was developed and validated by the MOTOROLA Research Group in Ft. Lauderdale.

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz)and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm mare 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. The paper describing the algorithm in detail is expected to be published in August 2004 within the Special Issue of Transactions on MTT.

In the second step, the same research group optimized the fitting algorithm to an Polynomial fit whereby the frequency validity was extended to cover the range 30-6000MHz. Details of this study can be found in the BEMS 2007 Proceedings.

Both algorithms are implemented in DASY software.

©Copyright. All rights reserved by CTTL.

# 11 Conducted Output Power

| Antenna | Receiver on (head scenario) | Receiver off (body scenario) |
|---|---|---|
| Main Antenna | Power Level A1 | Power Level B1 |

For WWAN, when the phone receiver is off, the power reduction (Power level B1) will be implemented immediately at GSM1900, WCDMA B2 and LTE B7/B41 and normal power (Power Level A1) is applied for other bands. If receiver is on, normal Power (Power Level A1) is applied for all bands.

## 11.1 GSM Measurement result

**Table 11.1-1: The conducted power measurement results–GSM850 (Power Level A1/B1)**

| GSM 850 Speech (GMSK) | Measured timeslot-averaged output power (dBm) | | | Tune up | calculation | Source-based time-averaged output power (dBm) | | |
|---|---|---|---|---|---|---|---|---|
| | 251 | 190 | 128 | | | 251 | 190 | 128 |
| 1 Txslot | 32.24 | 32.10 | 31.90 | 32.50 | / | / | / | / |
| GSM 850 GPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 251 | 190 | 128 | | | 251 | 190 | 128 |
| 1 Txslot | 32.45 | 31.62 | 31.38 | 32.50 | -9.03 | 23.42 | 22.59 | 22.35 |
| **2 Txslots** | 30.97 | 30.71 | 30.48 | 31.50 | -6.02 | 24.95 | 24.69 | 24.46 |
| 3 Txslots | 28.94 | 28.65 | 28.43 | 29.00 | -4.26 | 24.68 | 24.39 | 24.17 |
| 4 Txslots | 27.39 | 27.17 | 26.98 | 28.00 | -3.01 | 24.38 | 24.16 | 23.97 |
| GSM 850 EGPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 251 | 190 | 128 | | | 251 | 190 | 128 |
| 1 Txslot | 32.22 | 32.01 | 31.42 | 32.50 | -9.03 | 23.19 | 22.98 | 22.39 |
| **2 Txslots** | 30.70 | 30.51 | 30.31 | 31.50 | -6.02 | 24.68 | 24.49 | 24.29 |
| 3 Txslots | 28.83 | 28.65 | 28.47 | 29.00 | -4.26 | 24.57 | 24.39 | 24.21 |
| 4 Txslots | 27.24 | 27.11 | 26.96 | 28.00 | -3.01 | 24.23 | 24.10 | 23.95 |
| GSM 850 EGPRS (8PSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 251 | 190 | 128 | | | 251 | 190 | 128 |
| 1 Txslot | 27.22 | 27.47 | 27.48 | 27.50 | -9.03 | 18.19 | 18.44 | 18.45 |
| 2 Txslots | 24.56 | 24.55 | 24.64 | 26.50 | -6.02 | 18.54 | 18.53 | 18.62 |
| 3Txslots | 22.52 | 22.53 | 22.81 | 24.50 | -4.26 | 18.26 | 18.27 | 18.55 |
| 4 Txslots | 21.51 | 21.52 | 21.56 | 23.50 | -3.01 | 18.50 | 18.51 | 18.55 |

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

©Copyright. All rights reserved by CTTL.

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

**According to the conducted power as above, the body measurements are performed with 2Txslots for GSM850.**

**Table 11.1-2: The conducted power measurement results-GSM1900 (Power Level A1)**

| PCS1900 Speech (GMSK) | Measured timeslot-averaged output power (dBm) | | | Tune up | calculation | Source-based time-averaged output power (dBm) | | |
|---|---|---|---|---|---|---|---|---|
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 29.42 | 29.72 | 29.95 | 30.50 | / | / | / | / |
| PCS1900 GPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 29.47 | 29.75 | 29.99 | 30.50 | -9.03 | 20.44 | 20.72 | 20.96 |
| **2 Txslots** | 28.53 | 28.87 | 28.95 | 29.00 | -6.02 | 22.51 | 22.85 | 22.93 |
| 3 Txslots | 26.26 | 26.65 | 26.81 | 27.00 | -4.26 | 22.00 | 22.39 | 22.55 |
| 4 Txslots | 25.06 | 25.43 | 25.56 | 26.00 | -3.01 | 22.05 | 22.42 | 22.55 |
| PCS1900 EGPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 29.48 | 29.67 | 29.93 | 30.50 | -9.03 | 20.45 | 20.64 | 20.90 |
| **2 Txslots** | 28.43 | 28.78 | 28.95 | 29.00 | -6.02 | 22.41 | 22.76 | 22.93 |
| 3 Txslots | 26.16 | 26.55 | 26.72 | 27.00 | -4.26 | 21.90 | 22.29 | 22.46 |
| 4 Txslots | 24.96 | 25.34 | 25.48 | 26.00 | -3.01 | 21.95 | 22.33 | 22.47 |
| PCS1900 EGPRS (8PSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 25.18 | 25.14 | 25.54 | 26.50 | -9.03 | 16.15 | 16.11 | 16.51 |
| 2 Txslots | 24.59 | 24.31 | 24.63 | 25.50 | -6.02 | 18.57 | 18.29 | 18.61 |
| 3Txslots | 22.40 | 22.21 | 22.59 | 24.50 | -4.26 | 18.14 | 17.95 | 18.33 |
| 4 Txslots | 21.24 | 21.03 | 21.33 | 22.00 | -3.01 | 18.23 | 18.02 | 18.32 |

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

**According to the conducted power as above, the body measurements are performed with 2Txslots for GSM1900.**

©Copyright. All rights reserved by CTTL.

**Table 11.1-3: The conducted power measurement results-GSM1900 (Power Level B1)**

| PCS1900 GPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
|---|---|---|---|---|---|---|---|---|
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 27.36 | 27.70 | 27.93 | 28.50 | -9.03 | 18.33 | 18.67 | 18.90 |
| **2 Txslots** | 24.66 | 24.92 | 24.95 | 25.50 | -6.02 | 18.41 | 18.81 | 19.00 |
| 3 Txslots | 22.66 | 23.06 | 23.14 | 23.50 | -4.26 | 18.40 | 18.80 | 18.95 |
| 4 Txslots | 21.39 | 21.80 | 21.92 | 22.50 | -3.01 | 18.38 | 18.79 | 18.91 |
| PCS1900 EGPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 27.26 | 27.61 | 27.83 | 27.26 | -9.03 | 18.23 | 18.58 | 18.80 |
| **2 Txslots** | 24.53 | 24.78 | 24.91 | 24.53 | -6.02 | 18.31 | 18.73 | 18.89 |
| 3 Txslots | 22.55 | 22.98 | 23.10 | 22.55 | -4.26 | 18.29 | 18.72 | 18.84 |
| 4 Txslots | 21.28 | 21.71 | 21.81 | 21.28 | -3.01 | 18.27 | 18.70 | 18.80 |
| PCS1900 EGPRS (8PSK) | Measured timeslot-averaged output power (dBm) | | | | calculation | Source-based time-averaged output power (dBm) | | |
| | 810 | 661 | 512 | | | 810 | 661 | 512 |
| 1 Txslot | 23.29 | 23.85 | 23.56 | 24.00 | -9.03 | 14.26 | 14.82 | 14.53 |
| 2 Txslots | 20.31 | 20.88 | 20.57 | 21.50 | -6.02 | 14.29 | 14.86 | 14.55 |
| 3Txslots | 19.10 | 18.37 | 18.80 | 19.50 | -4.26 | 14.84 | 14.11 | 14.54 |
| 4 Txslots | 17.86 | 17.08 | 17.49 | 18.00 | -3.01 | 14.85 | 14.07 | 14.48 |

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

**According to the conducted power as above, the body measurements are performed with 2Txslots for GSM1900.**

©Copyright. All rights reserved by CTTL.

## 11.2 WCDMA Measurement result

**Table 11.2-1: The conducted Power for WCDMA B5 (Power Level A1/B1)**

| WCDMA850 | FDDV result (dBm) | | | Tune up |
|---|---|---|---|---|
| | 4233/4458 | 4183/4408 | 4132/4357 | |
| | (846.6MHz) | (836.6MHz) | (826.4MHz) | |
| | 22.87 | 22.98 | 22.92 | 23.5 |
| HSUPA | 18.98 | 18.99 | 19.01 | 20.5 |
| | 18.97 | 18.97 | 19.02 | 20 |
| | 19.97 | 20.01 | 19.99 | 21 |
| | 18.47 | 18.55 | 18.49 | 20 |
| | 19.94 | 19.99 | 20.01 | 20.5 |
| HSPA+ | 20.36 | 20.52 | 20.48 | 22 |
| DC-HSDPA | 20.97 | 20.98 | 20.96 | 21 |
| | 20.91 | 20.96 | 20.97 | 21 |
| | 20.44 | 20.45 | 20.47 | 20.5 |
| | 20.41 | 20.42 | 20.45 | 20.5 |

**Table 11.2-2: The conducted Power for WCDMA B2 (Power Level A1)**

| WCDMA1900 | FDDII result (dBm) | | | Tune up |
|---|---|---|---|---|
| | 9538/9938 | 9400/9800 | 9262/9662 | |
| | (1907.6MHz) | (1880MHz) | (1852.4MHz) | |
| | 23.12 | 23.05 | 23.19 | 23.5 |
| HSUPA | 20.42 | 20.30 | 20.29 | 20.5 |
| | 20.41 | 20.24 | 20.27 | 20.5 |
| | 20.98 | 20.97 | 20.97 | 21 |
| | 19.92 | 19.77 | 19.76 | 20 |
| | 21.35 | 21.25 | 21.23 | 21.5 |
| HSPA+ | 21.84 | 21.71 | 21.94 | 22 |
| DC-HSDPA | 22.44 | 22.27 | 22.31 | 22.5 |
| | 22.36 | 22.21 | 22.24 | 22.5 |
| | 21.89 | 21.73 | 21.74 | 22 |
| | 21.87 | 21.72 | 21.75 | 22 |

©Copyright. All rights reserved by CTTL.

**Table 11.2-3: The conducted Power for WCDMA B2 (Power Level B1)**

| WCDMA1900 | FDDII result (dBm) | | | Tune up |
|---|---|---|---|---|
| | 9538/9938 | 9400/9800 | 9262/9662 | |
| | (1907.6MHz) | (1880MHz) | (1852.4MHz) | |
| | 22.06 | 22.02 | 22.22 | 22.5 |
| HSUPA | 19.36 | 19.22 | 19.23 | 20.5 |
| | 19.43 | 19.29 | 19.30 | 20 |
| | 20.42 | 20.31 | 20.32 | 21 |
| | 19.07 | 18.91 | 18.94 | 19.5 |
| | 20.54 | 20.45 | 20.42 | 21 |
| HSPA+ | 20.72 | 20.63 | 20.76 | 21.5 |
| DC-HSDPA | 21.47 | 21.37 | 21.39 | 21.5 |
| | 20.52 | 20.49 | 20.54 | 21 |
| | 20.09 | 19.92 | 19.94 | 20.5 |
| | 20.11 | 19.95 | 19.97 | 21 |

©Copyright. All rights reserved by CTTL.

## 11.3 LTE Measurement result

### Maximum Target Power for Production Unit

| Band | Tune up | |
|---|---|---|
| | Receiver on (head scenario) | Receiver off (body scenario) |
| | Power Level A1 | Power Level B1 |
| LTE Band 5 | 24.5 | 24.5 |
| LTE Band 7 | 24.5 | 22.5 |
| LTE Band 13 | 24.5 | 24.5 |
| LTE Band 41 | 24 | 23 |

### Maximum Power Reduction (MPR) for LTE

| Modulation | Channel bandwidth / Transmission bandwidth configuration [RB] | | | | | | MPR (dB) |
|---|---|---|---|---|---|---|---|
| | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | |
| QPSK | > 5 | > 4 | > 8 | > 12 | > 16 | > 18 | 1 |
| 16 QAM | ≤ 5 | ≤ 4 | ≤ 8 | ≤ 12 | ≤ 16 | ≤ 18 | 1 |
| 16 QAM | > 5 | > 4 | > 8 | > 12 | > 16 | > 18 | 2 |
| 64 QAM | ≤ 5 | ≤ 4 | ≤ 8 | ≤ 12 | ≤ 16 | ≤ 18 | 3 |
| 64 QAM | > 5 | > 4 | > 8 | > 12 | > 16 | > 18 | 3 |

### LTE Band5 (Power Level A1/B1)

| LTE Band5 | | | | | |
|---|---|---|---|---|---|
| **BANDWIDTH** | **Number of RBs** | **Frequency** | **QPSK** | **16QAM** | **64QAM** |
| 1.4MHz | 1RB-High (5) | 848.3 (20643) | 23.13 | 22.28 | 21.25 |
| | | 836.5 (20525) | 23.09 | 22.35 | 21.25 |
| | | 824.7 (20407) | 23.10 | 22.34 | 21.29 |
| | 1RB-Middle (3) | 848.3 (20643) | 23.22 | 22.40 | 21.28 |
| | | 836.5 (20525) | 23.20 | 22.40 | 21.41 |
| | | 824.7 (20407) | 23.22 | 22.39 | 21.38 |
| | 1RB-Low (0) | 848.3 (20643) | 23.11 | 22.28 | 21.22 |
| | | 836.5 (20525) | 23.09 | 22.28 | 21.26 |
| | | 824.7 (20407) | 23.15 | 22.43 | 21.32 |
| | 3RB-High (3) | 848.3 (20643) | 23.22 | 22.14 | 21.25 |
| | | 836.5 (20525) | 23.18 | 22.17 | 21.25 |
| | | 824.7 (20407) | 23.19 | 22.24 | 21.33 |
| | 3RB-Middle (1) | 848.3 (20643) | 23.29 | 22.21 | 21.28 |
| | | 836.5 (20525) | 23.23 | 22.22 | 21.38 |
| | | 824.7 (20407) | 23.26 | 22.30 | 21.35 |
| | 3RB-Low (0) | 848.3 (20643) | 23.22 | 22.06 | 21.24 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 836.5 (20525) | 23.18 | 22.17 | 21.28 |
| | | 824.7 (20407) | 23.24 | 22.20 | 21.32 |
| | 6RB (0) | 848.3 (20643) | 22.32 | 21.31 | 20.23 |
| | | 836.5 (20525) | 22.25 | 21.31 | 20.21 |
| | | 824.7 (20407) | 22.25 | 21.32 | 20.25 |
| 3MHz | 1RB-High (14) | 847.5 (20635) | 23.21 | 22.36 | 21.36 |
| | | 836.5 (20525) | 23.19 | 22.44 | 21.28 |
| | | 825.5 (20415) | 23.15 | 22.39 | 21.37 |
| | 1RB-Middle (7) | 847.5 (20635) | 23.37 | 22.53 | 21.48 |
| | | 836.5 (20525) | 23.38 | 22.57 | 21.48 |
| | | 825.5 (20415) | 23.27 | 22.44 | 21.47 |
| | 1RB-Low (0) | 847.5 (20635) | 23.17 | 22.33 | 21.27 |
| | | 836.5 (20525) | 23.18 | 22.42 | 21.30 |
| | | 825.5 (20415) | 23.22 | 22.52 | 21.34 |
| | 8RB-High (7) | 847.5 (20635) | 22.23 | 21.23 | 20.22 |
| | | 836.5 (20525) | 22.27 | 21.29 | 20.25 |
| | | 825.5 (20415) | 22.23 | 21.26 | 20.25 |
| | 8RB-Middle (4) | 847.5 (20635) | 22.29 | 21.29 | 20.27 |
| | | 836.5 (20525) | 22.31 | 21.35 | 20.32 |
| | | 825.5 (20415) | 22.30 | 21.35 | 20.31 |
| | 8RB-Low (0) | 847.5 (20635) | 22.25 | 21.26 | 20.23 |
| | | 836.5 (20525) | 22.28 | 21.32 | 20.26 |
| | | 825.5 (20415) | 22.27 | 21.34 | 20.29 |
| | 15RB (0) | 847.5 (20635) | 22.28 | 21.22 | 20.22 |
| | | 836.5 (20525) | 22.29 | 21.29 | 20.24 |
| | | 825.5 (20415) | 22.25 | 21.24 | 20.23 |
| 5MHz | 1RB-High (24) | 846.5 (20625) | 23.09 | 22.29 | 21.23 |
| | | 836.5 (20525) | 23.09 | 22.41 | 21.32 |
| | | 826.5 (20425) | 23.09 | 22.39 | 21.28 |
| | 1RB-Middle (12) | 846.5 (20625) | 23.30 | 22.62 | 21.44 |
| | | 836.5 (20525) | 23.41 | 22.58 | 21.39 |
| | | 826.5 (20425) | 23.35 | 22.59 | 21.57 |
| | 1RB-Low (0) | 846.5 (20625) | 23.08 | 22.37 | 21.20 |
| | | 836.5 (20525) | 23.07 | 22.33 | 21.28 |
| | | 826.5 (20425) | 23.12 | 22.37 | 21.35 |
| | 12RB-High (13) | 846.5 (20625) | 22.23 | 21.18 | 20.21 |
| | | 836.5 (20525) | 22.25 | 21.19 | 20.24 |
| | | 826.5 (20425) | 22.38 | 21.33 | 20.34 |
| | 12RB-Middle (6) | 846.5 (20625) | 22.31 | 21.24 | 20.27 |
| | | 836.5 (20525) | 22.31 | 21.27 | 20.31 |
| | | 826.5 (20425) | 22.32 | 21.28 | 20.33 |
| | 12RB-Low (0) | 846.5 (20625) | 22.23 | 21.18 | 20.21 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 836.5 (20525) | 22.28 | 21.28 | 20.28 |
| | | 826.5 (20425) | 22.28 | 21.19 | 20.24 |
| | 25RB (0) | 846.5 (20625) | 22.28 | 21.21 | 20.23 |
| | | 836.5 (20525) | 22.30 | 21.29 | 20.28 |
| | | 826.5 (20425) | 22.36 | 21.34 | 20.31 |
| 10MHz | 1RB-High (49) | 844 (20600) | 23.71 | 22.40 | 21.27 |
| | | 836.5 (20525) | 23.19 | 22.45 | 21.36 |
| | | 829 (20450) | 23.17 | 22.32 | 21.35 |
| | 1RB-Middle (24) | 844 (20600) | 23.87 | 22.61 | 21.42 |
| | | 836.5 (20525) | 23.56 | 22.57 | 21.45 |
| | | 829 (20450) | 23.59 | 22.56 | 21.50 |
| | 1RB-Low (0) | 844 (20600) | 23.65 | 22.50 | 21.37 |
| | | 836.5 (20525) | 23.23 | 22.43 | 21.39 |
| | | 829 (20450) | 23.23 | 22.53 | 21.43 |
| | 25RB-High (25) | 844 (20600) | 22.69 | 21.30 | 20.29 |
| | | 836.5 (20525) | 22.33 | 21.27 | 20.29 |
| | | 829 (20450) | 22.39 | 21.32 | 20.30 |
| | 25RB-Middle (12) | 844 (20600) | 22.52 | 21.31 | 20.30 |
| | | 836.5 (20525) | 22.34 | 21.31 | 20.30 |
| | | 829 (20450) | 22.35 | 21.31 | 20.31 |
| | 25RB-Low (0) | 844 (20600) | 22.43 | 21.37 | 20.36 |
| | | 836.5 (20525) | 22.39 | 21.36 | 20.36 |
| | | 829 (20450) | 22.36 | 21.31 | 20.33 |
| | 50RB (0) | 844 (20600) | 22.40 | 21.33 | 20.34 |
| | | 836.5 (20525) | 22.37 | 21.34 | 20.31 |
| | | 829 (20450) | 22.39 | 21.34 | 20.33 |

**LTE Band7 (Power Level A1)**

| LTE Band7 | | | | | |
|---|---|---|---|---|---|
| **BANDWIDTH** | **Number of RBs** | **Frequency** | **QPSK** | **16QAM** | **64QAM** |
| 5MHz | 1RB-High (24) | 2567.5 (21425) | 23.23 | 21.93 | 21.27 |
| | | 2535 (21100) | 23.21 | 22.45 | 21.45 |
| | | 2502.5 (20775) | 22.67 | 21.92 | 20.94 |
| | 1RB-Middle (12) | 2567.5 (21425) | 23.48 | 22.21 | 21.47 |
| | | 2535 (21100) | 23.36 | 22.45 | 21.48 |
| | | 2502.5 (20775) | 22.55 | 22.17 | 21.05 |
| | 1RB-Low (0) | 2567.5 (21425) | 23.25 | 22.05 | 21.05 |
| | | 2535 (21100) | 22.98 | 22.23 | 21.42 |
| | | 2502.5 (20775) | 22.78 | 21.92 | 20.92 |
| | 12RB-High (13) | 2567.5 (21425) | 22.41 | 20.92 | 20.55 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2535 (21100) | 22.24 | 21.45 | 20.51 |
| | | 2502.5 (20775) | 21.69 | 20.87 | 20.62 |
| | 12RB-Middle (6) | 2567.5 (21425) | 22.49 | 21.00 | 20.51 |
| | | 2535 (21100) | 22.33 | 21.38 | 20.57 |
| | | 2502.5 (20775) | 21.84 | 20.97 | 20.52 |
| | 12RB-Low (0) | 2567.5 (21425) | 22.39 | 20.94 | 20.67 |
| | | 2535 (21100) | 22.03 | 21.33 | 20.57 |
| | | 2502.5 (20775) | 21.72 | 20.89 | 20.55 |
| | 25RB (0) | 2567.5 (21425) | 22.21 | 20.94 | 20.52 |
| | | 2535 (21100) | 22.40 | 21.35 | 20.52 |
| | | 2502.5 (20775) | 21.74 | 20.88 | 20.59 |
| 10MHz | 1RB-High (49) | 2565 (21400) | 23.37 | 22.02 | 21.50 |
| | | 2535 (21100) | 23.34 | 22.49 | 21.43 |
| | | 2505 (20800) | 22.79 | 22.14 | 21.09 |
| | 1RB-Middle (24) | 2565 (21400) | 23.46 | 22.21 | 21.46 |
| | | 2535 (21100) | 23.37 | 22.43 | 21.47 |
| | | 2505 (20800) | 22.76 | 22.18 | 21.13 |
| | 1RB-Low (0) | 2565 (21400) | 23.40 | 22.22 | 21.29 |
| | | 2535 (21100) | 23.15 | 22.40 | 21.46 |
| | | 2505 (20800) | 22.52 | 22.02 | 21.00 |
| | 25RB-High (25) | 2565 (21400) | 22.47 | 21.03 | 20.61 |
| | | 2535 (21100) | 22.47 | 21.44 | 20.57 |
| | | 2505 (20800) | 21.85 | 21.01 | 20.52 |
| | 25RB-Middle (12) | 2565 (21400) | 22.43 | 21.06 | 20.54 |
| | | 2535 (21100) | 22.42 | 21.45 | 20.53 |
| | | 2505 (20800) | 21.94 | 20.99 | 20.53 |
| | 25RB-Low (0) | 2565 (21400) | 22.48 | 21.02 | 20.53 |
| | | 2535 (21100) | 22.31 | 21.47 | 20.51 |
| | | 2505 (20800) | 21.89 | 20.94 | 20.54 |
| | 50RB (0) | 2565 (21400) | 22.39 | 21.04 | 20.55 |
| | | 2535 (21100) | 22.47 | 21.43 | 20.54 |
| | | 2505 (20800) | 21.96 | 20.98 | 20.51 |
| 15MHz | 1RB-High (74) | 2562.5 (21375) | 23.21 | 22.34 | 21.44 |
| | | 2535 (21100) | 23.20 | 22.46 | 21.50 |
| | | 2507.5 (20825) | 22.80 | 22.16 | 21.16 |
| | 1RB-Middle (37) | 2562.5 (21375) | 23.35 | 22.46 | 21.43 |
| | | 2535 (21100) | 23.26 | 22.46 | 21.46 |
| | | 2507.5 (20825) | 22.76 | 22.11 | 21.03 |
| | 1RB-Low (0) | 2562.5 (21375) | 23.29 | 22.40 | 21.49 |
| | | 2535 (21100) | 23.10 | 22.48 | 21.42 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2507.5 (20825) | 22.57 | 21.91 | 20.89 |
| | 36RB-High (38) | 2562.5 (21375) | 22.42 | 21.49 | 20.60 |
| | | 2535 (21100) | 22.44 | 21.48 | 20.53 |
| | | 2507.5 (20825) | 22.00 | 21.03 | 20.57 |
| | 36RB-Middle (19) | 2562.5 (21375) | 22.47 | 21.45 | 20.59 |
| | | 2535 (21100) | 22.44 | 21.47 | 20.52 |
| | | 2507.5 (20825) | 21.91 | 20.94 | 20.51 |
| | 36RB-Low (0) | 2562.5 (21375) | 22.47 | 21.45 | 20.55 |
| | | 2535 (21100) | 22.36 | 21.41 | 20.52 |
| | | 2507.5 (20825) | 21.86 | 20.89 | 20.53 |
| | 75RB (0) | 2562.5 (21375) | 22.49 | 21.47 | 20.55 |
| | | 2535 (21100) | 22.40 | 21.46 | 20.53 |
| | | 2507.5 (20825) | 21.89 | 20.95 | 20.59 |
| 20MHz | 1RB-High (99) | 2560 (21350) | 23.10 | 22.36 | 21.33 |
| | | 2535 (21100) | 22.93 | 22.35 | 21.23 |
| | | 2510 (20850) | 22.96 | 22.25 | 21.32 |
| | 1RB-Middle (50) | 2560 (21350) | 23.45 | 22.44 | 21.47 |
| | | 2535 (21100) | 23.32 | 22.46 | 21.49 |
| | | 2510 (20850) | 23.34 | 22.46 | 21.49 |
| | 1RB-Low (0) | 2560 (21350) | 23.08 | 22.34 | 21.32 |
| | | 2535 (21100) | 23.00 | 22.37 | 21.33 |
| | | 2510 (20850) | 23.04 | 22.40 | 21.34 |
| | 50RB-High (50) | 2560 (21350) | 22.47 | 21.46 | 20.48 |
| | | 2535 (21100) | 22.22 | 21.26 | 20.30 |
| | | 2510 (20850) | 22.31 | 21.33 | 20.37 |
| | 50RB-Middle (25) | 2560 (21350) | 22.48 | 21.45 | 20.46 |
| | | 2535 (21100) | 22.33 | 21.39 | 20.41 |
| | | 2510 (20850) | 22.39 | 21.41 | 20.47 |
| | 50RB-Low (0) | 2560 (21350) | 22.40 | 21.45 | 20.48 |
| | | 2535 (21100) | 22.29 | 21.36 | 20.35 |
| | | 2510 (20850) | 22.47 | 21.50 | 20.44 |
| | 100RB (0) | 2560 (21350) | 22.45 | 21.49 | 20.45 |
| | | 2535 (21100) | 22.27 | 21.29 | 20.32 |
| | | 2510 (20850) | 22.36 | 21.40 | 20.42 |

©Copyright. All rights reserved by CTTL.

**LTE Band7 (Power Level B1)**

| LTE Band7 | | | | | |
|---|---|---|---|---|---|
| **BANDWIDTH** | **Number of RBs** | **Frequency** | **QPSK** | **16QAM** | **64QAM** |
| 5MHz | 1RB-High (24) | 2567.5 (21425) | 21.43 | 21.58 | 20.58 |
| | | 2535 (21100) | 21.22 | 21.45 | 20.46 |
| | | 2502.5 (20775) | 21.29 | 21.40 | 20.60 |
| | 1RB-Middle (12) | 2567.5 (21425) | 21.62 | 21.78 | 20.86 |
| | | 2535 (21100) | 21.48 | 21.72 | 20.67 |
| | | 2502.5 (20775) | 21.24 | 21.46 | 20.89 |
| | 1RB-Low (0) | 2567.5 (21425) | 21.44 | 21.73 | 20.59 |
| | | 2535 (21100) | 21.24 | 21.53 | 20.46 |
| | | 2502.5 (20775) | 21.14 | 21.15 | 20.56 |
| | 12RB-High (13) | 2567.5 (21425) | 21.56 | 20.56 | 19.66 |
| | | 2535 (21100) | 21.35 | 20.39 | 19.48 |
| | | 2502.5 (20775) | 21.09 | 20.24 | 19.57 |
| | 12RB-Middle (6) | 2567.5 (21425) | 21.63 | 20.62 | 19.72 |
| | | 2535 (21100) | 21.41 | 20.45 | 19.53 |
| | | 2502.5 (20775) | 21.23 | 20.37 | 19.63 |
| | 12RB-Low (0) | 2567.5 (21425) | 21.58 | 20.59 | 19.65 |
| | | 2535 (21100) | 21.37 | 20.44 | 19.45 |
| | | 2502.5 (20775) | 21.12 | 20.45 | 19.61 |
| | 25RB (0) | 2567.5 (21425) | 21.60 | 20.61 | 19.63 |
| | | 2535 (21100) | 21.36 | 20.42 | 19.46 |
| | | 2502.5 (20775) | 21.22 | 20.43 | 19.55 |
| 10MHz | 1RB-High (49) | 2565 (21400) | 21.53 | 21.76 | 20.61 |
| | | 2535 (21100) | 21.30 | 21.68 | 20.54 |
| | | 2505 (20800) | 21.03 | 21.22 | 20.64 |
| | 1RB-Middle (24) | 2565 (21400) | 21.64 | 21.80 | 20.83 |
| | | 2535 (21100) | 21.41 | 21.76 | 20.69 |
| | | 2505 (20800) | 21.25 | 21.34 | 20.83 |
| | 1RB-Low (0) | 2565 (21400) | 21.47 | 21.76 | 20.68 |
| | | 2535 (21100) | 21.37 | 21.66 | 20.62 |
| | | 2505 (20800) | 21.08 | 21.21 | 20.74 |
| | 25RB-High (25) | 2565 (21400) | 21.66 | 20.67 | 19.74 |
| | | 2535 (21100) | 21.35 | 20.42 | 19.45 |
| | | 2505 (20800) | 21.28 | 20.10 | 19.57 |
| | 25RB-Middle (12) | 2565 (21400) | 21.62 | 20.61 | 19.67 |
| | | 2535 (21100) | 21.38 | 20.46 | 19.51 |
| | | 2505 (20800) | 21.07 | 20.12 | 19.63 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | 25RB-Low (0) | 2565 (21400) | 21.61 | 20.60 | 19.65 |
| | | 2535 (21100) | 21.42 | 20.47 | 19.52 |
| | | 2505 (20800) | 21.13 | 20.33 | 19.60 |
| | 50RB (0) | 2565 (21400) | 21.62 | 20.61 | 19.68 |
| | | 2535 (21100) | 21.41 | 20.43 | 19.47 |
| | | 2505 (20800) | 21.10 | 20.31 | 19.59 |
| 15MHz | 1RB-High (74) | 2562.5 (21375) | 21.46 | 21.57 | 20.62 |
| | | 2535 (21100) | 21.23 | 21.46 | 20.51 |
| | | 2507.5 (20825) | 21.28 | 21.64 | 20.55 |
| | 1RB-Middle (37) | 2562.5 (21375) | 21.56 | 21.85 | 20.78 |
| | | 2535 (21100) | 21.37 | 21.69 | 20.56 |
| | | 2507.5 (20825) | 21.43 | 21.74 | 20.64 |
| | 1RB-Low (0) | 2562.5 (21375) | 21.43 | 21.78 | 20.66 |
| | | 2535 (21100) | 21.28 | 21.52 | 20.55 |
| | | 2507.5 (20825) | 21.30 | 21.46 | 20.65 |
| | 36RB-High (38) | 2562.5 (21375) | 21.64 | 20.64 | 19.69 |
| | | 2535 (21100) | 21.43 | 20.39 | 19.46 |
| | | 2507.5 (20825) | 21.48 | 20.43 | 19.50 |
| | 36RB-Middle (19) | 2562.5 (21375) | 21.63 | 20.57 | 19.65 |
| | | 2535 (21100) | 21.43 | 20.43 | 19.50 |
| | | 2507.5 (20825) | 21.40 | 20.51 | 19.55 |
| | 36RB-Low (0) | 2562.5 (21375) | 21.60 | 20.60 | 19.62 |
| | | 2535 (21100) | 21.44 | 20.43 | 19.48 |
| | | 2507.5 (20825) | 21.44 | 20.50 | 19.58 |
| | 75RB (0) | 2562.5 (21375) | 21.62 | 20.60 | 19.63 |
| | | 2535 (21100) | 21.41 | 20.43 | 19.47 |
| | | 2507.5 (20825) | 21.41 | 20.51 | 19.54 |
| 20MHz | 1RB-High (99) | 2560 (21350) | 21.31 | 21.50 | 20.50 |
| | | 2535 (21100) | 21.13 | 21.41 | 20.35 |
| | | 2510 (20850) | 21.09 | 21.40 | 20.35 |
| | 1RB-Middle (50) | 2560 (21350) | 21.64 | 21.87 | 20.86 |
| | | 2535 (21100) | 21.63 | 21.79 | 20.67 |
| | | 2510 (20850) | 21.56 | 21.80 | 20.71 |
| | 1RB-Low (0) | 2560 (21350) | 21.26 | 21.57 | 20.53 |
| | | 2535 (21100) | 21.15 | 21.43 | 20.32 |
| | | 2510 (20850) | 21.28 | 21.50 | 20.41 |
| | 50RB-High (50) | 2560 (21350) | 21.64 | 20.64 | 19.70 |
| | | 2535 (21100) | 21.37 | 20.39 | 19.43 |
| | | 2510 (20850) | 21.42 | 20.46 | 19.48 |
| | 50RB-Middle (25) | 2560 (21350) | 21.66 | 20.66 | 19.66 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2535 (21100) | 21.63 | 20.49 | 19.51 |
| | | 2510 (20850) | 21.58 | 20.50 | 19.54 |
| | 50RB-Low (0) | 2560 (21350) | 21.58 | 20.60 | 19.61 |
| | | 2535 (21100) | 21.45 | 20.49 | 19.48 |
| | | 2510 (20850) | 21.54 | 20.55 | 19.60 |
| | 100RB (0) | 2560 (21350) | 21.57 | 20.59 | 19.64 |
| | | 2535 (21100) | 21.39 | 20.42 | 19.44 |
| | | 2510 (20850) | 21.46 | 20.47 | 19.49 |

**LTE Band13 (Power Level A1/B1)**

| LTE Band13 | | | | | |
|---|---|---|---|---|---|
| **BANDWIDTH** | **Number of RBs** | **Frequency** | **QPSK** | **16QAM** | **64QAM** |
| 5MHz | 1RB-High (24) | 784.5 (23255) | 22.90 | 22.08 | 21.03 |
| | | 782 (23230) | 22.83 | 22.06 | 21.01 |
| | | 779.5 (23205) | 22.91 | 22.09 | 21.04 |
| | 1RB-Middle (12) | 784.5 (23255) | 23.10 | 22.23 | 21.30 |
| | | 782 (23230) | 23.22 | 22.34 | 21.47 |
| | | 779.5 (23205) | 23.14 | 22.35 | 21.35 |
| | 1RB-Low (0) | 784.5 (23255) | 22.95 | 22.10 | 21.08 |
| | | 782 (23230) | 22.93 | 22.09 | 21.11 |
| | | 779.5 (23205) | 22.92 | 22.20 | 21.04 |
| | 12RB-High (13) | 784.5 (23255) | 22.03 | 21.00 | 20.02 |
| | | 782 (23230) | 22.00 | 20.97 | 19.99 |
| | | 779.5 (23205) | 22.04 | 21.04 | 20.07 |
| | 12RB-Middle (6) | 784.5 (23255) | 22.04 | 20.97 | 20.05 |
| | | 782 (23230) | 22.10 | 21.10 | 20.15 |
| | | 779.5 (23205) | 22.11 | 21.09 | 20.11 |
| | 12RB-Low (0) | 784.5 (23255) | 22.07 | 21.03 | 20.07 |
| | | 782 (23230) | 22.05 | 21.00 | 20.05 |
| | | 779.5 (23205) | 21.97 | 20.96 | 19.98 |
| | 25RB (0) | 784.5 (23255) | 22.07 | 21.04 | 20.05 |
| | | 782 (23230) | 22.02 | 20.98 | 20.02 |
| | | 779.5 (23205) | 22.05 | 21.02 | 20.04 |
| 10MHz | 1RB-High (49) | 782 (23230) | 22.95 | 22.14 | 21.06 |
| | 1RB-Middle (24) | 782 (23230) | 23.17 | 22.36 | 21.35 |
| | 1RB-Low (0) | 782 (23230) | 23.08 | 22.31 | 21.22 |
| | 25RB-High (25) | 782 (23230) | 22.08 | 21.09 | 20.09 |
| | 25RB-Middle (12) | 782 (23230) | 22.15 | 21.11 | 20.16 |
| | 25RB-Low (0) | 782 (23230) | 22.09 | 21.10 | 20.10 |
| | 50RB (0) | 782 (23230) | 22.10 | 21.09 | 20.09 |

©Copyright. All rights reserved by CTTL.

**LTE Band41 (Power Level A1)**

| LTE Band41 | | | | | |
|---|---|---|---|---|---|
| **BANDWIDTH** | **Number of RBs** | **Frequency** | **QPSK** | **16QAM** | **64QAM** |
| 5MHz | 1RB-High (24) | 2687.5 (41565) | 22.58 | 21.66 | 20.28 |
| | | 2640.3(41093) | 22.76 | 21.77 | 20.43 |
| | | 2593 (40620) | 22.73 | 21.80 | 20.40 |
| | | 2545.8(40148) | 22.91 | 22.02 | 20.65 |
| | | 2498.5 (39675) | 22.16 | 21.26 | 20.15 |
| | 1RB-Middle (12) | 2687.5 (41565) | 22.73 | 21.88 | 20.44 |
| | | 2640.3(41093) | 22.91 | 21.92 | 20.58 |
| | | 2593 (40620) | 22.95 | 22.02 | 20.60 |
| | | 2545.8(40148) | 23.07 | 22.29 | 20.88 |
| | | 2498.5 (39675) | 22.36 | 21.49 | 20.16 |
| | 1RB-Low (0) | 2687.5 (41565) | 22.56 | 21.61 | 20.23 |
| | | 2640.3(41093) | 22.70 | 21.71 | 20.36 |
| | | 2593 (40620) | 22.80 | 21.84 | 20.43 |
| | | 2545.8(40148) | 22.92 | 22.01 | 20.64 |
| | | 2498.5 (39675) | 22.07 | 21.23 | 20.32 |
| | 12RB-High (13) | 2687.5 (41565) | 21.74 | 20.65 | 19.74 |
| | | 2640.3(41093) | 21.92 | 20.80 | 19.86 |
| | | 2593 (40620) | 21.84 | 20.81 | 19.88 |
| | | 2545.8(40148) | 22.08 | 21.03 | 20.10 |
| | | 2498.5 (39675) | 21.29 | 20.25 | 19.35 |
| | 12RB-Middle (6) | 2687.5 (41565) | 21.79 | 20.68 | 19.78 |
| | | 2640.3(41093) | 21.95 | 20.85 | 19.96 |
| | | 2593 (40620) | 21.94 | 20.81 | 19.90 |
| | | 2545.8(40148) | 22.09 | 21.03 | 20.18 |
| | | 2498.5 (39675) | 21.46 | 20.36 | 19.46 |
| | 12RB-Low (0) | 2687.5 (41565) | 21.72 | 20.60 | 19.70 |
| | | 2640.3(41093) | 21.88 | 20.80 | 19.89 |
| | | 2593 (40620) | 21.86 | 20.77 | 19.88 |
| | | 2545.8(40148) | 22.06 | 21.00 | 20.11 |
| | | 2498.5 (39675) | 21.29 | 20.30 | 19.35 |
| | 25RB (0) | 2687.5 (41565) | 21.68 | 20.70 | 19.79 |
| | | 2640.3(41093) | 21.81 | 20.82 | 19.85 |
| | | 2593 (40620) | 21.85 | 20.85 | 19.93 |
| | | 2545.8(40148) | 22.01 | 21.06 | 20.14 |
| | | 2498.5 (39675) | 21.27 | 20.40 | 19.44 |
| 10MHz | 1RB-High (49) | 2685 (41540) | 22.69 | 21.75 | 20.33 |
| | | 2639(41080) | 22.80 | 21.85 | 20.51 |
| | | 2593 (40620) | 22.79 | 21.84 | 20.45 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2547(40160) | 23.01 | 22.11 | 20.75 |
| | | 2501 (39700) | 22.29 | 21.39 | 20.05 |
| | 1RB-Middle (24) | 2685 (41540) | 22.76 | 21.84 | 20.46 |
| | | 2639(41080) | 22.96 | 21.93 | 20.60 |
| | | 2593 (40620) | 22.96 | 22.02 | 20.64 |
| | | 2547(40160) | 23.16 | 22.20 | 20.88 |
| | | 2501 (39700) | 22.39 | 21.48 | 20.14 |
| | 1RB-Low (0) | 2685 (41540) | 22.62 | 21.70 | 20.31 |
| | | 2639(41080) | 22.78 | 21.80 | 20.39 |
| | | 2593 (40620) | 22.91 | 21.99 | 20.57 |
| | | 2547(40160) | 22.98 | 22.10 | 20.71 |
| | | 2501 (39700) | 22.19 | 21.27 | 20.11 |
| | 25RB-High (25) | 2685 (41540) | 21.71 | 20.72 | 19.80 |
| | | 2639(41080) | 21.84 | 20.85 | 19.92 |
| | | 2593 (40620) | 21.86 | 20.88 | 19.95 |
| | | 2547(40160) | 22.08 | 21.12 | 20.19 |
| | | 2501 (39700) | 21.38 | 20.43 | 19.53 |
| | 25RB-Middle (12) | 2685 (41540) | 21.68 | 20.70 | 19.76 |
| | | 2639(41080) | 21.84 | 20.86 | 19.92 |
| | | 2593 (40620) | 21.89 | 20.88 | 19.94 |
| | | 2547(40160) | 22.10 | 21.19 | 20.25 |
| | | 2501 (39700) | 21.34 | 20.45 | 19.48 |
| | 25RB-Low (0) | 2685 (41540) | 21.71 | 20.69 | 19.78 |
| | | 2639(41080) | 21.80 | 20.80 | 19.88 |
| | | 2593 (40620) | 21.91 | 20.89 | 19.96 |
| | | 2547(40160) | 22.07 | 21.10 | 20.17 |
| | | 2501 (39700) | 21.29 | 20.40 | 19.44 |
| | 50RB (0) | 2685 (41540) | 21.65 | 20.72 | 19.76 |
| | | 2639(41080) | 21.78 | 20.77 | 19.82 |
| | | 2593 (40620) | 21.83 | 20.85 | 19.89 |
| | | 2547(40160) | 22.02 | 21.12 | 20.13 |
| | | 2501 (39700) | 21.26 | 20.45 | 19.43 |
| 15MHz | 1RB-High (74) | 2682.5 (41515) | 22.79 | 21.59 | 20.23 |
| | | 2637.8(41068) | 22.73 | 21.73 | 20.39 |
| | | 2593 (40620) | 22.69 | 21.70 | 20.33 |
| | | 2548.3(40173) | 22.88 | 22.01 | 20.63 |
| | | 2503.5 (39725) | 22.28 | 21.42 | 20.01 |
| | 1RB-Middle (37) | 2682.5 (41515) | 22.60 | 21.68 | 20.29 |
| | | 2637.8(41068) | 22.77 | 21.84 | 20.46 |
| | | 2593 (40620) | 22.86 | 21.92 | 20.52 |
| | | 2548.3(40173) | 23.03 | 22.11 | 20.77 |
| | | 2503.5 (39725) | 22.29 | 21.42 | 20.02 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | 1RB-Low (0) | 2682.5 (41515) | 22.50 | 21.56 | 20.17 |
| | | 2637.8(41068) | 22.66 | 21.71 | 20.30 |
| | | 2593 (40620) | 22.86 | 21.90 | 20.50 |
| | | 2548.3(40173) | 22.88 | 21.97 | 20.62 |
| | | 2503.5 (39725) | 22.10 | 21.21 | 20.12 |
| | 36RB-High (38) | 2682.5 (41515) | 21.68 | 20.60 | 19.66 |
| | | 2637.8(41068) | 21.89 | 20.80 | 19.83 |
| | | 2593 (40620) | 21.89 | 20.79 | 19.82 |
| | | 2548.3(40173) | 22.13 | 21.02 | 20.13 |
| | | 2503.5 (39725) | 21.39 | 20.38 | 19.40 |
| | 36RB-Middle (19) | 2682.5 (41515) | 21.64 | 20.60 | 19.66 |
| | | 2637.8(41068) | 21.88 | 20.76 | 19.82 |
| | | 2593 (40620) | 21.93 | 20.82 | 19.86 |
| | | 2548.3(40173) | 22.09 | 21.02 | 20.16 |
| | | 2503.5 (39725) | 21.35 | 20.36 | 19.40 |
| | 36RB-Low (0) | 2682.5 (41515) | 21.66 | 20.60 | 19.64 |
| | | 2637.8(41068) | 21.83 | 20.77 | 19.77 |
| | | 2593 (40620) | 21.88 | 20.81 | 19.90 |
| | | 2548.3(40173) | 22.04 | 20.98 | 20.10 |
| | | 2503.5 (39725) | 21.27 | 20.29 | 19.30 |
| | 75RB (0) | 2682.5 (41515) | 21.58 | 20.61 | 19.64 |
| | | 2637.8(41068) | 21.76 | 20.73 | 19.87 |
| | | 2593 (40620) | 21.79 | 20.79 | 19.90 |
| | | 2548.3(40173) | 22.06 | 21.10 | 20.12 |
| | | 2503.5 (39725) | 21.32 | 20.39 | 19.43 |
| 20MHz | 1RB-High (99) | 2680 (41490) | 22.80 | 21.40 | 20.00 |
| | | 2636.5(41055) | 23.10 | 21.63 | 20.29 |
| | | 2593 (40620) | 22.51 | 21.53 | 20.34 |
| | | 2549.5(40185) | 22.69 | 21.80 | 20.42 |
| | | 2506 (39750) | 22.16 | 21.31 | 20.09 |
| | 1RB-Middle (50) | 2680 (41490) | 23.15 | 21.71 | 20.38 |
| | | 2636.5(41055) | 23.33 | 21.85 | 20.51 |
| | | 2593 (40620) | 22.94 | 22.03 | 20.72 |
| | | 2549.5(40185) | 23.12 | 22.23 | 20.87 |
| | | 2506 (39750) | 22.41 | 21.50 | 20.14 |
| | 1RB-Low (0) | 2680 (41490) | 22.80 | 21.39 | 20.12 |
| | | 2636.5(41055) | 23.01 | 21.58 | 20.19 |
| | | 2593 (40620) | 22.67 | 21.75 | 20.41 |
| | | 2549.5(40185) | 22.70 | 21.81 | 20.44 |
| | | 2506 (39750) | 22.32 | 21.07 | 20.15 |
| | 50RB-High (50) | 2680 (41490) | 21.97 | 20.52 | 19.60 |
| | | 2636.5(41055) | 22.11 | 20.69 | 19.81 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2593 (40620) | 21.69 | 20.71 | 19.90 |
| | | 2549.5(40185) | 22.02 | 21.11 | 20.09 |
| | | 2506 (39750) | 21.39 | 20.51 | 19.52 |
| | 50RB-Middle (25) | 2680 (41490) | 22.05 | 20.64 | 19.66 |
| | | 2636.5(41055) | 22.13 | 20.68 | 20.07 |
| | | 2593 (40620) | 21.82 | 20.83 | 19.84 |
| | | 2549.5(40185) | 21.99 | 21.11 | 20.17 |
| | | 2506 (39750) | 21.33 | 20.46 | 19.49 |
| | 50RB-Low (0) | 2680 (41490) | 22.05 | 20.59 | 19.62 |
| | | 2636.5(41055) | 22.08 | 20.67 | 19.97 |
| | | 2593 (40620) | 21.73 | 20.79 | 19.88 |
| | | 2549.5(40185) | 21.99 | 21.09 | 20.13 |
| | | 2506 (39750) | 21.24 | 20.36 | 19.35 |
| | 100RB (0) | 2680 (41490) | 22.08 | 20.59 | 19.62 |
| | | 2636.5(41055) | 22.33 | 20.83 | 20.19 |
| | | 2593 (40620) | 21.90 | 20.84 | 19.98 |
| | | 2549.5(40185) | 22.04 | 21.10 | 20.19 |
| | | 2506 (39750) | 21.43 | 20.47 | 19.51 |

**LTE Band41 (Power Level B1)**

| LTE Band41 | | | | | |
|---|---|---|---|---|---|
| **BANDWIDTH** | **Number of RBs** | **Frequency** | **QPSK** | **16QAM** | **64QAM** |
| 5MHz | 1RB-High (24) | 2687.5 (41565) | 20.72 | 20.79 | 20.37 |
| | | 2640.3(41093) | 21.01 | 21.06 | 20.67 |
| | | 2593 (40620) | 20.94 | 21.01 | 20.62 |
| | | 2545.8(40148) | 21.19 | 21.26 | 20.86 |
| | | 2498.5 (39675) | 20.55 | 20.67 | 20.23 |
| | 1RB-Middle (12) | 2687.5 (41565) | 20.92 | 20.99 | 20.59 |
| | | 2640.3(41093) | 21.24 | 21.28 | 20.91 |
| | | 2593 (40620) | 21.22 | 21.22 | 20.81 |
| | | 2545.8(40148) | 21.36 | 21.45 | 21.07 |
| | | 2498.5 (39675) | 20.77 | 20.84 | 20.43 |
| | 1RB-Low (0) | 2687.5 (41565) | 20.74 | 20.83 | 20.39 |
| | | 2640.3(41093) | 21.09 | 21.10 | 20.71 |
| | | 2593 (40620) | 21.03 | 21.08 | 20.67 |
| | | 2545.8(40148) | 21.20 | 21.27 | 20.88 |
| | | 2498.5 (39675) | 20.53 | 20.65 | 20.20 |
| | 12RB-High (13) | 2687.5 (41565) | 20.81 | 20.74 | 19.80 |
| | | 2640.3(41093) | 21.16 | 21.06 | 20.12 |
| | | 2593 (40620) | 21.02 | 20.97 | 20.06 |
| | | 2545.8(40148) | 21.27 | 21.25 | 20.29 |
| | | 2498.5 (39675) | 20.69 | 20.70 | 19.71 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | 12RB-Middle (6) | 2687.5 (41565) | 20.92 | 20.84 | 19.87 |
| | | 2640.3(41093) | 21.22 | 21.13 | 20.19 |
| | | 2593 (40620) | 21.08 | 21.02 | 20.10 |
| | | 2545.8(40148) | 21.36 | 21.33 | 20.42 |
| | | 2498.5 (39675) | 20.80 | 20.72 | 19.81 |
| | 12RB-Low (0) | 2687.5 (41565) | 20.85 | 20.78 | 19.84 |
| | | 2640.3(41093) | 21.18 | 21.07 | 20.10 |
| | | 2593 (40620) | 21.06 | 20.97 | 20.10 |
| | | 2545.8(40148) | 21.29 | 21.24 | 20.37 |
| | | 2498.5 (39675) | 20.66 | 20.61 | 19.76 |
| | 25RB (0) | 2687.5 (41565) | 20.82 | 20.82 | 19.85 |
| | | 2640.3(41093) | 21.12 | 21.16 | 20.09 |
| | | 2593 (40620) | 21.03 | 21.05 | 20.10 |
| | | 2545.8(40148) | 21.28 | 21.29 | 20.40 |
| | | 2498.5 (39675) | 20.66 | 20.69 | 19.77 |
| 10MHz | 1RB-High (49) | 2685 (41540) | 20.84 | 20.90 | 20.49 |
| | | 2639(41080) | 21.13 | 21.15 | 20.72 |
| | | 2593 (40620) | 21.06 | 21.05 | 20.66 |
| | | 2547(40160) | 21.27 | 21.35 | 20.93 |
| | | 2501 (39700) | 20.70 | 20.79 | 20.39 |
| | 1RB-Middle (24) | 2685 (41540) | 20.97 | 21.03 | 20.63 |
| | | 2639(41080) | 21.29 | 21.31 | 20.85 |
| | | 2593 (40620) | 21.18 | 21.29 | 20.85 |
| | | 2547(40160) | 21.41 | 21.50 | 21.10 |
| | | 2501 (39700) | 20.78 | 20.83 | 20.45 |
| | 1RB-Low (0) | 2685 (41540) | 20.89 | 20.97 | 20.57 |
| | | 2639(41080) | 21.25 | 21.28 | 20.88 |
| | | 2593 (40620) | 21.14 | 21.21 | 20.80 |
| | | 2547(40160) | 21.30 | 21.40 | 21.01 |
| | | 2501 (39700) | 20.66 | 20.74 | 20.31 |
| | 25RB-High (25) | 2685 (41540) | 20.87 | 20.90 | 19.91 |
| | | 2639(41080) | 21.15 | 21.12 | 20.14 |
| | | 2593 (40620) | 21.11 | 21.09 | 20.16 |
| | | 2547(40160) | 21.35 | 21.37 | 20.46 |
| | | 2501 (39700) | 20.74 | 20.75 | 19.85 |
| | 25RB-Middle (12) | 2685 (41540) | 20.90 | 20.92 | 19.95 |
| | | 2639(41080) | 21.18 | 21.17 | 20.24 |
| | | 2593 (40620) | 21.12 | 21.10 | 20.16 |
| | | 2547(40160) | 21.33 | 21.37 | 20.51 |
| | | 2501 (39700) | 20.74 | 20.75 | 19.89 |
| | 25RB-Low (0) | 2685 (41540) | 20.94 | 20.93 | 19.95 |
| | | 2639(41080) | 21.26 | 21.19 | 20.23 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2593 (40620) | 21.11 | 21.07 | 20.17 |
| | | 2547(40160) | 21.39 | 21.39 | 20.46 |
| | | 2501 (39700) | 20.73 | 20.75 | 19.84 |
| | 50RB (0) | 2685 (41540) | 20.80 | 20.84 | 19.85 |
| | | 2639(41080) | 21.14 | 21.13 | 20.12 |
| | | 2593 (40620) | 21.02 | 21.00 | 20.05 |
| | | 2547(40160) | 21.26 | 21.32 | 20.38 |
| | | 2501 (39700) | 20.69 | 20.73 | 19.82 |
| 15MHz | 1RB-High (74) | 2682.5 (41515) | 20.78 | 20.83 | 20.38 |
| | | 2637.8(41068) | 21.03 | 21.08 | 20.66 |
| | | 2593 (40620) | 21.00 | 21.05 | 20.62 |
| | | 2548.3(40173) | 21.23 | 21.28 | 20.88 |
| | | 2503.5 (39725) | 20.73 | 20.80 | 20.37 |
| | 1RB-Middle (37) | 2682.5 (41515) | 20.96 | 21.02 | 20.60 |
| | | 2637.8(41068) | 21.25 | 21.24 | 20.88 |
| | | 2593 (40620) | 21.15 | 21.23 | 20.80 |
| | | 2548.3(40173) | 21.37 | 21.44 | 21.03 |
| | | 2503.5 (39725) | 20.76 | 20.82 | 20.41 |
| | 1RB-Low (0) | 2682.5 (41515) | 20.91 | 20.94 | 20.51 |
| | | 2637.8(41068) | 21.24 | 21.25 | 20.85 |
| | | 2593 (40620) | 21.14 | 21.19 | 20.77 |
| | | 2548.3(40173) | 21.25 | 21.40 | 20.90 |
| | | 2503.5 (39725) | 20.61 | 20.69 | 20.26 |
| | 36RB-High (38) | 2682.5 (41515) | 20.93 | 20.84 | 19.87 |
| | | 2637.8(41068) | 21.23 | 21.16 | 20.17 |
| | | 2593 (40620) | 21.12 | 21.07 | 20.10 |
| | | 2548.3(40173) | 21.39 | 21.36 | 20.39 |
| | | 2503.5 (39725) | 20.82 | 20.78 | 19.86 |
| | 36RB-Middle (19) | 2682.5 (41515) | 20.96 | 20.90 | 19.90 |
| | | 2637.8(41068) | 21.33 | 21.21 | 20.22 |
| | | 2593 (40620) | 21.14 | 21.04 | 20.12 |
| | | 2548.3(40173) | 21.38 | 21.34 | 20.37 |
| | | 2503.5 (39725) | 20.82 | 20.80 | 19.79 |
| | 36RB-Low (0) | 2682.5 (41515) | 21.01 | 20.95 | 19.91 |
| | | 2637.8(41068) | 21.33 | 21.24 | 20.22 |
| | | 2593 (40620) | 21.15 | 21.09 | 20.12 |
| | | 2548.3(40173) | 21.38 | 21.35 | 20.38 |
| | | 2503.5 (39725) | 20.76 | 20.75 | 19.78 |
| | 75RB (0) | 2682.5 (41515) | 20.91 | 20.89 | 19.88 |
| | | 2637.8(41068) | 21.19 | 21.12 | 20.14 |
| | | 2593 (40620) | 21.08 | 21.06 | 20.08 |
| | | 2548.3(40173) | 21.35 | 21.34 | 20.38 |

©Copyright. All rights reserved by CTTL.

| | | | | | |
|---|---|---|---|---|---|
| | | 2503.5 (39725) | 20.75 | 20.74 | 19.84 |
| 20MHz | 1RB-High (99) | 2680 (41490) | 20.73 | 20.75 | 20.28 |
| | | 2636.5(41055) | 21.01 | 20.97 | 20.53 |
| | | 2593 (40620) | 20.95 | 20.94 | 20.51 |
| | | 2549.5(40185) | 21.16 | 21.23 | 20.76 |
| | | 2506 (39750) | 20.75 | 20.80 | 20.35 |
| | 1RB-Middle (50) | 2680 (41490) | 21.18 | 21.17 | 20.74 |
| | | 2636.5(41055) | 21.42 | 21.42 | 20.95 |
| | | 2593 (40620) | 21.36 | 21.35 | 20.92 |
| | | 2549.5(40185) | 21.34 | 21.61 | 21.16 |
| | | 2506 (39750) | 21.25 | 21.02 | 20.54 |
| | 1RB-Low (0) | 2680 (41490) | 20.96 | 20.95 | 20.50 |
| | | 2636.5(41055) | 21.22 | 21.21 | 20.76 |
| | | 2593 (40620) | 21.13 | 21.13 | 20.69 |
| | | 2549.5(40185) | 21.23 | 21.27 | 20.84 |
| | | 2506 (39750) | 20.55 | 20.59 | 20.12 |
| | 50RB-High (50) | 2680 (41490) | 20.94 | 20.89 | 19.81 |
| | | 2636.5(41055) | 21.14 | 21.13 | 20.05 |
| | | 2593 (40620) | 21.17 | 21.11 | 20.06 |
| | | 2549.5(40185) | 21.32 | 21.43 | 20.45 |
| | | 2506 (39750) | 21.15 | 20.94 | 19.97 |
| | 50RB-Middle (25) | 2680 (41490) | 20.99 | 21.00 | 19.95 |
| | | 2636.5(41055) | 21.33 | 21.25 | 20.16 |
| | | 2593 (40620) | 21.14 | 21.12 | 20.08 |
| | | 2549.5(40185) | 21.31 | 21.45 | 20.47 |
| | | 2506 (39750) | 20.86 | 20.86 | 19.95 |
| | 50RB-Low (0) | 2680 (41490) | 21.10 | 21.05 | 20.02 |
| | | 2636.5(41055) | 21.29 | 21.23 | 20.23 |
| | | 2593 (40620) | 21.15 | 21.12 | 20.10 |
| | | 2549.5(40185) | 21.21 | 21.46 | 20.42 |
| | | 2506 (39750) | 20.80 | 20.80 | 19.84 |
| | 100RB (0) | 2680 (41490) | 21.13 | 21.08 | 20.01 |
| | | 2636.5(41055) | 21.41 | 21.33 | 20.25 |
| | | 2593 (40620) | 21.17 | 21.15 | 20.21 |
| | | 2549.5(40185) | 21.50 | 21.46 | 20.53 |
| | | 2506 (39750) | 20.90 | 20.96 | 19.95 |

©Copyright. All rights reserved by CTTL.

## 11.4 Wi-Fi and BT Measurement result

The maximum output power of BT antenna is 9.72dBm.
The maximum tune up of BT antenna is 11dBm.

The average conducted power for Wi-Fi 2.4G is as following-(Receiver on/off):

| 802.11b | |
|---|---|
| Channel\data rate | 1Mbps |
| 11(2462MHz) | 16.82 |
| 6(2437(MHz) | 17.48 |
| 1(2412MHz) | 17.29 |
| Tune up | 18.00 |
| 802.11g | |
| Channel\data rate | 6Mbps |
| 11(2462MHz) | 14.46 |
| 6(2437(MHz) | 15.15 |
| 1(2412MHz) | 15.01 |
| Tune up | 16.00 |
| 802.11n-20MHz | |
| Channel\data rate | MCS0 |
| 11(2462MHz) | 14.01 |
| 6(2437(MHz) | 14.78 |
| 1(2412MHz) | 14.62 |
| Tune up | 16.00 |
| 802.11n-40MHz | |
| Channel\data rate | MCS0 |
| 9(2452MHz) | 9.81 |
| Tune up | 11.50 |
| 6(2437MHz) | 13.27 |
| 3(2422MHz) | 13.66 |
| Tune up | 14.50 |

©Copyright. All rights reserved by CTTL.

The tune up power for Wi-Fi 5G is as following-(Receiver on/off):

| WiFi 802.11a (5GHz) 6Mbps | | | |
|---|---|---|---|
| Channel | Channel 36~64 | Channel 100~140 | Channel 149~155 |
| Target (dBm) | 14.0+/-1 | 14.0 +/-1 | 14.0+/-1 |
| WiFi 802.11n-20 (5GHz) MCS0 | | | |
| Channel | Channel 36~64 | Channel 100~140 | Channel 149~155 |
| Target (dBm) | 14.0+/-1 | 14.0 +/-1 | 14.0+/-1 |
| WiFi 802.11n-40 (5GHz) MCS0 | | | |
| Channel | Channel 38~62 | Channel 102~134 | Channel 149~155 |
| Target (dBm) | 13.5+/-1 | 13.5+/-1 | 13.5+/-1 |
| WiFi 802.11ac-20 (5GHz) MCS0 | | | |
| Channel | Channel 36~64 | Channel 100~140 | Channel 149~155 |
| Target (dBm) | 14.0+/-1 | 14.0+/-1 | 14.0+/-1 |
| WiFi 802.11ac-40 (5GHz) MCS0 | | | |
| Channel | Channel 38~62 | Channel 102~134 | Channel 149~155 |
| Target (dBm) | 13.5+/-1 | 13.5+/-1 | 13.5+/-1 |
| WiFi 802.11ac-80 (5GHz) MCS0 | | | |
| Channel | Channel 42~58 | Channel 106~138 | Channel14+/-15 |
| Target (dBm) | 14.5+1/-1.5 | 14.5+1/-1.5 | 14.5+1/-1.5 |

The average conducted power for Wi-Fi 5G is as following-(Receiver on/off):

| 802.11ac(dBm)-80MHz | |
|---|---|
| Channel\data rate | MCS0 |
| 42(5210 MHz) | 14.63 |
| 58(5290 MHz) | 14.82 |
| 106(5530 MHz) | 14.73 |
| 122(5610 MHz) | 14.58 |
| 138(5690 MHz) | 14.94 |
| 155(5775 MHz) | 14.42 |
| Tune up | 15.50 |

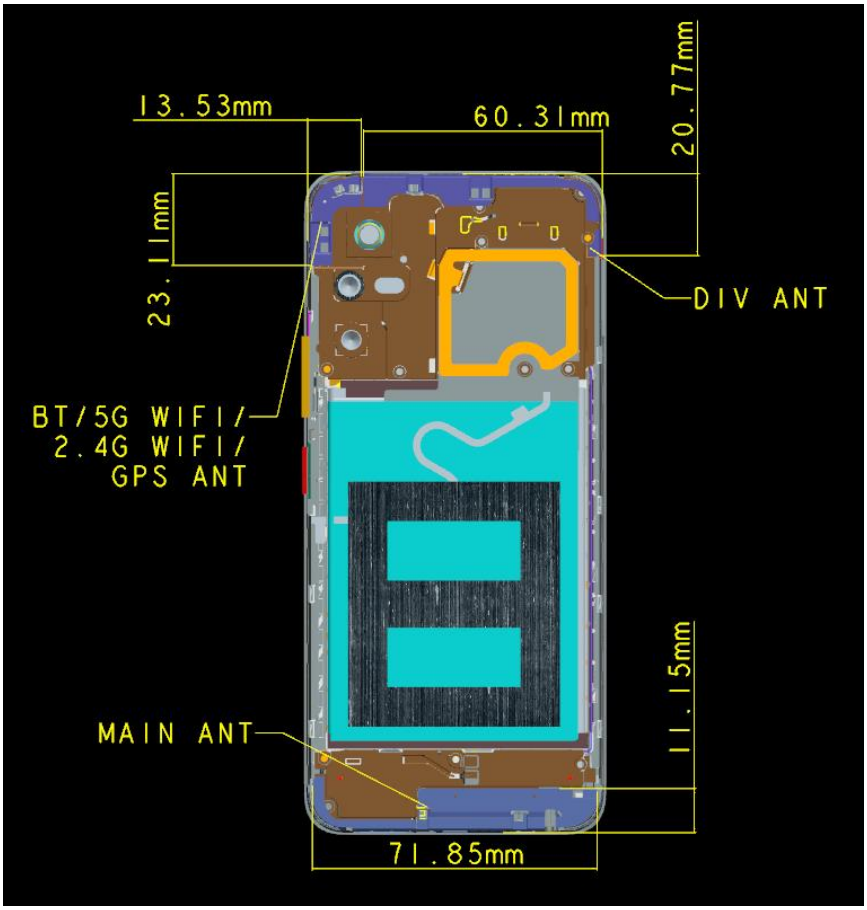
©Copyright. All rights reserved by CTTL.

# 12 Simultaneous TX SAR Considerations

## 12.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For this device, the BT and Wi-Fi can transmit simultaneous with other transmitters.

## 12.2 Transmit Antenna Separation Distances




**Picture 12-1 Antenna Locations**

## 12.3 SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

| SAR measurement positions | | | | | | |
|---|---|---|---|---|---|---|
| Mode | Front | Rear | Left edge | Right edge | Top edge | Bottom edge |
| WWAN-Main | Yes | Yes | Yes | Yes | No | Yes |
| WWAN-DIV | Yes | Yes | Yes | Yes | Yes | No |
| WIFI | Yes | Yes | No | Yes | Yes | No |

©Copyright. All rights reserved by CTTL.

# 13 Evaluation of Simultaneous

**Table 13.1: The sum of SAR values for Main antenna + WiFi-2.4G**

| | Position | Main antenna | WiFi-2.4G | Sum |
|---|---|---|---|---|
| **Highest SAR value for Head** | Left head, Touch (LTE B5) | 0.78 | 0.60 | **1.38** |
| **Highest SAR value for Body** | Rear 10mm (W1900) | 1.11 | 0.24 | **1.35** |

**Table 13.3: The sum of SAR values for Main antenna + WiFi-5G +BT**

| | Position | Main antenna | WiFi-5G | BT | Sum |
|---|---|---|---|---|---|
| **Highest SAR value for Head** | Left head, Touch (LTE B5) | 0.78 | 0.46 | 0.08 | **1.32** |
| **Highest SAR value for Body** | Rear 10mm (W1900) | 1.11 | 0.16 | 0.01 | **1.28** |

**Conclusion:**

According to the above tables, the sum of reported SAR values is<1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

# 14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.

The distance is 10 mm and just applied to the condition of body worn accessory.

It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-g SAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or more than 1.2W/kg.

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target}-P_{Measured})/10}$$

Where $P_{Target}$ is the power of manufacturing upper limit;

$P_{Measured}$ is the measured power in chapter 11.

**Table 14.1: Duty Cycle**

| Mode | Duty Cycle |
|---|---|
| GSM 850/1900 Speech | 1:8.3 |
| GPRS/EGPRS 850/1900 | 1:4 |
| WCDMA&LTE FDD | 1:1 |
| LTE TDD | 1:1.58 |

**Note**

**S1: SIM1**

**S2: SIM2**

©Copyright. All rights reserved by CTTL.

## 14.1 SAR results for 2G/3G/4G

**Table 14.1-1: SAR Values (GSM 850 MHz Band – Head)**

| Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)( W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 190 | 836.6 | Left | Cheek | / | 32.1 | 32.5 | 0.644 | **0.71** | 0.448 | **0.49** | -0.09 |
| 190 | 836.6 | Left | Tilt | / | 32.1 | 32.5 | 0.522 | **0.57** | 0.318 | **0.35** | 0.02 |
| 251 | 848.8 | Right | Cheek | Fig.1 | 32.24 | 32.5 | 0.8 | **0.85** | 0.552 | **0.59** | -0.11 |
| 190 | 836.6 | Right | Cheek | / | 32.1 | 32.5 | 0.746 | **0.82** | 0.501 | **0.55** | 0.08 |
| 128 | 824.2 | Right | Cheek | / | 31.9 | 32.5 | 0.659 | **0.76** | 0.453 | **0.52** | 0.06 |
| 190 | 836.6 | Right | Tilt | / | 32.1 | 32.5 | 0.665 | **0.73** | 0.395 | **0.43** | 0.03 |

**Table 14.1-2: SAR Values (GSM 850 MHz Band - Body)**

| Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode (number of timeslots) | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)( W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g ) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 190 | 836.6 | GPRS (2) | Front | / | 30.71 | 31.5 | 0.197 | **0.24** | 0.134 | **0.16** | 0.12 |
| 251 | 848.8 | GPRS (2) | Rear | Fig.2 | 30.97 | 31.5 | 0.376 | **0.42** | 0.214 | **0.24** | -0.08 |
| 190 | 836.6 | GPRS (2) | Rear | / | 30.71 | 31.5 | 0.348 | **0.42** | 0.195 | **0.23** | 0.07 |
| 128 | 824.2 | GPRS (2) | Rear | / | 30.48 | 31.5 | 0.335 | **0.42** | 0.183 | **0.23** | 0.13 |
| 190 | 836.6 | GPRS (2) | Left | / | 30.71 | 31.5 | 0.331 | **0.40** | 0.206 | **0.25** | 0.08 |
| 190 | 836.6 | GPRS (2) | Right | / | 30.71 | 31.5 | 0.138 | **0.17** | 0.086 | **0.10** | -0.09 |
| 190 | 836.6 | GPRS (2) | Top | / | 30.71 | 31.5 | 0.267 | **0.32** | 0.129 | **0.15** | 0.03 |
| 251 | 848.8 | EGPRS (2) | Rear | / | 30.7 | 31.5 | 0.345 | **0.41** | 0.194 | **0.23** | 0.03 |

Note: The distance between the EUT and the phantom bottom is 10mm.

©Copyright. All rights reserved by CTTL.

**Table 14.1-3: SAR Values (GSM 1900 MHz Band - Head)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 810 | 1909.8 | Left | Cheek | / | 29.42 | 30.5 | 0.102 | **0.13** | 0.065 | **0.08** | 0.02 |
| 661 | 1880 | Left | Cheek | Fig.3 | 29.72 | 30.5 | 0.109 | **0.13** | 0.071 | **0.08** | 0.14 |
| 512 | 1850.2 | Left | Cheek | / | 29.95 | 30.5 | 0.094 | **0.11** | 0.059 | **0.07** | -0.04 |
| 661 | 1880 | Left | Tilt | / | 29.72 | 30.5 | 0.075 | **0.09** | 0.045 | **0.05** | -0.12 |
| 661 | 1880 | Right | Cheek | / | 29.72 | 30.5 | 0.105 | **0.13** | 0.064 | **0.08** | -0.12 |
| 661 | 1880 | Right | Tilt | / | 29.72 | 30.5 | 0.071 | **0.08** | 0.042 | **0.05** | -0.02 |

**Table 14.1-4: SAR Values (GSM 1900 MHz Band - Body)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode (number of timeslots) | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 661 | 1880 | GPRS (2) | Front | / | 24.92 | 25.5 | 0.354 | **0.40** | 0.22 | **0.25** | 0.06 |
| 810 | 1909.8 | GPRS (2) | Rear | / | 24.66 | 25.5 | 0.703 | **0.85** | 0.384 | **0.47** | -0.06 |
| 661 | 1880 | GPRS (2) | Rear | / | 24.92 | 25.5 | 0.782 | **0.89** | 0.443 | **0.51** | 0.01 |
| 512 | 1850.2 | GPRS (2) | Rear | / | 24.95 | 25.5 | 0.776 | **0.88** | 0.415 | **0.47** | 0.03 |
| 661 | 1880 | GPRS (2) | Left | / | 24.92 | 25.5 | 0.226 | **0.26** | 0.127 | **0.15** | -0.1 |
| 661 | 1880 | GPRS (2) | Right | / | 24.92 | 25.5 | 0.078 | **0.09** | 0.048 | **0.05** | -0.05 |
| 810 | 1909.8 | GPRS (2) | Bottom | / | 24.66 | 25.5 | 0.717 | **0.87** | 0.392 | **0.48** | -0.02 |
| 661 | 1880 | GPRS (2) | Bottom | / | 24.92 | 25.5 | 0.785 | **0.90** | 0.423 | **0.48** | -0.14 |
| 512 | 1850.2 | GPRS (2) | Bottom | Fig.4 | 24.95 | 25.5 | 0.801 | **0.91** | 0.433 | **0.49** | 0.03 |
| 512 | 1850.2 | EGPRS (2) | Bottom | / | 24.91 | 25.5 | 0.784 | **0.90** | 0.421 | **0.48** | -0.13 |

Note1: The distance between the EUT and the phantom bottom is 10mm

©Copyright. All rights reserved by CTTL.

**Table 14.1-5: SAR Values (WCDMA 1900 MHz Band - Head)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)( W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g ) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 9538 | 1907.6 | Left | Cheek | / | 23.12 | 23.5 | 0.137 | **0.15** | 0.085 | **0.09** | 0.09 |
| 9400 | 1880 | Left | Cheek | Fig.5 | 23.05 | 23.5 | 0.182 | **0.20** | 0.115 | **0.13** | 0.08 |
| 9262 | 1852.4 | Left | Cheek | / | 23.19 | 23.5 | 0.134 | **0.14** | 0.085 | **0.09** | 0.11 |
| 9400 | 1880 | Left | Tilt | / | 23.05 | 23.5 | 0.132 | **0.15** | 0.078 | **0.09** | -0.07 |
| 9400 | 1880 | Right | Cheek | / | 23.05 | 23.5 | 0.141 | **0.16** | 0.086 | **0.10** | -0.04 |
| 9400 | 1880 | Right | Tilt | / | 23.05 | 23.5 | 0.098 | **0.11** | 0.06 | **0.07** | -0.02 |

**Table 14.1-6: SAR Values (WCDMA 1900 MHz Band - Body)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)( W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 9400 | 1880 | Front | / | 22.02 | 22.5 | 0.426 | **0.48** | 0.272 | **0.30** | 0.06 |
| 9538 | 1907.6 | Rear | / | 22.06 | 22.5 | 0.899 | **0.99** | 0.524 | **0.58** | 0.1 |
| 9400 | 1880 | Rear | / | 22.02 | 22.5 | 0.977 | **1.09** | 0.563 | **0.63** | 0.14 |
| 9262 | 1852.4 | Rear | Fig.6 | 22.22 | 22.5 | 1.04 | **1.11** | 0.598 | **0.64** | 0.1 |
| 9400 | 1880 | Left | / | 22.02 | 22.5 | 0.271 | **0.30** | 0.154 | **0.17** | -0.15 |
| 9400 | 1880 | Right | / | 22.02 | 22.5 | 0.085 | **0.09** | 0.053 | **0.06** | -0.11 |
| 9538 | 1907.6 | Bottom | / | 22.06 | 22.5 | 0.972 | **1.08** | 0.535 | **0.59** | -0.13 |
| 9400 | 1880 | Bottom | / | 22.02 | 22.5 | 0.975 | **1.09** | 0.533 | **0.60** | 0.06 |
| 9262 | 1852.4 | Bottom | / | 22.22 | 22.5 | 1.04 | **1.11** | 0.571 | **0.61** | -0.08 |
| 9262 | 1852.4 | Rear | S2 | 22.22 | 22.5 | 1.02 | **1.09** | 0.584 | **0.62** | 0.09 |
| 9262 | 1852.4 | Rear | Single SIM | 22.22 | 22.5 | 1.01 | **1.08** | 0.577 | **0.62** | -0.06 |

Note1: The distance between the EUT and the phantom bottom is 10mm

©Copyright. All rights reserved by CTTL.

**Table 14.1-7: SAR Values (WCDMA 850 MHz Band - Head)**

| Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 4183 | 836.6 | Left | Cheek | / | 22.98 | 23.5 | 0.307 | **0.35** | 0.219 | **0.25** | -0.11 |
| 4183 | 836.6 | Left | Tilt | / | 22.98 | 23.5 | 0.242 | **0.27** | 0.157 | **0.18** | 0.08 |
| 4233 | 846.6 | Right | Cheek | Fig.7 | 22.87 | 23.5 | 0.378 | **0.44** | 0.261 | **0.30** | 0.07 |
| 4183 | 836.6 | Right | Cheek | / | 22.98 | 23.5 | 0.347 | **0.39** | 0.236 | **0.27** | -0.12 |
| 4132 | 826.4 | Right | Cheek | / | 22.92 | 23.5 | 0.337 | **0.39** | 0.234 | **0.27** | 0.06 |
| 4183 | 836.6 | Right | Tilt | / | 22.98 | 23.5 | 0.323 | **0.36** | 0.19 | **0.21** | -0.11 |

**Table 14.1-8: SAR Values (WCDMA 850 MHz Band - Body)**

| Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 4183 | 836.6 | Front | / | 22.98 | 23.5 | 0.182 | **0.21** | 0.106 | **0.12** | 0.08 |
| 4233 | 846.6 | Rear | / | 22.87 | 23.5 | 0.337 | **0.39** | 0.186 | **0.22** | -0.02 |
| 4183 | 836.6 | Rear | Fig.8 | 22.98 | 23.5 | 0.386 | **0.44** | 0.215 | **0.24** | 0.07 |
| 4132 | 826.4 | Rear | / | 22.92 | 23.5 | 0.228 | **0.26** | 0.124 | **0.14** | 0.07 |
| 4183 | 836.6 | Left | / | 22.98 | 23.5 | 0.301 | **0.34** | 0.186 | **0.21** | 0.11 |
| 4183 | 836.6 | Right | / | 22.98 | 23.5 | 0.148 | **0.17** | 0.091 | **0.10** | 0.05 |
| 4183 | 836.6 | Top | / | 22.98 | 23.5 | 0.34 | **0.38** | 0.161 | **0.18** | -0.06 |

Note: The distance between the EUT and the phantom bottom is 10mm.

©Copyright. All rights reserved by CTTL.

**Table 14.1-9: SAR Values (LTE Band5 - Head)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | | |
| 20600 | 844 | 1RB-Mid | Left | Cheek | / | 23.87 | 24.5 | 0.678 | **0.78** | 0.484 | **0.56** | 0.09 |
| 20600 | 844 | 1RB-Mid | Left | Tilt | / | 23.87 | 24.5 | 0.588 | **0.68** | 0.373 | **0.43** | -0.07 |
| 20600 | 844 | 1RB-Mid | Right | Cheek | Fig.9 | 23.87 | 24.5 | 0.795 | **0.92** | 0.551 | **0.64** | -0.07 |
| 20525 | 836.5 | 1RB-Mid | Right | Cheek | / | 23.56 | 24.5 | 0.704 | **0.87** | 0.491 | **0.61** | -0.11 |
| 20450 | 829 | 1RB-Mid | Right | Cheek | / | 23.59 | 24.5 | 0.639 | **0.79** | 0.446 | **0.55** | 0.14 |
| 20600 | 844 | 50RB | Right | Cheek | / | 22.4 | 23.5 | 0.625 | **0.81** | 0.378 | **0.49** | 0.15 |
| 20600 | 844 | 1RB-Mid | Right | Tilt | / | 23.87 | 24.5 | 0.665 | **0.77** | 0.402 | **0.46** | -0.12 |
| 20600 | 844 | 25RB-High | Left | Cheek | / | 22.69 | 23.5 | 0.517 | **0.62** | 0.37 | **0.45** | 0.04 |
| 20600 | 844 | 25RB-High | Left | Tilt | / | 22.69 | 23.5 | 0.447 | **0.54** | 0.284 | **0.34** | -0.01 |
| 20600 | 844 | 25RB-High | Right | Cheek | / | 22.69 | 23.5 | 0.607 | **0.73** | 0.422 | **0.51** | -0.13 |
| 20600 | 844 | 25RB-High | Right | Tilt | / | 22.69 | 23.5 | 0.616 | **0.74** | 0.373 | **0.45** | 0.08 |
| 20600 | 844 | 1RB-Mid | Right | Cheek | S2 | 23.87 | 24.5 | 0.767 | **0.89** | 0.543 | **0.63** | -0.09 |
| 20600 | 844 | 1RB-Mid | Right | Cheek | Single SIM | 23.87 | 24.5 | 0.784 | **0.91** | 0.547 | **0.63** | 0.09 |

Note1: The LTE mode is QPSK_10MHz.

**Table 14.1-10: SAR Values (LTE Band5 - Body)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 20600 | 844 | 1RB-Mid Front | / | 23.87 | 24.5 | 0.336 | **0.39** | 0.194 | **0.22** | 0.01 |
| 20600 | 844 | 1RB-Mid Rear | Fig.10 | 23.87 | 24.5 | 0.59 | **0.68** | 0.319 | **0.37** | 0.08 |
| 20600 | 844 | 1RB-Mid Left | / | 23.87 | 24.5 | 0.462 | **0.53** | 0.282 | **0.33** | -0.04 |
| 20600 | 844 | 1RB-Mid Right | / | 23.87 | 24.5 | 0.214 | **0.25** | 0.131 | **0.15** | 0.08 |
| 20600 | 844 | 1RB-Mid Top | / | 23.87 | 24.5 | 0.447 | **0.52** | 0.208 | **0.24** | 0.11 |
| 20600 | 844 | 25RB-High Front | / | 22.69 | 23.5 | 0.252 | **0.30** | 0.146 | **0.18** | -0.1 |
| 20600 | 844 | 25RB-High Rear | / | 22.69 | 23.5 | 0.451 | **0.54** | 0.248 | **0.30** | -0.04 |
| 20600 | 844 | 25RB-High Left | / | 22.69 | 23.5 | 0.373 | **0.45** | 0.227 | **0.27** | 0.06 |
| 20600 | 844 | 25RB-High Right | / | 22.69 | 23.5 | 0.17 | **0.20** | 0.102 | **0.12** | -0.02 |
| 20600 | 844 | 25RB-High Top | / | 22.69 | 23.5 | 0.341 | **0.41** | 0.16 | **0.19** | -0.07 |

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

©Copyright. All rights reserved by CTTL.

**Table 14.1-11: SAR Values (LTE Band7 - Head)**

| Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | | |
| 21350 | 2560 | 1RB-Mid | Left | Cheek | / | 23.45 | 24.5 | 0.135 | **0.17** | 0.070 | **0.09** | -0.12 |
| 21100 | 2535 | 1RB-Mid | Left | Cheek | Fig.11 | 23.32 | 24.5 | 0.141 | **0.19** | 0.073 | **0.10** | 0.01 |
| 20850 | 2510 | 1RB-Mid | Left | Cheek | / | 23.34 | 24.5 | 0.127 | **0.17** | 0.066 | **0.09** | 0.03 |
| 21350 | 2560 | 1RB-Mid | Left | Tilt | / | 23.45 | 24.5 | 0.048 | **0.06** | 0.024 | **0.03** | -0.04 |
| 21100 | 2535 | 1RB-Mid | Right | Cheek | / | 23.45 | 24.5 | 0.043 | **0.05** | 0.024 | **0.03** | -0.11 |
| 21350 | 2560 | 1RB-Mid | Right | Tilt | / | 23.45 | 24.5 | 0.034 | **0.04** | 0.019 | **0.02** | 0.01 |
| 21350 | 2560 | 50RB-Mid | Left | Cheek | / | 22.48 | 23.5 | 0.065 | **0.08** | 0.034 | **0.04** | 0.11 |
| 21350 | 2560 | 50RB-Mid | Left | Tilt | / | 22.48 | 23.5 | 0.041 | **0.05** | 0.022 | **0.03** | -0.08 |
| 21350 | 2560 | 50RB-Mid | Right | Cheek | / | 22.48 | 23.5 | 0.034 | **0.04** | 0.020 | **0.03** | 0.1 |
| 21350 | 2560 | 50RB-Mid | Right | Tilt | / | 22.48 | 23.5 | 0.029 | **0.04** | 0.015 | **0.02** | -0.1 |

Note1: The LTE mode is QPSK_20MHz.

**Table 14.1-12: SAR Values (LTE Band7 – Body)**

| Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 21350 | 2560 | 1RB-Mid Front | / | 21.64 | 22.5 | 0.361 | **0.44** | 0.193 | **0.24** | -0.04 |
| 21350 | 2560 | 1RB-Mid Rear | / | 21.64 | 22.5 | 0.812 | **0.99** | 0.378 | **0.46** | -0.05 |
| 21100 | 2535 | 1RB-Mid Rear | Fig.12 | 21.63 | 22.5 | 0.868 | **1.06** | 0.401 | **0.49** | -0.09 |
| 20850 | 2510 | 1RB-Mid Rear | / | 21.56 | 22.5 | 0.851 | **1.06** | 0.392 | **0.49** | -0.1 |
| 21100 | 2535 | 100RB Rear | / | 21.39 | 22.5 | 0.811 | **1.05** | 0.371 | **0.48** | 0.06 |
| 21350 | 2560 | 1RB-Mid Left | / | 21.64 | 22.5 | 0.058 | **0.07** | 0.034 | **0.04** | -0.08 |
| 21350 | 2560 | 1RB-Mid Right | / | 21.64 | 22.5 | 0.059 | **0.07** | 0.033 | **0.04** | -0.03 |
| 21350 | 2560 | 1RB-Mid Bottom | / | 21.64 | 22.5 | 0.676 | **0.82** | 0.33 | **0.40** | -0.03 |
| 21350 | 2560 | 50RB-Mid Front | / | 21.66 | 22.5 | 0.359 | **0.44** | 0.191 | **0.23** | -0.06 |
| 21350 | 2560 | 50RB-Mid Rear | / | 21.66 | 22.5 | 0.804 | **0.98** | 0.376 | **0.46** | -0.1 |
| 21100 | 2535 | 50RB-Mid Rear | / | 21.63 | 22.5 | 0.862 | **1.05** | 0.394 | **0.48** | 0.08 |
| 20850 | 2510 | 50RB-Mid Rear | / | 21.58 | 22.5 | 0.845 | **1.04** | 0.381 | **0.47** | -0.09 |
| 21350 | 2560 | 50RB-Low Left | / | 21.66 | 22.5 | 0.056 | **0.07** | 0.033 | **0.04** | -0.08 |
| 21350 | 2560 | 50RB-Low Right | / | 21.66 | 22.5 | 0.056 | **0.07** | 0.03 | **0.04** | 0.13 |
| 21350 | 2560 | 50RB-Low Bottom | / | 21.66 | 22.5 | 0.674 | **0.82** | 0.33 | **0.34** | 0.07 |

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

©Copyright. All rights reserved by CTTL.

**Table 14.1-13: SAR Values (LTE Band13 - Head)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | | |
| 23230 | 782 | 1RB-Mid | Left | Cheek | Fig.13 | 23.17 | 24.5 | 0.172 | **0.23** | 0.109 | **0.11** | 0.07 |
| 23230 | 782 | 1RB-Mid | Left | Tilt | / | 23.17 | 24.5 | 0.099 | **0.13** | 0.057 | **0.06** | 0.03 |
| 23230 | 782 | 1RB-Mid | Right | Cheek | / | 23.17 | 24.5 | 0.158 | **0.21** | 0.1 | **0.10** | 0.04 |
| 23230 | 782 | 1RB-Mid | Right | Tilt | / | 23.17 | 24.5 | 0.126 | **0.17** | 0.068 | **0.07** | -0.08 |
| 23230 | 782 | 25RB-Low | Left | Cheek | / | 22.15 | 23.5 | 0.112 | **0.15** | 0.071 | **0.07** | 0.05 |
| 23230 | 782 | 25RB-Low | Left | Tilt | / | 22.15 | 23.5 | 0.063 | **0.09** | 0.037 | **0.04** | -0.06 |
| 23230 | 782 | 25RB-Low | Right | Cheek | / | 22.15 | 23.5 | 0.127 | **0.17** | 0.079 | **0.08** | -0.1 |
| 23230 | 782 | 25RB-Low | Right | Tilt | / | 22.15 | 23.5 | 0.081 | **0.11** | 0.044 | **0.04** | -0.06 |

Note1: The LTE mode is QPSK_10MHz.

**Table 14.1-14: SAR Values (LTE Band13 – Body)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 23230 | 782 | 1RB-Mid Front | / | 23.17 | 24.5 | 0.095 | **0.13** | 0.071 | **0.07** | -0.08 |
| 23230 | 782 | 1RB-Mid Rear | / | 23.17 | 24.5 | 0.163 | **0.22** | 0.12 | **0.12** | 0.04 |
| 23230 | 782 | 1RB-Mid Left | Fig.14 | 23.17 | 24.5 | 0.184 | **0.25** | 0.126 | **0.13** | 0.06 |
| 23230 | 782 | 1RB-Mid Right | / | 23.17 | 24.5 | 0.078 | **0.11** | 0.054 | **0.05** | 0.11 |
| 23230 | 782 | 1RB-Mid Top | / | 23.17 | 24.5 | 0.1 | **0.14** | 0.055 | **0.06** | -0.01 |
| 23230 | 782 | 25RB-Mid Front | / | 22.15 | 23.5 | 0.064 | **0.09** | 0.048 | **0.05** | -0.05 |
| 23230 | 782 | 25RB-Mid Rear | / | 22.15 | 23.5 | 0.108 | **0.15** | 0.079 | **0.08** | 0.07 |
| 23230 | 782 | 25RB-Mid Left | / | 22.15 | 23.5 | 0.117 | **0.16** | 0.079 | **0.08** | -0.15 |
| 23230 | 782 | 25RB-Mid Right | / | 22.15 | 23.5 | 0.051 | **0.07** | 0.036 | **0.04** | -0.02 |
| 23230 | 782 | 25RB-Mid Top | / | 22.15 | 23.5 | 0.063 | **0.09** | 0.035 | **0.04** | 0.05 |

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_10MHz.

©Copyright. All rights reserved by CTTL.

**Table 14.1-15: SAR Values (LTE Band41 - Head)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Side | Test Position | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | | |
| 41490 | 2680 | 1RB-Mid | Left | Cheek | / | 23.15 | 24 | 0.042 | **0.05** | 0.022 | **0.03** | 0.14 |
| 41055 | 2636.5 | 1RB-Mid | Left | Cheek | / | 23.33 | 24 | 0.053 | **0.06** | 0.027 | **0.03** | -0.02 |
| 40620 | 2593 | 1RB-Mid | Left | Cheek | Fig.15 | 22.94 | 24 | 0.059 | **0.08** | 0.03 | **0.04** | -0.09 |
| 40185 | 2549.5 | 1RB-Mid | Left | Cheek | / | 23.12 | 24 | 0.057 | **0.07** | 0.024 | **0.03** | -0.12 |
| 39750 | 2506 | 1RB-Mid | Left | Cheek | / | 22.41 | 24 | 0.038 | **0.05** | 0.02 | **0.03** | 0.07 |
| 41055 | 2636.5 | 1RB-Mid | Left | Tilt | / | 23.33 | 24 | 0.041 | **0.05** | 0.02 | **0.02** | 0.12 |
| 41055 | 2636.5 | 1RB-Mid | Right | Cheek | / | 23.33 | 24 | 0.044 | **0.05** | 0.023 | **0.03** | 0.01 |
| 41055 | 2636.5 | 1RB-Mid | Right | Tilt | / | 23.33 | 24 | 0.025 | **0.03** | 0.013 | **0.02** | -0.12 |
| 41055 | 2636.5 | 50RB-Mid | Left | Cheek | / | 22.13 | 23 | 0.038 | **0.05** | 0.02 | **0.02** | 0.1 |
| 41055 | 2636.5 | 50RB-Mid | Left | Tilt | / | 22.13 | 23 | 0.032 | **0.04** | 0.016 | **0.02** | 0.07 |
| 41055 | 2636.5 | 50RB-Mid | Right | Cheek | / | 22.13 | 23 | 0.032 | **0.04** | 0.016 | **0.02** | 0.12 |
| 41055 | 2636.5 | 50RB-Mid | Right | Tilt | / | 22.13 | 23 | <0.01 | <0.01 | <0.01 | <0.01 | / |

Note1: The LTE mode is QPSK_20MHz.

©Copyright. All rights reserved by CTTL.

**Table 14.1-16: SAR Values (LTE Band41 – Body)**

| Ambient Temperature: 22.9 °C | | Liquid Temperature: 22.5°C | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Mode | Figure No. | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 41055 | 2636.5 | 1RB-Middle Front | / | 21.42 | 23 | 0.287 | **0.41** | 0.142 | **0.15** | 0.1 |
| 41490 | 2680 | 1RB-Middle Rear | / | 21.18 | 23 | 0.42 | **0.64** | 0.181 | **0.19** | 0.12 |
| 41055 | 2636.5 | 1RB-Middle Rear | / | 21.42 | 23 | 0.666 | **0.96** | 0.291 | **0.31** | 0.03 |
| 40620 | 2593 | 1RB-Middle Rear | / | 21.36 | 23 | 0.63 | **0.92** | 0.268 | **0.29** | -0.08 |
| 40185 | 2549.5 | 1RB-Middle Rear | Fig.16 | 21.34 | 23 | 0.728 | **1.07** | 0.306 | **0.33** | 0.09 |
| 39750 | 2506 | 1RB-Middle Rear | / | 21.25 | 23 | 0.701 | **1.05** | 0.293 | **0.32** | 0.15 |
| 40185 | 2549.5 | 100RB Rear | / | 21.5 | 23 | 0.712 | **1.01** | 0.299 | **0.32** | 0.06 |
| 41055 | 2636.5 | 1RB-Middle Left | / | 21.42 | 23 | 0.053 | **0.08** | 0.028 | **0.03** | 0.03 |
| 41055 | 2636.5 | 1RB-Middle Right | / | 21.42 | 23 | 0.075 | **0.11** | 0.03 | **0.03** | -0.01 |
| 41055 | 2636.5 | 1RB-Middle Bottom | / | 21.42 | 23 | 0.524 | **0.75** | 0.239 | **0.25** | -0.08 |
| 41055 | 2636.5 | 50RB-Mid Front | / | 21.39 | 23 | 0.278 | **0.40** | 0.14 | **0.14** | -0.08 |
| 41490 | 2680 | 50RB-Low Rear | / | 21.1 | 23 | 0.412 | **0.64** | 0.175 | **0.18** | -0.04 |
| 41055 | 2636.5 | 50RB-Mid Rear | / | 21.39 | 23 | 0.658 | **0.95** | 0.285 | **0.31** | -0.04 |
| 40620 | 2593 | 50RB-High Rear | / | 21.17 | 23 | 0.617 | **0.94** | 0.262 | **0.28** | -0.11 |
| 40185 | 2549.5 | 50RB-Mid Rear | / | 21.31 | 23 | 0.713 | **1.05** | 0.287 | **0.31** | 0.06 |
| 39750 | 2506 | 50RB-High Rear | / | 21.15 | 23 | 0.681 | **1.04** | 0.284 | **0.31** | -0.07 |
| 41055 | 2636.5 | 50RB-Mid Left | / | 21.39 | 23 | 0.064 | **0.09** | 0.023 | **0.02** | 0.12 |
| 41055 | 2636.5 | 50RB-Mid Right | / | 21.39 | 23 | 0.049 | **0.07** | 0.028 | **0.03** | 0.01 |
| 41055 | 2636.5 | 50RB-Mid Bottom | / | 21.39 | 23 | 0.513 | **0.74** | 0.233 | **0.25** | -0.02 |

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

©Copyright. All rights reserved by CTTL.

## 14.2 WLAN Evaluation for WIFI

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac/ax modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n ac then ax) is selected.

SAR Test reduction was applied from KDB 248227 guidance, when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

**Table 14.2-1: SAR Values (WLAN2.4G - Head)– 802.11b**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency** | | **Side** | **Test Position** | **Note** | **Conducted Power (dBm)** | **Max. tune-up Power (dBm)** | **Measured SAR(1g) (W/kg)** | **Reported SAR(1g)(W/kg)** | **Measured SAR(10g) (W/kg)** | **Reported SAR(10g)(W/kg)** | **Power Drift (dB)** |
| Ch. | MHz | | | | | | | | | | |
| 6 | 2437 | Left | Cheek | Fig.17 | 17.48 | 18 | 0.536 | **0.60** | 0.26 | **0.26** | -0.06 |
| 6 | 2437 | Left | Tilt | / | 17.48 | 18 | 0.414 | **0.47** | 0.197 | **0.20** | 0.11 |
| 6 | 2437 | Right | Cheek | / | 17.48 | 18 | 0.227 | **0.26** | 0.123 | **0.12** | -0.12 |
| 6 | 2437 | Right | Tilt | / | 17.48 | 18 | 0.266 | **0.30** | 0.13 | **0.13** | 0.11 |

**Table 14.2-2: SAR Values (WLAN2.4G - Head) – 802.11b (Scaled Reported SAR)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Actual duty factor | maximum duty factor | Reported SAR (1g)(W/kg) | Scaled reported SAR (1g)(W/kg) |
| Ch. | MHz | | | | | | |
| 6 | 2437 | Left | Cheek | 100% | 100% | **0.60** | **0.60** |

SAR is not required for OFDM because the 802.11g adjusted SAR ≤ 1.2 W/kg.

©Copyright. All rights reserved by CTTL.

**Table 14.2-3: SAR Values (WLAN2.4G - Body)– 802.11b**

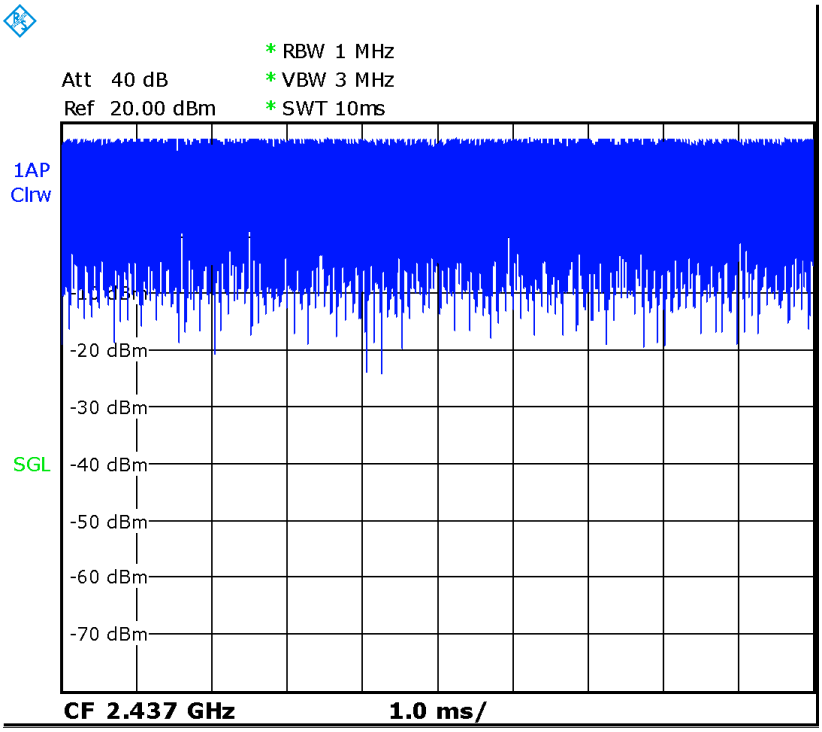
| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Test Position | Note | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g)(W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 6 | 2437 | Front | / | 17.48 | 18 | 0.146 | **0.16** | 0.073 | **0.07** | -0.11 |
| 6 | 2437 | Rear | Fig.18 | 17.48 | 18 | 0.209 | **0.24** | 0.1 | **0.10** | -0.09 |
| 6 | 2437 | Right | / | 17.48 | 18 | 0.16 | **0.18** | 0.076 | **0.08** | 0.1 |
| 6 | 2437 | Top | / | 17.48 | 18 | 0.162 | **0.18** | 0.08 | **0.08** | -0.13 |

Note: The distance between the EUT and the phantom bottom is 10mm.

**Table 14.2-4: SAR Values (WLAN2.4G - Body) – 802.11b (Scaled Reported SAR)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | | Test Position | Actual duty factor | maximum duty factor | Reported SAR (1g)(W/kg) | Scaled reported SAR (1g)(W/kg) |
| Ch. | MHz | | | | | |
| 6 | 2437 | Rear 10mm | 100% | 100% | **0.24** | **0.24** |

SAR is not required for OFDM because the 802.11g adjusted SAR ≤ 1.2 W/kg.




**Picture 14.2-1 Duty factor plot**

©Copyright. All rights reserved by CTTL.

**Table 14.2-5: SAR Values (WLAN5G - Head)– 802.11ac 80M**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Note | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g)(W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | | |
| 42 | 5210 | Left | Cheek | / | 14.63 | 15.5 | 0.174 | **0.21** | 0.052 | **0.06** | 0.06 |
| 58 | 5290 | Left | Cheek | / | 14.82 | 15.5 | 0.181 | **0.21** | 0.054 | **0.06** | -0.15 |
| 58 | 5290 | Left | Tilt | / | 14.82 | 15.5 | 0.235 | **0.27** | 0.067 | **0.08** | -0.12 |
| 58 | 5290 | Right | Cheek | / | 14.82 | 15.5 | 0.114 | **0.13** | 0.036 | **0.04** | -0.12 |
| 58 | 5290 | Right | Tilt | / | 14.82 | 15.5 | 0.139 | **0.16** | 0.044 | **0.05** | -0.05 |
| 122 | 5610 | Left | Cheek | / | 14.58 | 15.5 | 0.37 | **0.46** | 0.101 | **0.12** | 0.02 |
| 106 | 5530 | Left | Tilt | / | 14.73 | 15.5 | 0.294 | **0.35** | 0.086 | **0.10** | -0.09 |
| 122 | 5610 | Left | Tilt | / | 14.58 | 15.5 | 0.374 | **0.46** | 0.101 | **0.12** | 0.15 |
| 138 | 5690 | Left | Tilt | Fig.19 | 14.94 | 15.5 | 0.425 | **0.48** | 0.118 | **0.13** | -0.09 |
| 122 | 5610 | Right | Cheek | / | 14.58 | 15.5 | 0.141 | **0.17** | 0.049 | **0.06** | -0.15 |
| 122 | 5610 | Right | Tilt | / | 14.58 | 15.5 | 0.169 | **0.21** | 0.058 | **0.07** | -0.05 |
| 155 | 5775 | Left | Cheek | / | 14.42 | 15.5 | 0.296 | **0.38** | 0.085 | **0.11** | -0.14 |
| 155 | 5775 | Left | Tilt | / | 14.42 | 15.5 | 0.303 | **0.39** | 0.083 | **0.11** | 0.1 |
| 155 | 5775 | Right | Cheek | / | 14.42 | 15.5 | 0.11 | **0.14** | 0.038 | **0.05** | -0.02 |
| 155 | 5775 | Right | Tilt | / | 14.42 | 15.5 | 0.117 | **0.15** | 0.04 | **0.05** | -0.04 |

**Table 14.2-6: SAR Values (WLAN5G - Head) – 802.11ac 80M (Scaled Reported SAR)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Actual duty factor | maximum duty factor | Reported SAR (1g)(W/kg) | Scaled reported SAR (1g)(W/kg) |
| Ch. | MHz | | | | | | |
| 138 | 5690 | Left | Tilt | 100% | 100% | **0.48** | **0.48** |

©Copyright. All rights reserved by CTTL.

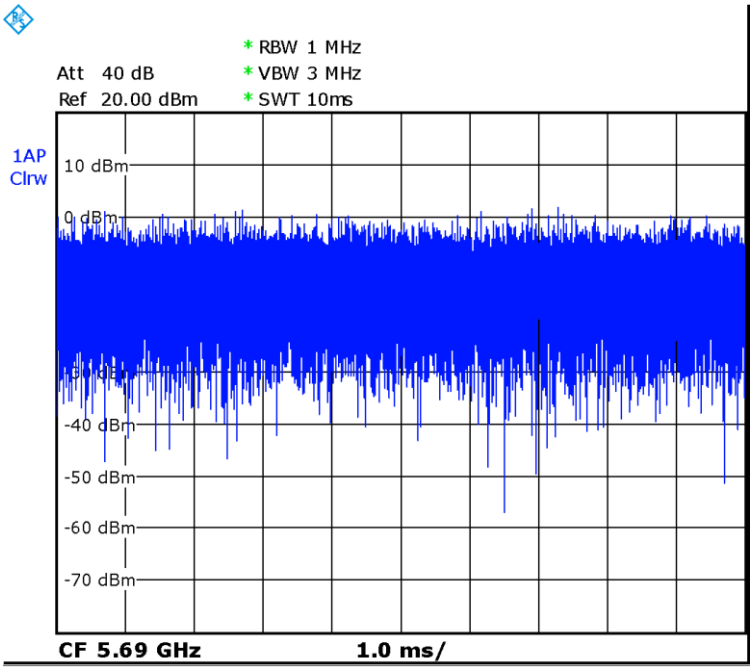
**Table 14.2-7: SAR Values (WLAN5G - Body)– 802.11ac 80M**

| Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Test Position | Note | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g)(W/kg) | Measured SAR(10g) (W/kg) | Reported SAR(10g)(W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 58 | 5290 | Front | / | 14.82 | 15.5 | 0.06 | **0.07** | 0.016 | **0.02** | -0.09 |
| 58 | 5290 | Rear | / | 14.82 | 15.5 | 0.128 | **0.15** | 0.046 | **0.05** | -0.05 |
| 58 | 5290 | Right | / | 14.82 | 15.5 | 0.088 | **0.10** | 0.029 | **0.03** | -0.12 |
| 58 | 5290 | Top | / | 14.82 | 15.5 | 0.119 | **0.14** | 0.041 | **0.05** | 0.03 |
| 138 | 5690 | Front | / | 14.94 | 15.5 | 0.14 | **0.16** | 0.051 | **0.06** | 0.15 |
| 138 | 5690 | Rear | / | 14.94 | 15.5 | 0.145 | **0.16** | 0.055 | **0.06** | 0.07 |
| 138 | 5690 | Right | / | 14.94 | 15.5 | 0.162 | **0.18** | 0.058 | **0.07** | 0.04 |
| 138 | 5690 | Top | Fig.20 | 14.94 | 15.5 | 0.212 | **0.24** | 0.072 | **0.08** | -0.09 |
| 155 | 5775 | Front | / | 14.42 | 15.5 | 0.118 | **0.15** | 0.04 | **0.05** | 0.06 |
| 155 | 5775 | Rear | / | 14.42 | 15.5 | 0.066 | **0.08** | 0.023 | **0.03** | 0.02 |
| 155 | 5775 | Right | / | 14.42 | 15.5 | 0.142 | **0.18** | 0.048 | **0.06** | -0.09 |
| 155 | 5775 | Top | / | 14.42 | 15.5 | 0.109 | **0.14** | 0.024 | **0.03** | -0.04 |

Note: The distance between the EUT and the phantom bottom is 10mm.

**Table 14.2-8: SAR Values (WLAN5G - Body) – 802.11ac 80M (Scaled Reported SAR)**

| Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | | Test Position | Actual duty factor | maximum duty factor | Reported SAR (1g)(W/kg) | Scaled reported SAR (1g)(W/kg) |
| Ch. | MHz | | | | | |
| 138 | 5690 | Rear 10mm | 100% | 100% | **0.24** | **0.24** |




**Picture 14.2-2 Duty factor plot**

©Copyright. All rights reserved by CTTL.

## 14.3 WLAN Evaluation For BT

**Table 14.3-1: SAR Values (BT - Head)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Side | Test Position | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Measured SAR(1g) (W/kg) | Reported SAR(1g)( W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | | |
| 78 | 2480 | Left | Cheek | 9.72 | 11 | 0.061 | **0.08** | 0.028 | **0.04** | 0.04 |
| 78 | 2480 | Left | Tilt | 9.72 | 11 | 0.041 | **0.06** | 0.02 | **0.03** | 0.13 |
| 78 | 2480 | Right | Cheek | 9.72 | 11 | <0.01 | <0.01 | <0.01 | <0.01 | / |
| 78 | 2480 | Right | Tilt | 9.72 | 11 | <0.01 | <0.01 | <0.01 | <0.01 | / |

**Table 14.3-2: SAR Values (BT - Body)**

| Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | | Test Position | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(10g) (W/kg) | Reported SAR(10g) (W/kg) | Measured SAR(1g) (W/kg) | Reported SAR(1g)( W/kg) | Power Drift (dB) |
| Ch. | MHz | | | | | | | | |
| 78 | 2480 | Front | 9.72 | 11 | <0.01 | <0.01 | <0.01 | <0.01 | / |
| 78 | 2480 | Rear | 9.72 | 11 | 0.01 | **0.01** | 0 | **0.00** | 0.05 |
| 78 | 2480 | Left | 9.72 | 11 | <0.01 | <0.01 | <0.01 | <0.01 | / |
| 78 | 2480 | Top | 9.72 | 11 | <0.01 | <0.01 | <0.01 | <0.01 | / |

Note1: The distance between the EUT and the phantom bottom is 10mm

©Copyright. All rights reserved by CTTL.

# 15 SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20

**Table 15.1: SAR Measurement Variability for Head&Body**

| Frequency | | Mode | Test Position | Spacing (mm) | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | |
| GSM850 | 848.8 | Speech | Right Cheek | 0 | 0.8 | 0.784 | 1.02 | / |
| GSM1900 | 1850.2 | GPRS(2) | Bottom | 10 | 0.801 | 0.789 | 1.02 | / |
| WCDMA B2 | 1852.4 | RMC | Rear | 10 | 1.04 | 1.01 | 1.03 | / |
| WCDMA B2 | 1852.4 | RMC | Bottom | 10 | 1.01 | 0.989 | 1.02 | / |
| LTE B7 | 2535 | 1RB-Mid | Rear | 10 | 0.868 | 0.854 | 1.02 | / |

©Copyright. All rights reserved by CTTL.

# 16 Measurement Uncertainty

## 16.1 Measurement Uncertainty for Normal SAR Tests (300MHz~3GHz)

| No. | Error Description | Type | Uncertainty value | Probably Distribution | Div. | (Ci) 1g | (Ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) | Degree of freedom |
|---|---|---|---|---|---|---|---|---|---|---|
| **Measurement system** | | | | | | | | | | |
| 1 | Probe calibration | B | 6.0 | N | 1 | 1 | 1 | 6.0 | 6.0 | ∞ |
| 2 | Isotropy | B | 4.7 | R | √3 | 0.7 | 0.7 | 1.9 | 1.9 | ∞ |
| 3 | Boundary effect | B | 1.0 | R | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| 4 | Linearity | B | 4.7 | R | √3 | 1 | 1 | 2.7 | 2.7 | ∞ |
| 5 | Detection limit | B | 1.0 | N | 1 | 1 | 1 | 0.6 | 0.6 | ∞ |
| 6 | Readout electronics | B | 0.3 | R | √3 | 1 | 1 | 0.3 | 0.3 | ∞ |
| 7 | Response time | B | 0.8 | R | √3 | 1 | 1 | 0.5 | 0.5 | ∞ |
| 8 | Integration time | B | 2.6 | R | √3 | 1 | 1 | 1.5 | 1.5 | ∞ |
| 9 | RF ambient conditions-noise | B | 0 | R | √3 | 1 | 1 | 0 | 0 | ∞ |
| 10 | RFambient conditions-reflection | B | 0 | R | √3 | 1 | 1 | 0 | 0 | ∞ |
| 11 | Probe positioned mech. restrictions | B | 0.4 | R | √3 | 1 | 1 | 0.2 | 0.2 | ∞ |
| 12 | Probe positioning with respect to phantom shell | B | 2.9 | R | √3 | 1 | 1 | 1.7 | 1.7 | ∞ |
| 13 | Post-processing | B | 1.0 | R | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| **Test sample related** | | | | | | | | | | |
| 14 | Test sample positioning | A | 3.3 | N | 1 | 1 | 1 | 3.3 | 3.3 | 71 |
| 15 | Device holder uncertainty | A | 3.4 | N | 1 | 1 | 1 | 3.4 | 3.4 | 5 |
| 16 | Drift of output power | B | 5.0 | R | √3 | 1 | 1 | 2.9 | 2.9 | ∞ |
| **Phantom and set-up** | | | | | | | | | | |
| 17 | Phantom uncertainty | B | 4.0 | R | √3 | 1 | 1 | 2.3 | 2.3 | ∞ |
| 18 | Liquid conductivity (target) | B | 5.0 | R | √3 | 0.64 | 0.43 | 1.8 | 1.2 | ∞ |
| 19 | Liquid conductivity (meas.) | A | 2.06 | N | 1 | 0.64 | 0.43 | 1.32 | 0.89 | 43 |
| 20 | Liquid permittivity (target) | B | 5.0 | R | √3 | 0.6 | 0.49 | 1.7 | 1.4 | ∞ |
| 21 | Liquid permittivity (meas.) | A | 1.6 | N | 1 | 0.6 | 0.49 | 1.0 | 0.8 | 521 |

©Copyright. All rights reserved by CTTL.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Combined standard uncertainty | $u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$ | | | | | 9.55 | 9.43 | 257 |
| Expanded uncertainty (confidence interval of 95 %) | $u_e = 2u_c$ | | | | | 19.1 | 18.9 | |

## 16.2 Measurement Uncertainty for Normal SAR Tests (3~6GHz)

| No. | Error Description | Type | Uncertainty value | Probably Distribution | Div. | (Ci) 1g | (Ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) | Degree of freedom |
|---|---|---|---|---|---|---|---|---|---|---|
| **Measurement system** | | | | | | | | | | |
| 1 | Probe calibration | B | 6.55 | N | 1 | 1 | 1 | 6.55 | 6.55 | ∞ |
| 2 | Isotropy | B | 4.7 | R | √3 | 0.7 | 0.7 | 1.9 | 1.9 | ∞ |
| 3 | Boundary effect | B | 2.0 | R | √3 | 1 | 1 | 1.2 | 1.2 | ∞ |
| 4 | Linearity | B | 4.7 | R | √3 | 1 | 1 | 2.7 | 2.7 | ∞ |
| 5 | Detection limit | B | 1.0 | R | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| 6 | Readout electronics | B | 0.3 | R | √3 | 1 | 1 | 0.3 | 0.3 | ∞ |
| 7 | Response time | B | 0.8 | R | √3 | 1 | 1 | 0.5 | 0.5 | ∞ |
| 8 | Integration time | B | 2.6 | R | √3 | 1 | 1 | 1.5 | 1.5 | ∞ |
| 9 | RF ambient conditions-noise | B | 0 | R | √3 | 1 | 1 | 0 | 0 | ∞ |
| 10 | RFambient conditions-reflection | B | 0 | R | √3 | 1 | 1 | 0 | 0 | ∞ |
| 11 | Probe positioned mech. restrictions | B | 0.8 | R | √3 | 1 | 1 | 0.5 | 0.5 | ∞ |
| 12 | Probe positioning with respect to phantom shell | B | 6.7 | R | √3 | 1 | 1 | 3.9 | 3.9 | ∞ |
| 13 | Post-processing | B | 4.0 | R | √3 | 1 | 1 | 2.3 | 2.3 | ∞ |
| **Test sample related** | | | | | | | | | | |
| 14 | Test sample positioning | A | 3.3 | N | 1 | 1 | 1 | 3.3 | 3.3 | 71 |
| 15 | Device holder uncertainty | A | 3.4 | N | 1 | 1 | 1 | 3.4 | 3.4 | 5 |
| 16 | Drift of output power | B | 5.0 | R | √3 | 1 | 1 | 2.9 | 2.9 | ∞ |
| **Phantom and set-up** | | | | | | | | | | |
| 17 | Phantom uncertainty | B | 4.0 | R | √3 | 1 | 1 | 2.3 | 2.3 | ∞ |
| 18 | Liquid conductivity (target) | B | 5.0 | R | √3 | 0.64 | 0.43 | 1.8 | 1.2 | ∞ |
| 19 | Liquid conductivity (meas.) | A | 2.06 | N | 1 | 0.64 | 0.43 | 1.32 | 0.89 | 43 |
| 20 | Liquid permittivity (target) | B | 5.0 | R | √3 | 0.6 | 0.49 | 1.7 | 1.4 | ∞ |

©Copyright. All rights reserved by CTTL.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Liquid permittivity (meas.) | A | 1.6 | N | 1 | 0.6 | 0.49 | 1.0 | 0.8 | 521 |
| Combined standard uncertainty | | $u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$ | | | | | | 10.7 | 10.6 | 257 |
| Expanded uncertainty (confidence interval of 95 %) | | $u_e = 2u_c$ | | | | | | 21.4 | 21.1 | |

## 16.3 Measurement Uncertainty for Fast SAR Tests (300MHz~3GHz)

| No. | Error Description | Type | Uncertainty value | Probably Distribution | Div. | (Ci) 1g | (Ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) | Degree of freedom |
|---|---|---|---|---|---|---|---|---|---|---|
| **Measurement system** | | | | | | | | | | |
| 1 | Probe calibration | B | 6.0 | N | 1 | 1 | 1 | 6.0 | 6.0 | ∞ |
| 2 | Isotropy | B | 4.7 | R | √3 | 0.7 | 0.7 | 1.9 | 1.9 | ∞ |
| 3 | Boundary effect | B | 1.0 | R | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| 4 | Linearity | B | 4.7 | R | √3 | 1 | 1 | 2.7 | 2.7 | ∞ |
| 5 | Detection limit | B | 1.0 | R | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| 6 | Readout electronics | B | 0.3 | R | √3 | 1 | 1 | 0.3 | 0.3 | ∞ |
| 7 | Response time | B | 0.8 | R | √3 | 1 | 1 | 0.5 | 0.5 | ∞ |
| 8 | Integration time | B | 2.6 | R | √3 | 1 | 1 | 1.5 | 1.5 | ∞ |
| 9 | RF ambient conditions-noise | B | 0 | R | √3 | 1 | 1 | 0 | 0 | ∞ |
| 10 | RFambient conditions-reflection | B | 0 | R | √3 | 1 | 1 | 0 | 0 | ∞ |
| 11 | Probe positioned mech. Restrictions | B | 0.4 | R | √3 | 1 | 1 | 0.2 | 0.2 | ∞ |
| 12 | Probe positioning with respect to phantom shell | B | 2.9 | R | √3 | 1 | 1 | 1.7 | 1.7 | ∞ |
| 13 | Post-processing | B | 1.0 | R | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| 14 | Fast SAR z-Approximation | B | 7.0 | R | √3 | 1 | 1 | 4.0 | 4.0 | ∞ |
| **Test sample related** | | | | | | | | | | |
| 15 | Test sample positioning | A | 3.3 | N | 1 | 1 | 1 | 3.3 | 3.3 | 71 |
| 16 | Device holder uncertainty | A | 3.4 | N | 1 | 1 | 1 | 3.4 | 3.4 | 5 |
| 17 | Drift of output power | B | 5.0 | R | √3 | 1 | 1 | 2.9 | 2.9 | ∞ |
| **Phantom and set-up** | | | | | | | | | | |
| 18 | Phantom uncertainty | B | 4.0 | R | √3 | 1 | 1 | 2.3 | 2.3 | ∞ |
| 19 | Liquid conductivity (target) | B | 5.0 | R | √3 | 0.64 | 0.43 | 1.8 | 1.2 | ∞ |

©Copyright. All rights reserved by CTTL.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | Liquid conductivity (meas.) | A | 2.06 | N | 1 | 0.64 | 0.43 | 1.32 | 0.89 | 43 |
| 21 | Liquid permittivity (target) | B | 5.0 | R | $\sqrt{3}$ | 0.6 | 0.49 | 1.7 | 1.4 | ∞ |
| 22 | Liquid permittivity (meas.) | A | 1.6 | N | 1 | 0.6 | 0.49 | 1.0 | 0.8 | 521 |
| Combined standard uncertainty | | $u_c' = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$ | | | | | | 10.4 | 10.3 | 257 |
| Expanded uncertainty (confidence interval of 95 %) | | $u_e = 2u_c$ | | | | | | 20.8 | 20.6 | |

## 16.4 Measurement Uncertainty for Fast SAR Tests (3~6GHz)

| No. | Error Description | Type | Uncertainty value | Probably Distribution | Div. | (Ci) 1g | (Ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) | Degree of freedom |
|---|---|---|---|---|---|---|---|---|---|---|
| **Measurement system** | | | | | | | | | | |
| 1 | Probe calibration | B | 6.55 | N | 1 | 1 | 1 | 6.55 | 6.55 | ∞ |
| 2 | Isotropy | B | 4.7 | R | $\sqrt{3}$ | 0.7 | 0.7 | 1.9 | 1.9 | ∞ |
| 3 | Boundary effect | B | 2.0 | R | $\sqrt{3}$ | 1 | 1 | 1.2 | 1.2 | ∞ |
| 4 | Linearity | B | 4.7 | R | $\sqrt{3}$ | 1 | 1 | 2.7 | 2.7 | ∞ |
| 5 | Detection limit | B | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 | ∞ |
| 6 | Readout electronics | B | 0.3 | R | $\sqrt{3}$ | 1 | 1 | 0.3 | 0.3 | ∞ |
| 7 | Response time | B | 0.8 | R | $\sqrt{3}$ | 1 | 1 | 0.5 | 0.5 | ∞ |
| 8 | Integration time | B | 2.6 | R | $\sqrt{3}$ | 1 | 1 | 1.5 | 1.5 | ∞ |
| 9 | RF ambient conditions-noise | B | 0 | R | $\sqrt{3}$ | 1 | 1 | 0 | 0 | ∞ |
| 10 | RFambient conditions-reflection | B | 0 | R | $\sqrt{3}$ | 1 | 1 | 0 | 0 | ∞ |
| 11 | Probe positioned mech. Restrictions | B | 0.8 | R | $\sqrt{3}$ | 1 | 1 | 0.5 | 0.5 | ∞ |
| 12 | Probe positioning with respect to phantom shell | B | 6.7 | R | $\sqrt{3}$ | 1 | 1 | 3.9 | 3.9 | ∞ |
| 13 | Post-processing | B | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 | ∞ |
| 14 | Fast SAR z-Approximation | B | 14.0 | R | $\sqrt{3}$ | 1 | 1 | 8.1 | 8.1 | ∞ |
| **Test sample related** | | | | | | | | | | |
| 15 | Test sample positioning | A | 3.3 | N | 1 | 1 | 1 | 3.3 | 3.3 | 71 |
| 16 | Device holder uncertainty | A | 3.4 | N | 1 | 1 | 1 | 3.4 | 3.4 | 5 |

©Copyright. All rights reserved by CTTL.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | Drift of output power | B | 5.0 | R | $\sqrt{3}$ | 1 | 1 | 2.9 | 2.9 | ∞ |
| **Phantom and set-up** | | | | | | | | | | |
| 18 | Phantom uncertainty | B | 4.0 | R | $\sqrt{3}$ | 1 | 1 | 2.3 | 2.3 | ∞ |
| 19 | Liquid conductivity (target) | B | 5.0 | R | $\sqrt{3}$ | 0.64 | 0.43 | 1.8 | 1.2 | ∞ |
| 20 | Liquid conductivity (meas.) | A | 2.06 | N | 1 | 0.64 | 0.43 | 1.32 | 0.89 | 43 |
| 21 | Liquid permittivity (target) | B | 5.0 | R | $\sqrt{3}$ | 0.6 | 0.49 | 1.7 | 1.4 | ∞ |
| 22 | Liquid permittivity (meas.) | A | 1.6 | N | 1 | 0.6 | 0.49 | 1.0 | 0.8 | 521 |
| Combined standard uncertainty | | $u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$ | | | | | | 13.5 | 13.4 | 257 |
| Expanded uncertainty (confidence interval of 95 %) | | $u_e = 2u_c$ | | | | | | 27.0 | 26.8 | |

©Copyright. All rights reserved by CTTL.

# 17 MAIN TEST INSTRUMENTS

**Table 17.1: List of Main Instruments**

| No. | Name | Type | Serial Number | Calibration Date | Valid Period |
|---|---|---|---|---|---|
| 01 | Network analyzer | E5071C | MY46110673 | January 14, 2022 | One year |
| 02 | Power sensor | NRP110T | 101139 | January 13, 2022 | One year |
| 03 | Power sensor | NRP110T | 101159 | | |
| 04 | Signal Generator | E4438C | MY49071430 | January 13, 2022 | One year |
| 05 | Amplifier | 60S1G4 | 0331848 | No Calibration Requested | |
| 06 | BTS | CMW500 | 159850 | January 24, 2022 | One year |
| 07 | E-field Probe | SPEAG EX3DV4 | 7548 | August 1, 2022 | One year |
| 08 | DAE | SPEAG DAE4 | 1331 | September 15, 2022 | One year |
| 09 | Dipole Validation Kit | SPEAG D750V3 | 1017 | July 20,,2022 | One year |
| 10 | Dipole Validation Kit | SPEAG D835V2 | 4d069 | July 20,,2022 | One year |
| 12 | Dipole Validation Kit | SPEAG D1900V2 | 5d101 | July 26,2022 | One year |
| 13 | Dipole Validation Kit | SPEAG D2450V2 | 853 | July 20,2022 | One year |
| 14 | Dipole Validation Kit | SPEAG D2600V2 | 1012 | July 20,2022 | One year |
| 15 | Dipole Validation Kit | SPEAG D5GHzV2 | 1060 | July 5,2022 | One year |

***END OF REPORT BODY***

©Copyright. All rights reserved by CTTL.

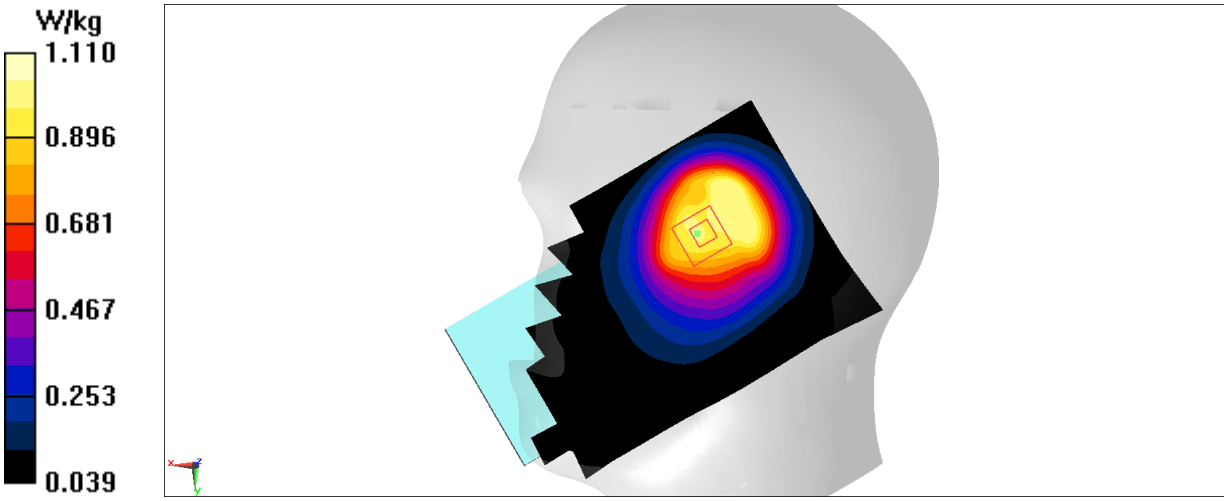
# ANNEX A Graph Results

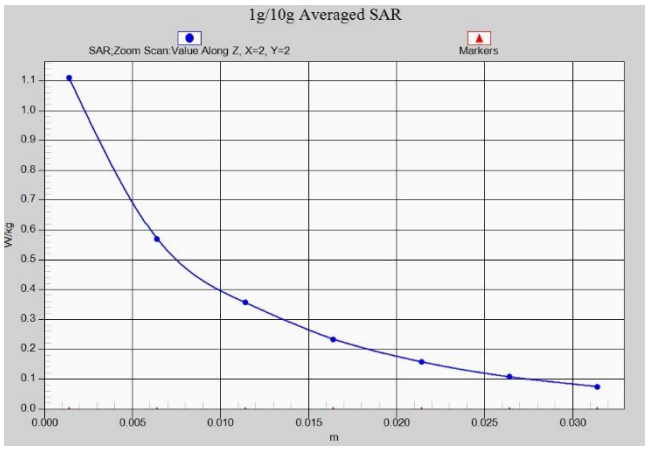
**GSM850 Head**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 848.8 MHz; $\sigma$ = 0.919 S/m; $\varepsilon_r$ = 42.759; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: GSM850 848.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.23 W/kg

**Zoom Scan (6x7x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.83 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.40 W/kg
**SAR(1 g) = 0.800 W/kg; SAR(10 g) = 0.552 W/kg**

Maximum value of SAR (measured) = 1.11 W/kg



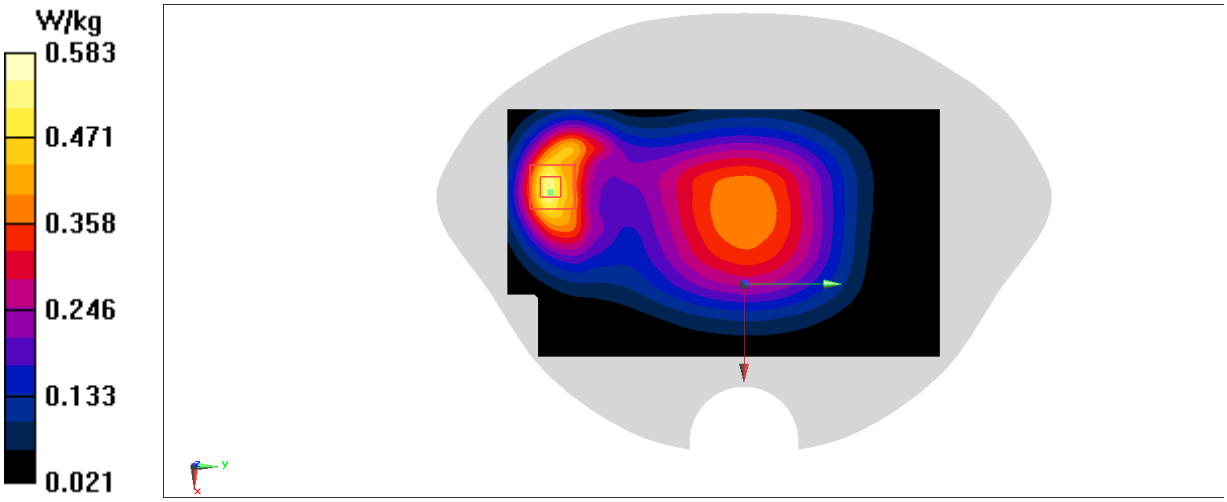



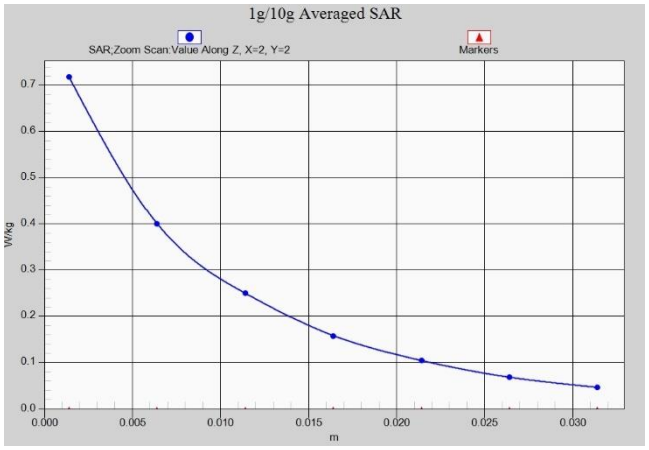

©Copyright. All rights reserved by CTTL.

**GSM850 Body**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 848.8 MHz; $\sigma$ = 0.919 S/m; $\varepsilon_r$ = 42.759; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: GSM850 2TX 848.8 MHz Duty Cycle: 1:4.00037
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.527 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.07 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.712 W/kg
**SAR(1 g) = 0.376 W/kg; SAR(10 g) = 0.214 W/kg**
Maximum value of SAR (measured) = 0.583 W/kg



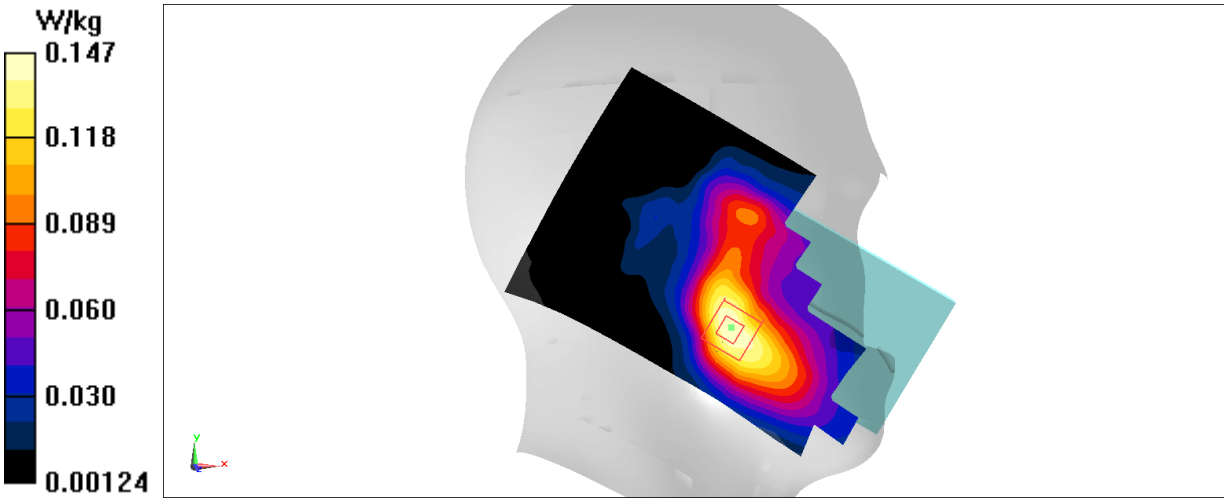



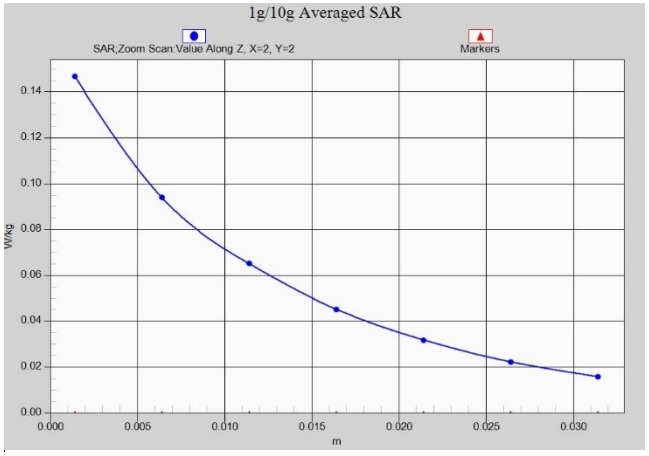

©Copyright. All rights reserved by CTTL.

**GSM1900 Head**
Date: 12/19/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.388 S/m; $\varepsilon_r$ = 40.622; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: GSM1900 1880 MHz Duty Cycle: 1:4.00037
Probe: EX3DV4 - SN7548 ConvF(7.8, 7.8, 7.8)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.150 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.190 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.171 W/kg
**SAR(1 g) = 0.109 W/kg; SAR(10 g) = 0.070 W/kg**
Maximum value of SAR (measured) = 0.147 W/kg



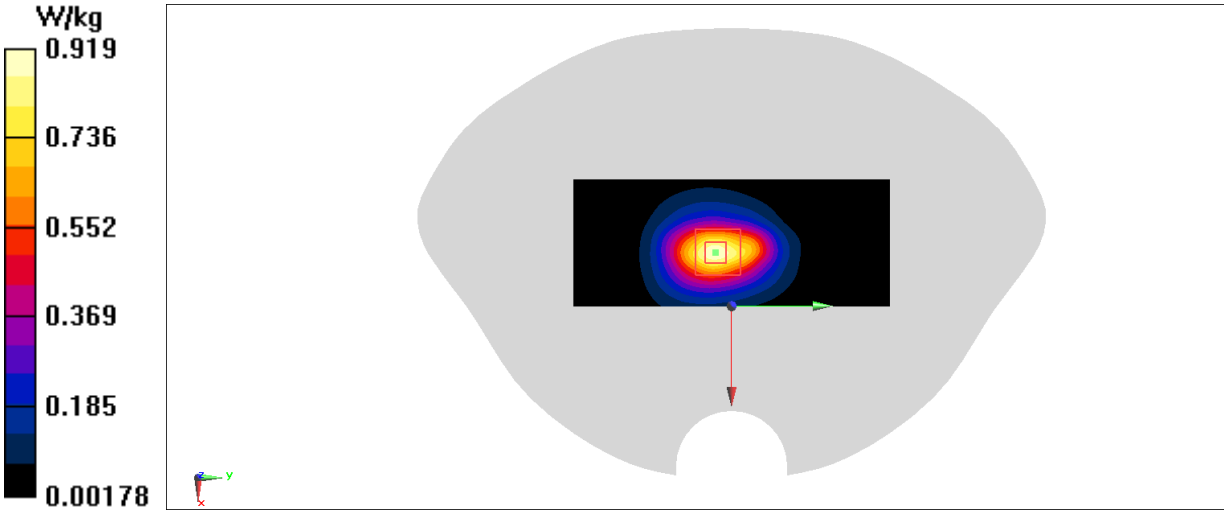



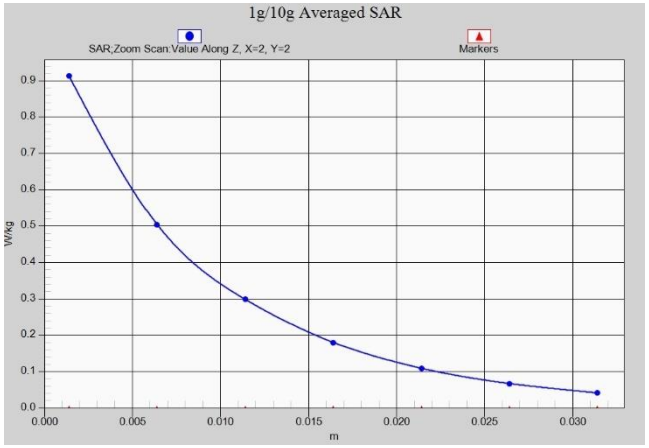

©Copyright. All rights reserved by CTTL.

**GSM1900 Body**
Date: 12/19/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 1850 MHz; $\sigma$ = 1.368 S/m; $\varepsilon_r$ = 40.649; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: GSM1900 2TX 1850.2 MHz Duty Cycle: 1:4.00037
Probe: EX3DV4 - SN7548 ConvF(7.8, 7.8, 7.8)

**Area Scan (41x101x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.919 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.13 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.09 W/kg
**SAR(1 g) = 0.601 W/kg; SAR(10 g) = 0.332 W/kg**
Maximum value of SAR (measured) = 0.913 W/kg



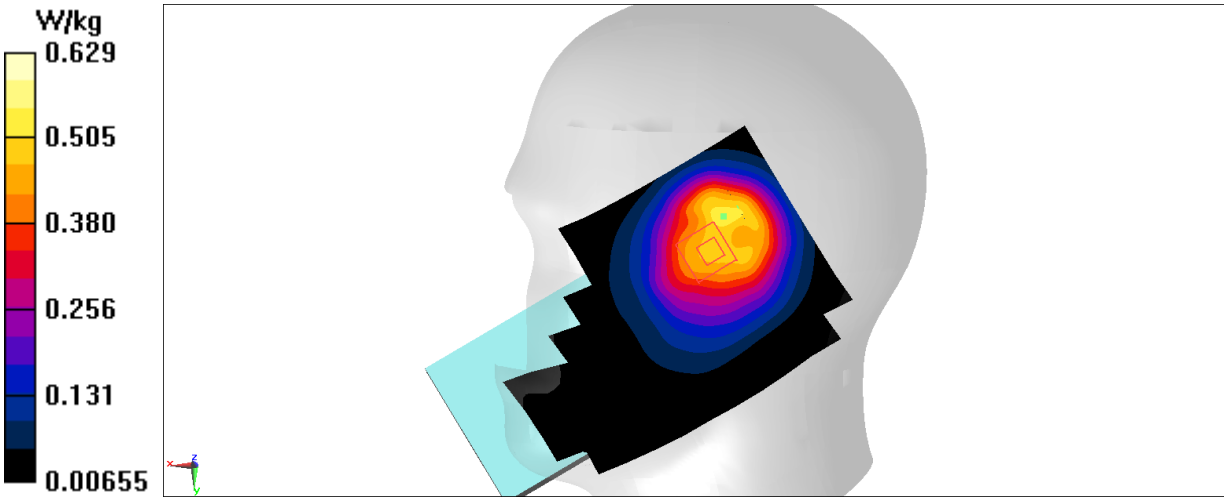

©Copyright. All rights reserved by CTTL.

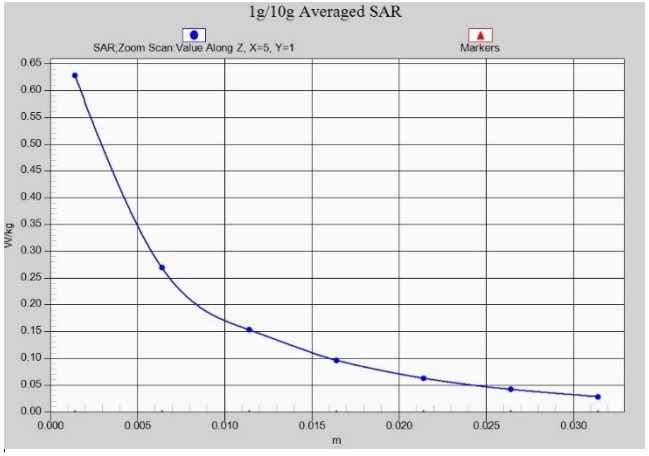
**WCDMA850 Head**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 846.6 MHz; $\sigma$ = 0.917 S/m; $\varepsilon$ r = 42.758; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA850(B5) 846.6 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.544 W/kg

**Zoom Scan (9x7x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.34 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.816 W/kg
**SAR(1 g) = 0.378 W/kg; SAR(10 g) = 0.261 W/kg**

Maximum value of SAR (measured) = 0.629 W/kg



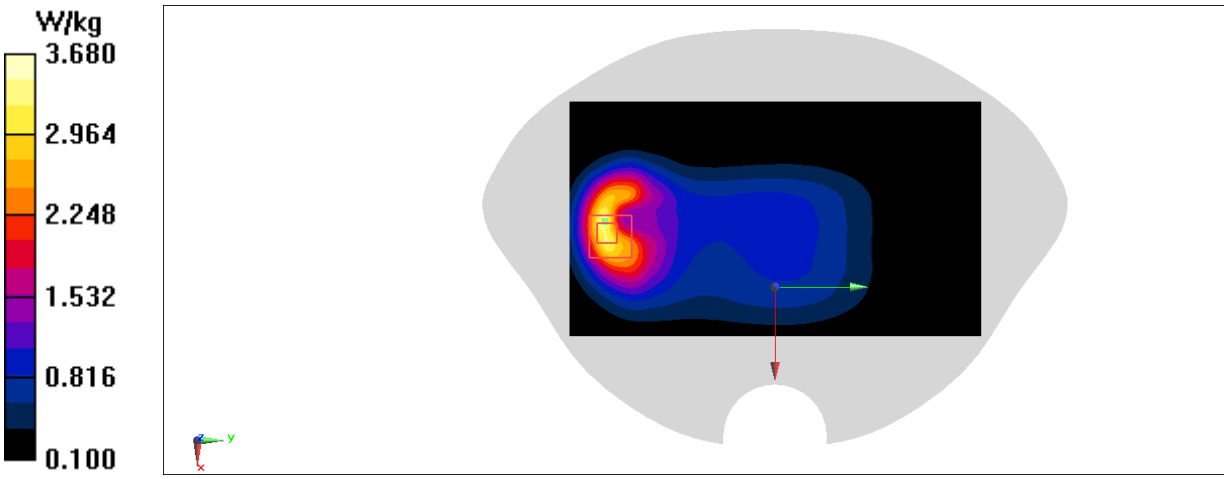



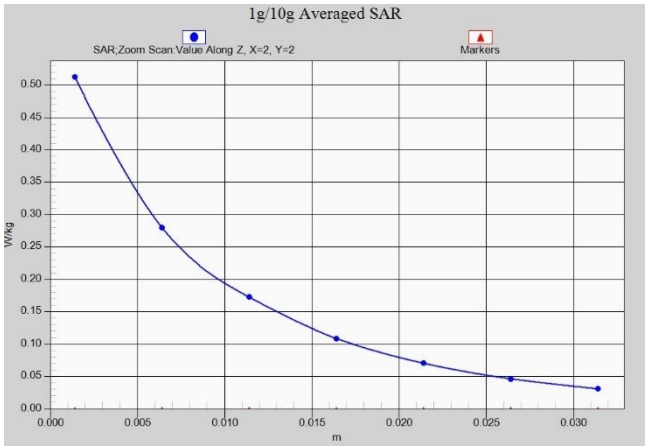

©Copyright. All rights reserved by CTTL.

**WCDMA850 Body**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 836.6 MHz; $\sigma$ = 0.914 S/m; $\varepsilon_r$ = 42.73; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA850(B5) 836.6 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.543 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.70 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.643 W/kg
**SAR(1 g) = 0.386 W/kg; SAR(10 g) = 0.215 W/kg**
Maximum value of SAR (measured) = 0.513 W/kg



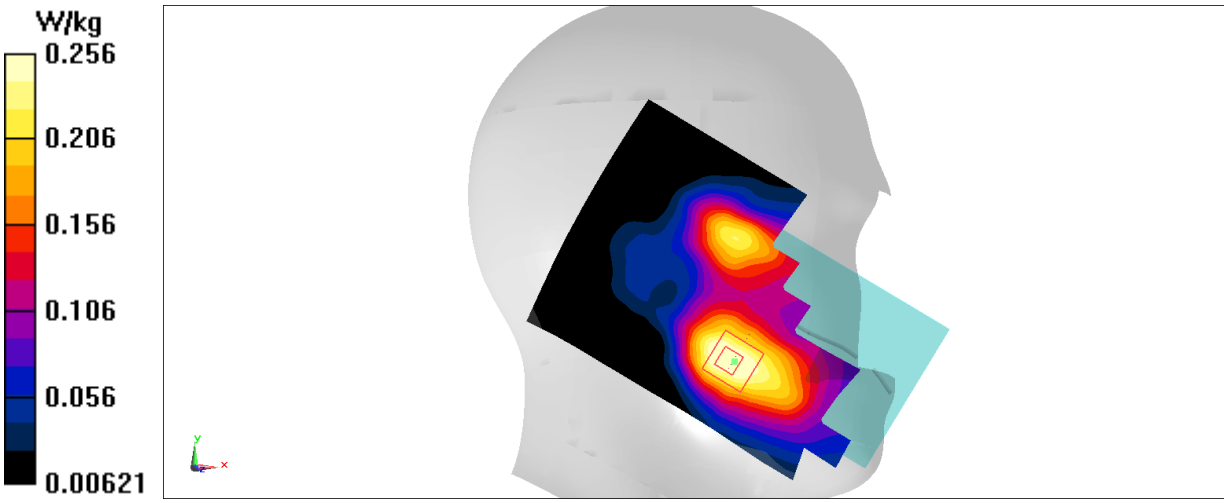



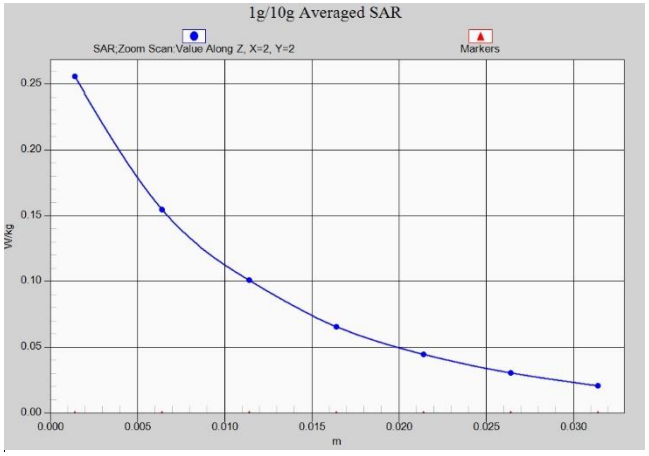

©Copyright. All rights reserved by CTTL.

**WCDMA1900 Head**
Date: 12/19/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.388 S/m; $\varepsilon_r$ = 40.622; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA1900(B2) 1880 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.8, 7.8, 7.8)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.273 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.168 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.300 W/kg
**SAR(1 g) = 0.182 W/kg; SAR(10 g) = 0.115 W/kg**
Maximum value of SAR (measured) = 0.256 W/kg



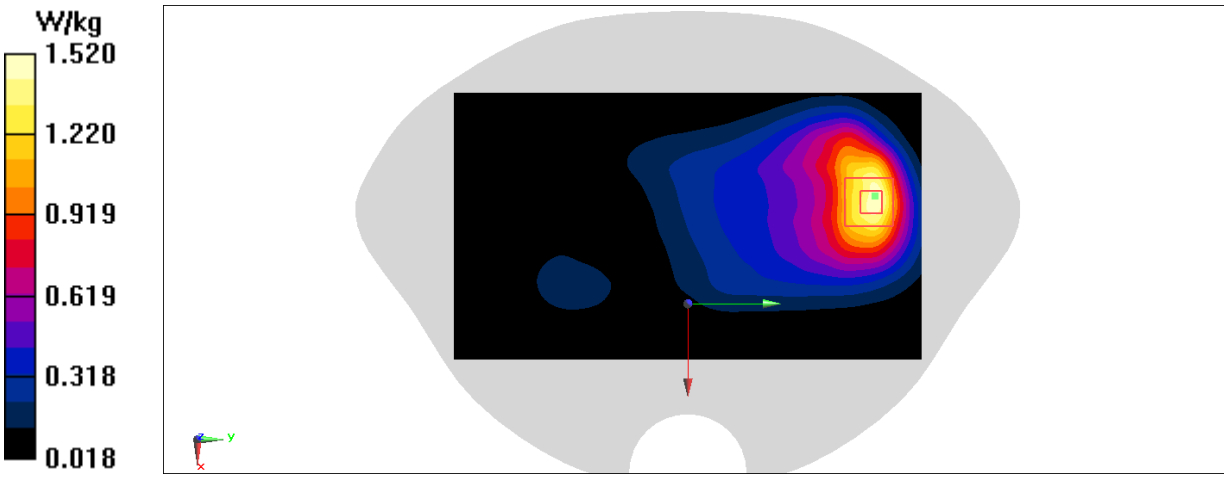

©Copyright. All rights reserved by CTTL.

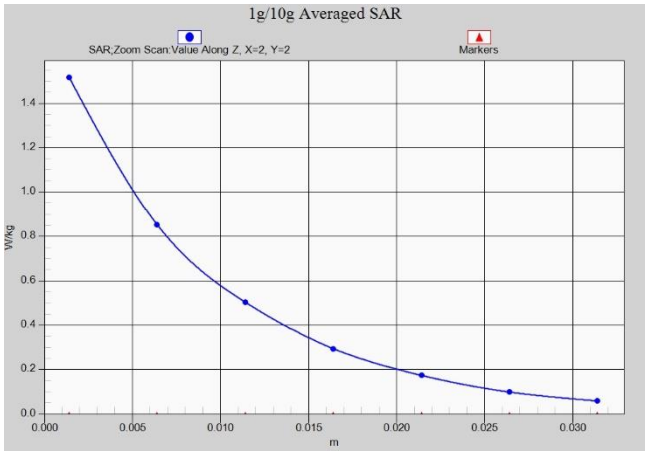
**WCDMA1900 Body**
Date: 12/19/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f =1852.4 MHz; $\sigma$ =1.369 S/m; $\varepsilon_r$ =40.643; $\rho$ =1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA1900(B2) 1852.4 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.8, 7.8, 7.8)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.52 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.70 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 1.85 W/kg
**SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.598 W/kg**

Maximum value of SAR (measured) = 1.52 W/kg



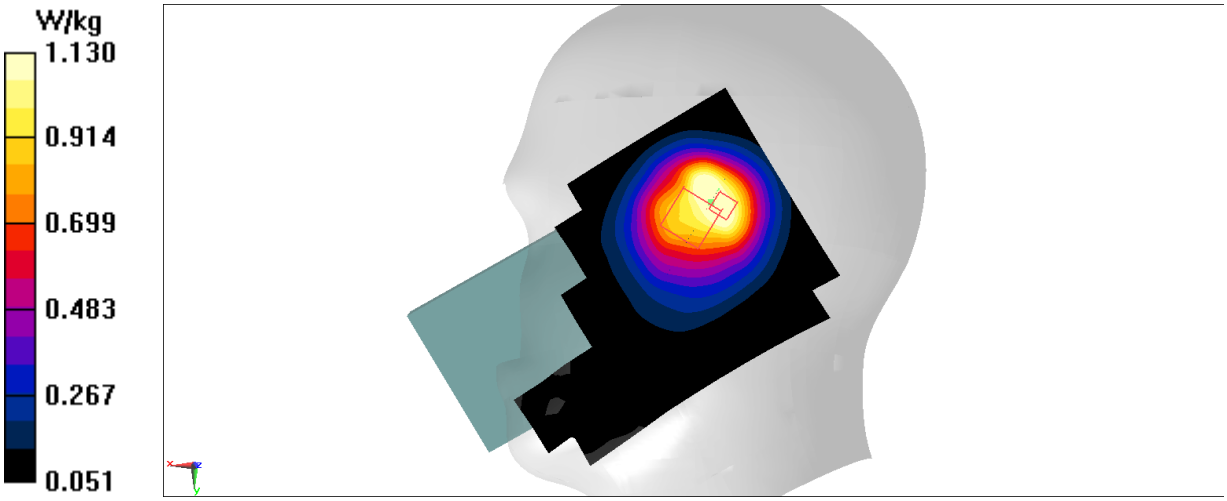

©Copyright. All rights reserved by CTTL.

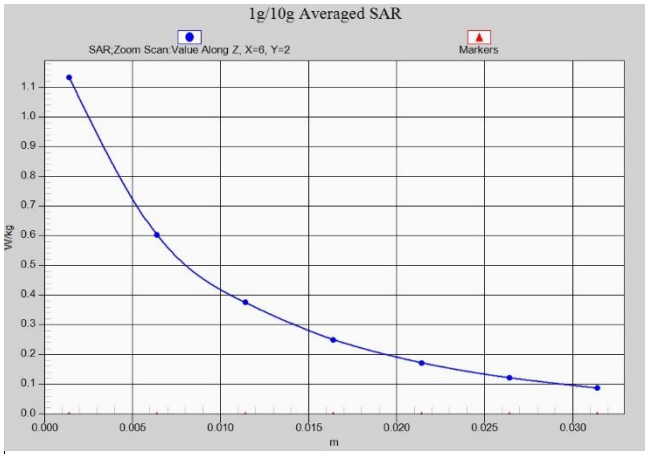
**LTE Band5 Head**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 844 MHz; $\sigma$ = 0.916 S/m; $\varepsilon r$ = 42.759.; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band5 844 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.22 W/kg

**Zoom Scan (8x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.74 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.39 W/kg
**SAR(1 g) = 0.795 W/kg; SAR(10 g) = 0.551 W/kg**

Maximum value of SAR (measured) = 1.13 W/kg



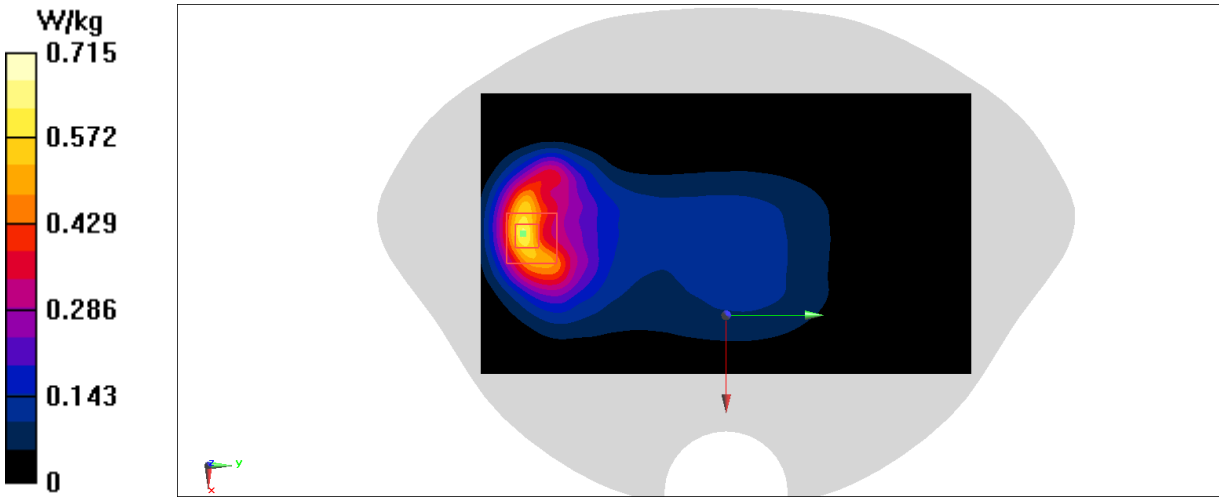



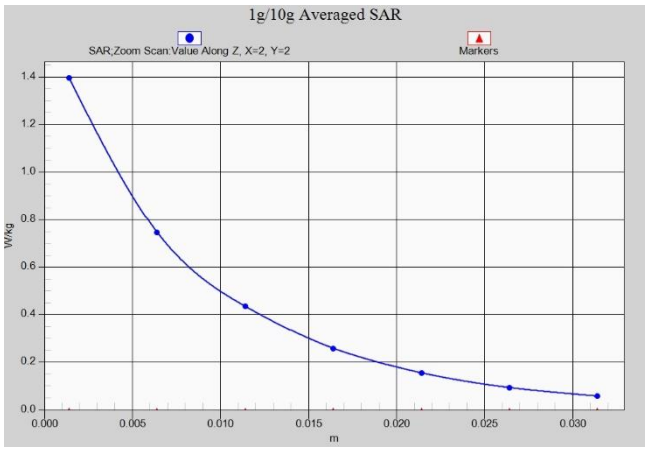

©Copyright. All rights reserved by CTTL.

**LTE Band5 Body**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 844 MHz; $\sigma$ = 0.916 S/m; $\varepsilon r$ = 42.759.; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band5 844 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (41x101x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.43 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.73 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.69 W/kg
**SAR(1 g) = 0.795 W/kg; SAR(10 g) = 0.551W/kg**
Maximum value of SAR (measured) = 1.40 W/kg



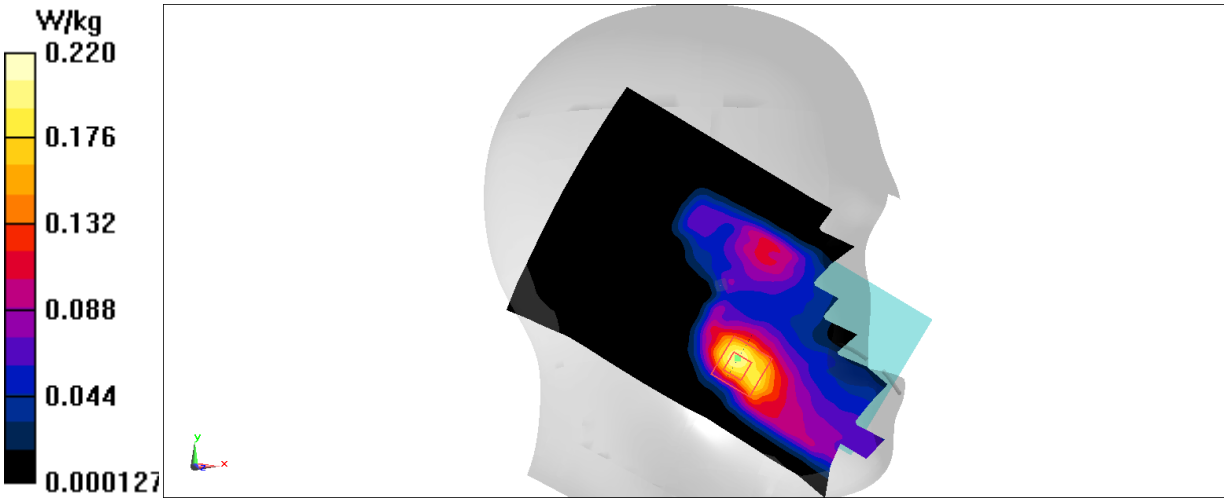



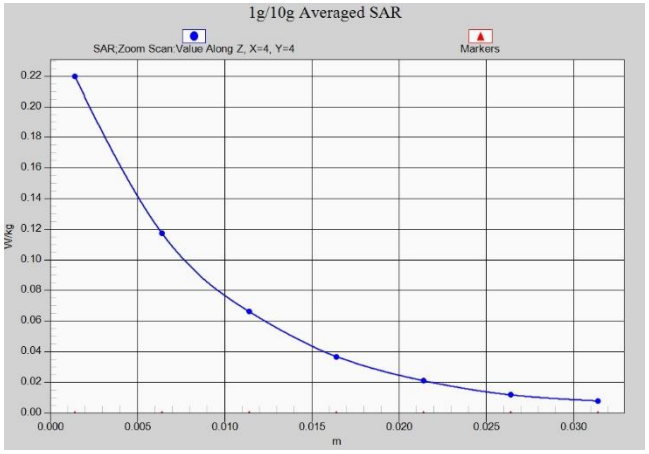

©Copyright. All rights reserved by CTTL.

**LTE Band7 Head**
Date: 12/22/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 2535 MHz; $\sigma$ = 1.881 S/m; $\varepsilon_r$ = 39.958; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band7 2535 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.12, 7.12, 7.12)

**Area Scan (101x181x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.204 W/kg

**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.01dB
Peak SAR (extrapolated) = 0.266 W/kg
**SAR(1 g) = 0.141 W/kg; SAR(10 g) = 0.073 W/kg**
Maximum value of SAR (measured) = 0.220 W/kg



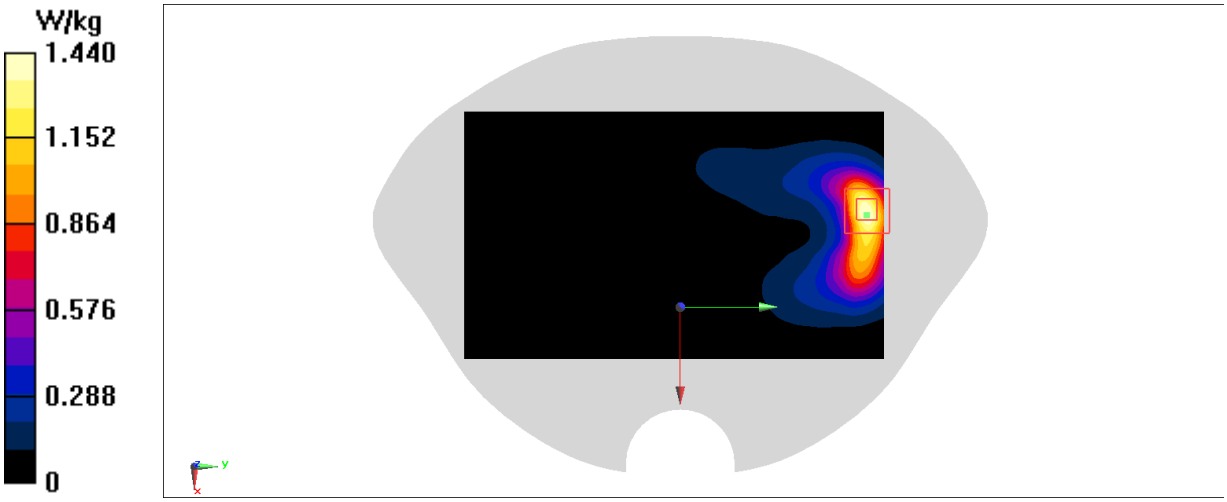



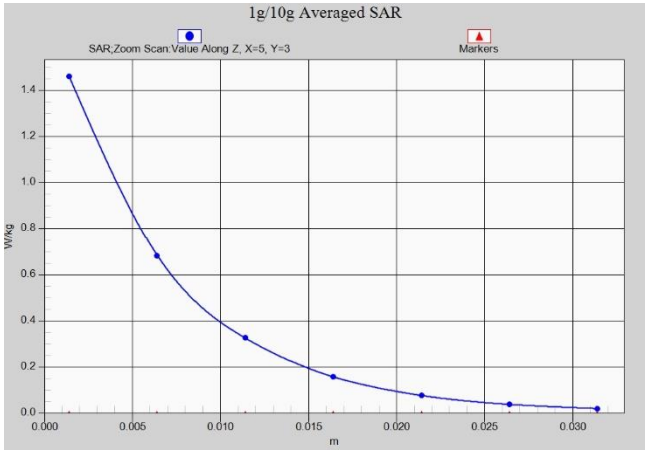

©Copyright. All rights reserved by CTTL.

**LTE Band7 Body**
Date: 12/22/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 2535 MHz; $\sigma$ = 1.881 S/m; $\varepsilon_r$ = 39.958; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band7 2535 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.12, 7.12, 7.12)

**Area Scan (101x171x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.44 W/kg

**Zoom Scan (8x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.088 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.85 W/kg
**SAR(1 g) = 0.868 W/kg; SAR(10 g) = 0.401 W/kg**
Maximum value of SAR (measured) = 1.44 W/kg



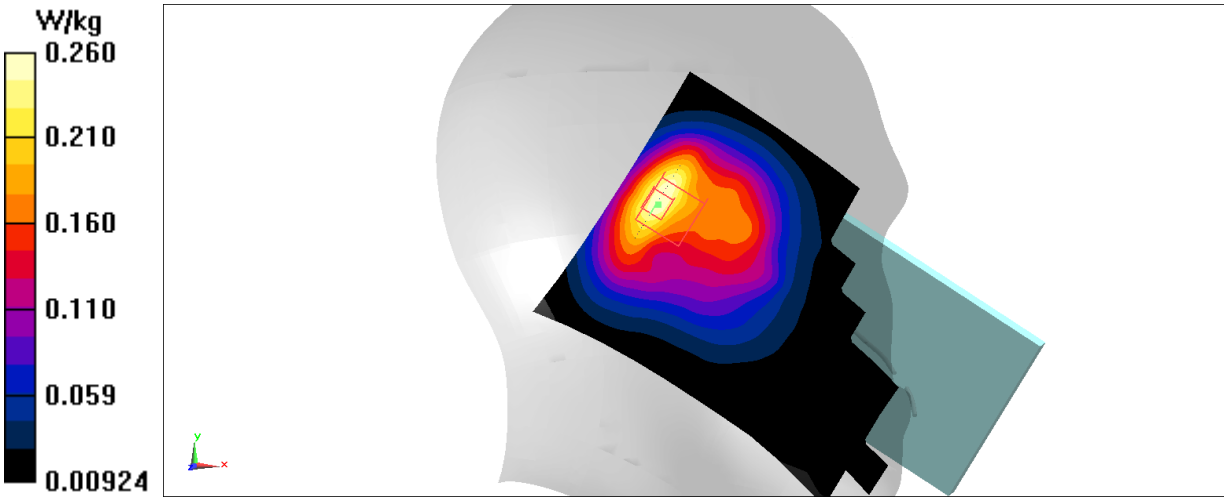

©Copyright. All rights reserved by CTTL.

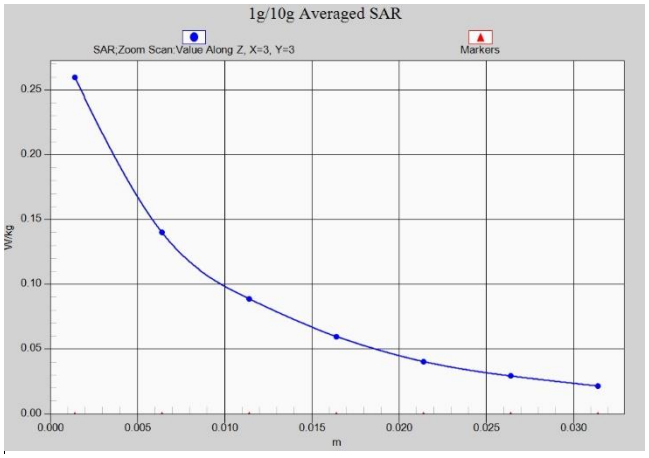
**LTE Band13 Head**
Date: 12/12/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 782 MHz; $\sigma$ = 0.873 S/m; $\varepsilon_r$ = 43.472; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band13 782 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (81x141x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.262 W/kg

**Zoom Scan (6x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.29 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.317 W/kg
**SAR(1 g) = 0.172 W/kg; SAR(10 g) = 0.109 W/kg**
Maximum value of SAR (measured) = 0.260 W/kg



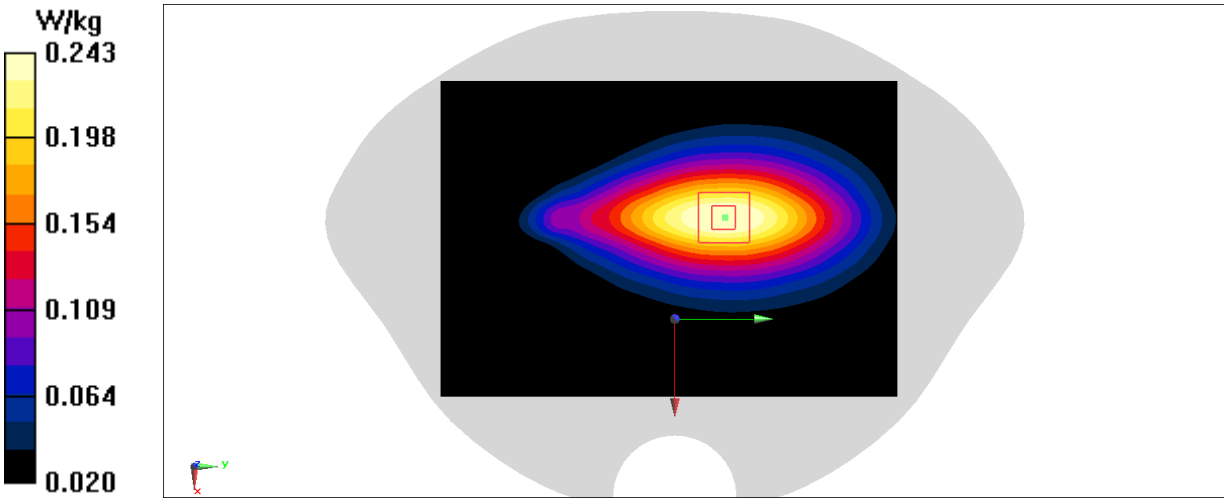



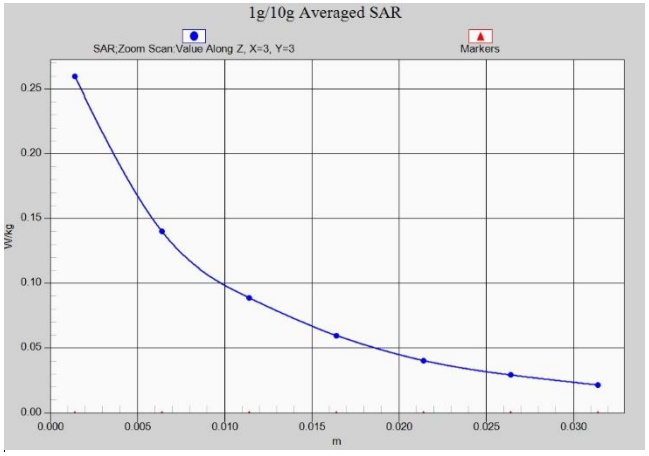

©Copyright. All rights reserved by CTTL.

**LTE Band13 Body**
Date: 12/12/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 782 MHz; $\sigma$ = 0.873 S/m; $\varepsilon_r$ = 43.472; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band13 782 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

**Area Scan (91x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.250 W/kg

**Zoom Scan (6x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.814 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.292 W/kg
**SAR(1 g) = 0.184 W/kg; SAR(10 g) = 0.126 W/kg**
Maximum value of SAR (measured) = 0.243 W/kg



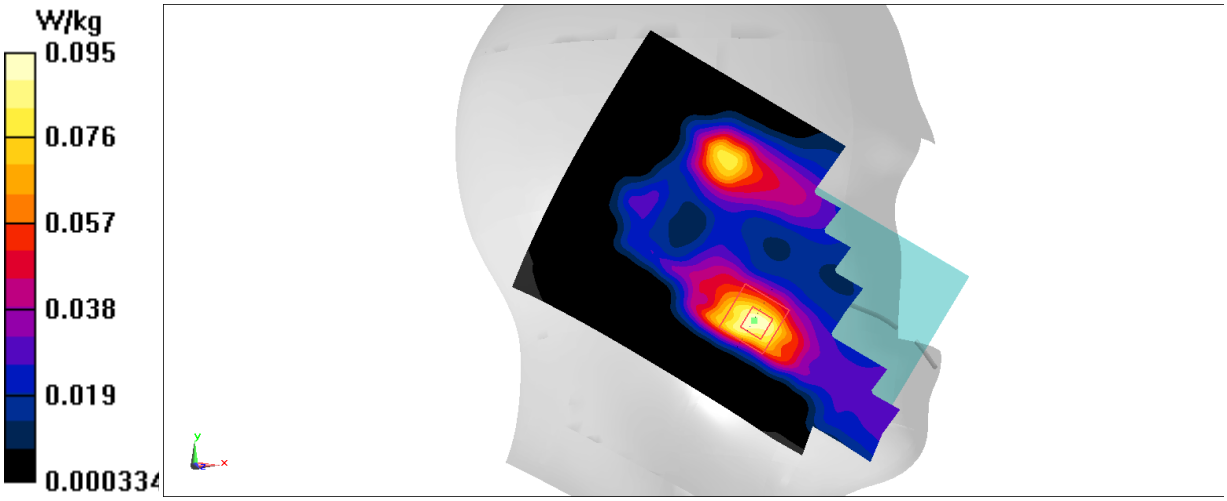

©Copyright. All rights reserved by CTTL.

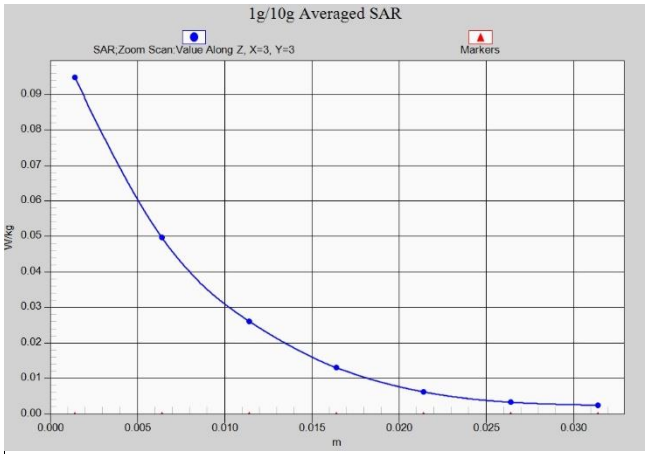
**LTE Band41 Head**
Date: 12/22/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 2593 MHz; $\sigma$ = 1.916 S/m; $\varepsilon_r$ =38.894; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band41 2593 MHz Duty Cycle: 1:1.5787
Probe: EX3DV4 - SN7548 ConvF(7.12, 7.12, 7.12)

**Area Scan (101x171x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0960 W/kg

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.750 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.115 W/kg
**SAR(1 g) = 0.059 W/kg; SAR(10 g) = 0.029 W/kg**

Maximum value of SAR (measured) = 0.0949 W/kg



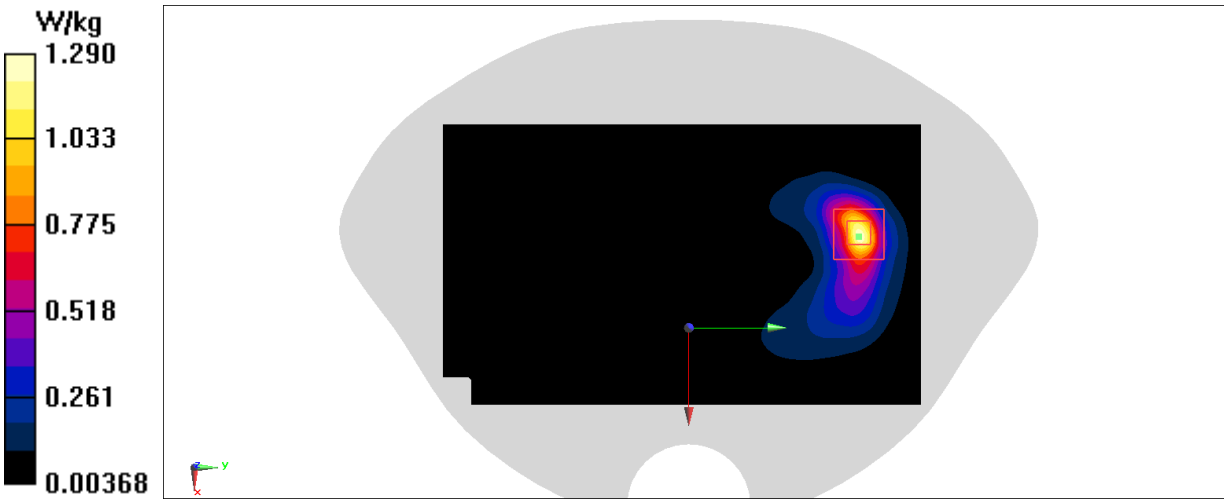



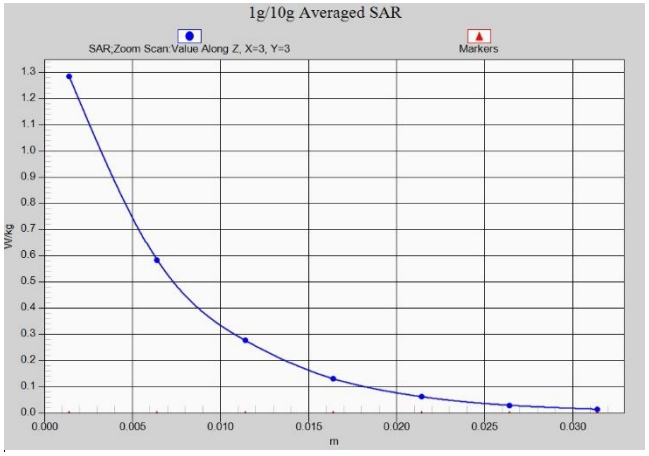

©Copyright. All rights reserved by CTTL. 

**LTE Band41 Body**
Date: 12/22/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 2550 MHz; $\sigma$ = 1.889 S/m; $\varepsilon_r$ =38.98; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band41 2549.5 MHz Duty Cycle: 1:1.5787
Probe: EX3DV4 - SN7548 ConvF(7.12, 7.12, 7.12)

**Area Scan (101x171x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.26 W/kg

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.713 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.66 W/kg
**SAR(1 g) = 0.728 W/kg; SAR(10 g) = 0.306 W/kg**
Maximum value of SAR (measured) = 1.29 W/kg



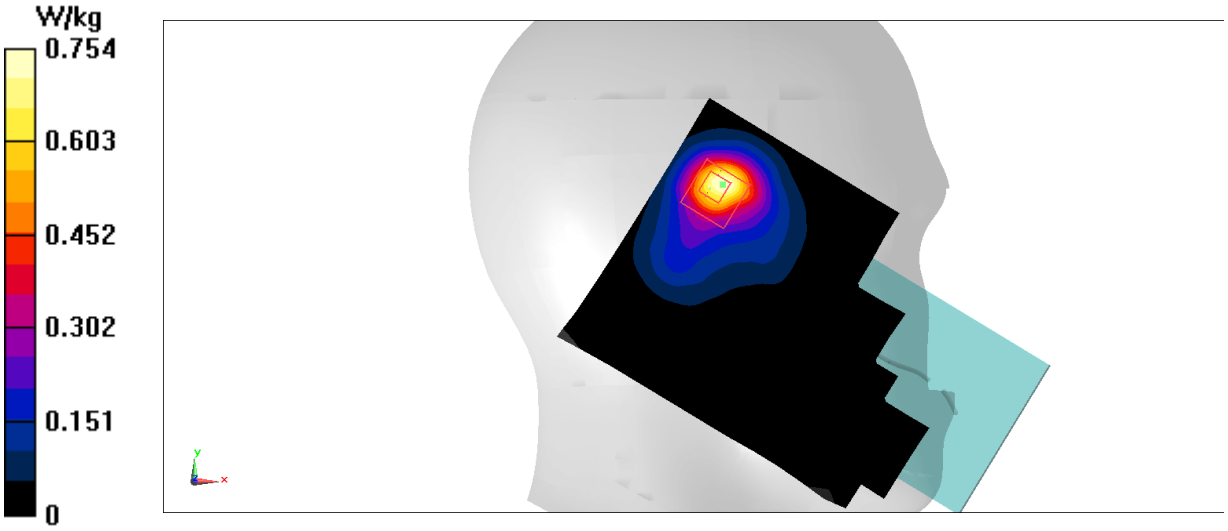

©Copyright. All rights reserved by CTTL.

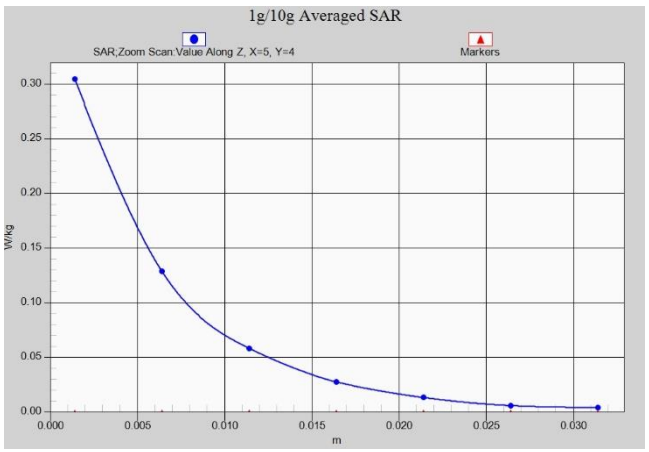
**WLAN 2.4G Head**
Date: 12/21/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 2437 MHz; $\sigma$ = 1.75 S/m; $\varepsilon_r$ =39.708; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: wifi 2450 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.32, 7.32, 7.32)

**Area Scan (101x171x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.570 W/kg

**Zoom Scan (8x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.337 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.692 W/kg
**SAR(1 g) = 0.536 W/kg; SAR(10 g) = 0.26 W/kg**

Maximum value of SAR (measured) = 0.754 W/kg



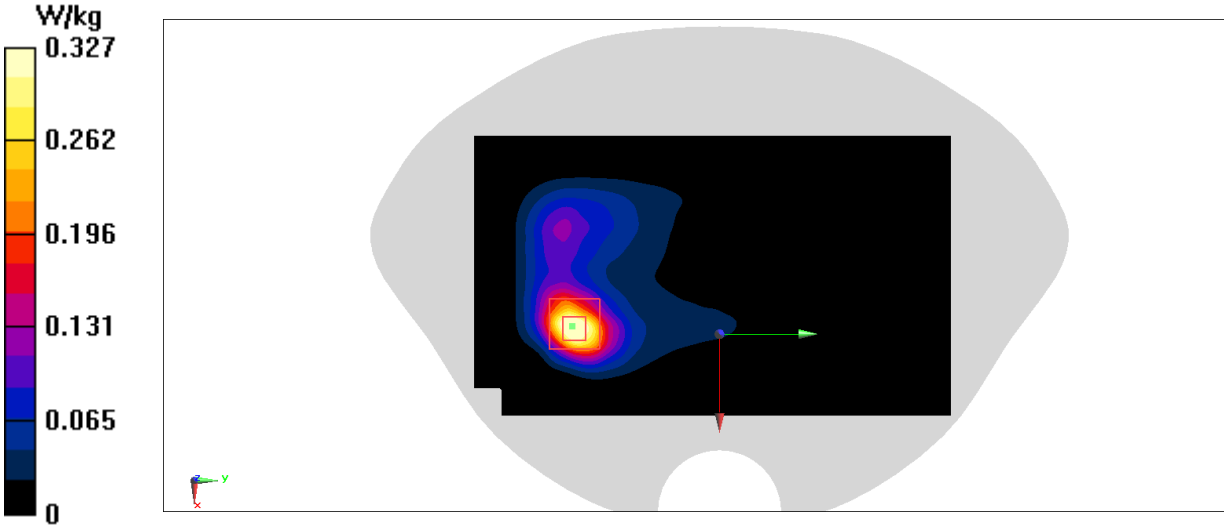



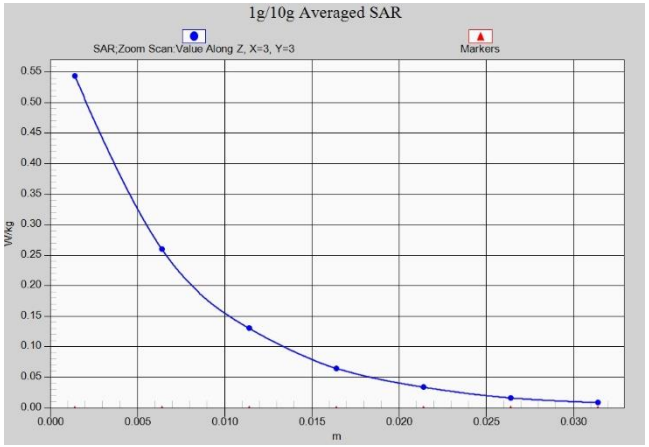

©Copyright. All rights reserved by CTTL. 

**WLAN 2.4G Body**
Date: 12/21/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 2437 MHz; $\sigma$ = 1.75 S/m; $\varepsilon_r$ =39.708; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WIFI 2450 (0) Frequency: 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.32, 7.32, 7.32)

**Area Scan (101x171x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.245 W/kg

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.915 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.278 W/kg
**SAR(1 g) = 0.209 W/kg; SAR(10 g) = 0.1 W/kg**
Maximum value of SAR (measured) = 0.327 W/kg



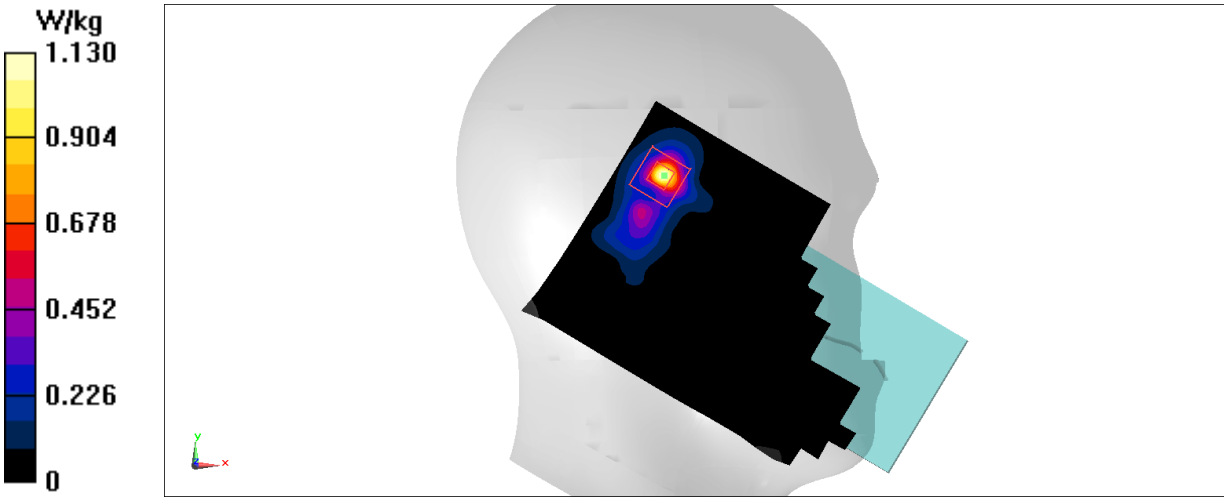



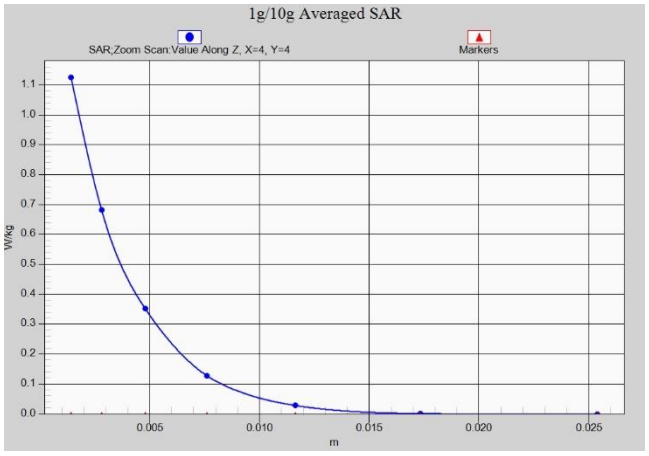

©Copyright. All rights reserved by CTTL.

**WLAN 5G Head**
Date: 12/25/2022
Electronics: DAE4 Sn1331
Medium: H650-7000M
Medium parameters used: f = 5690 MHz; $\sigma$ = 5.161 S/m; $\varepsilon_r$ = 33.896; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WIFI 5G (0) 5690 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(4.57, 4.57, 4.57)

**Area Scan (121x211x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.14 W/kg

**Zoom Scan (8x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 8.374 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 2.08 W/kg
**SAR(1 g) = 0.425 W/kg; SAR(10 g) = 0.118 W/kg**
Maximum value of SAR (measured) = 1.13 W/kg



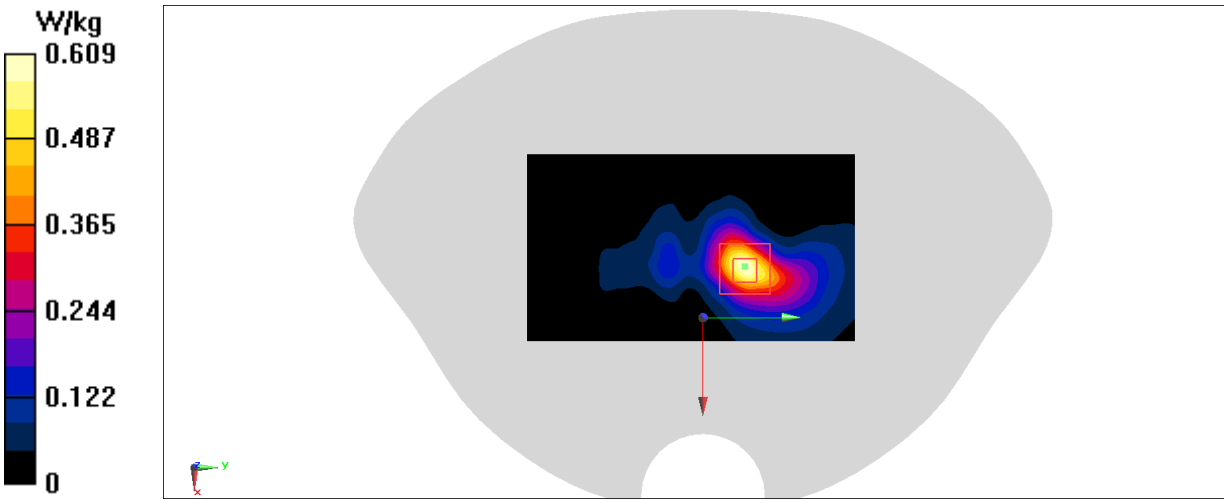



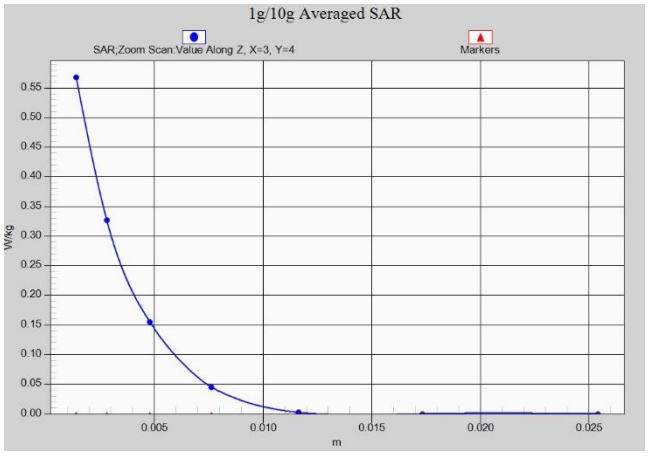

©Copyright. All rights reserved by CTTL.

**WLAN 5G Body**
Date: 12/25/2022
Electronics: DAE4 Sn1331
Medium: H650-7000M
Medium parameters used: f = 5690 MHz; $\sigma$ = 5.161 S/m; $\varepsilon_r$ = 33.896; $\rho$ = 1000 kg/m$^3$
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: WIFI 5G (0) 5690 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(4.57, 4.57, 4.57)

**Area Scan (81x141x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.609 W/kg

**Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 6.242 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.965 W/kg
**SAR(1 g) = 0.212 W/kg; SAR(10 g) = 0.072 W/kg**
Maximum value of SAR (measured) = 0.568 W/kg



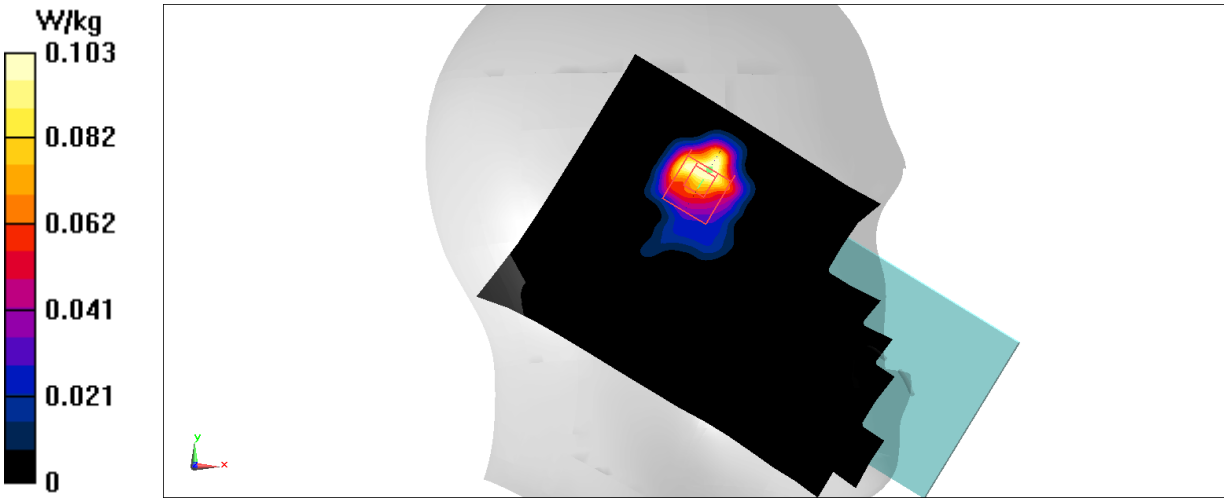



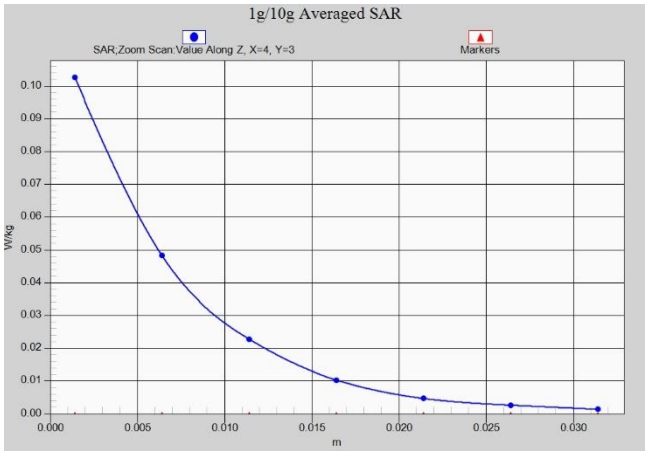

©Copyright. All rights reserved by CTTL.

**BT Head**
Date: 12/21/2022
Electronics: DAE4 Sn1588
Medium: H700-6000M
Medium parameters used: f = 2480 MHz; $\sigma$ = 1.861 S/m; $\varepsilon r$ = 38.849; $\rho$ = 1000 kg/m3
Ambient Temperature:23.3℃ Liquid Temperature: 22.5℃
Communication System: UID 0, Bluetooth (0) Frequency: 2480 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7548 ConvF(7.32, 7.32, 7.32)

**Area Scan (101x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.115 W/kg

**Zoom Scan (8x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.028 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.134 W/kg
**SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.028 W/kg**
Maximum value of SAR (measured) = 0.103 W/kg



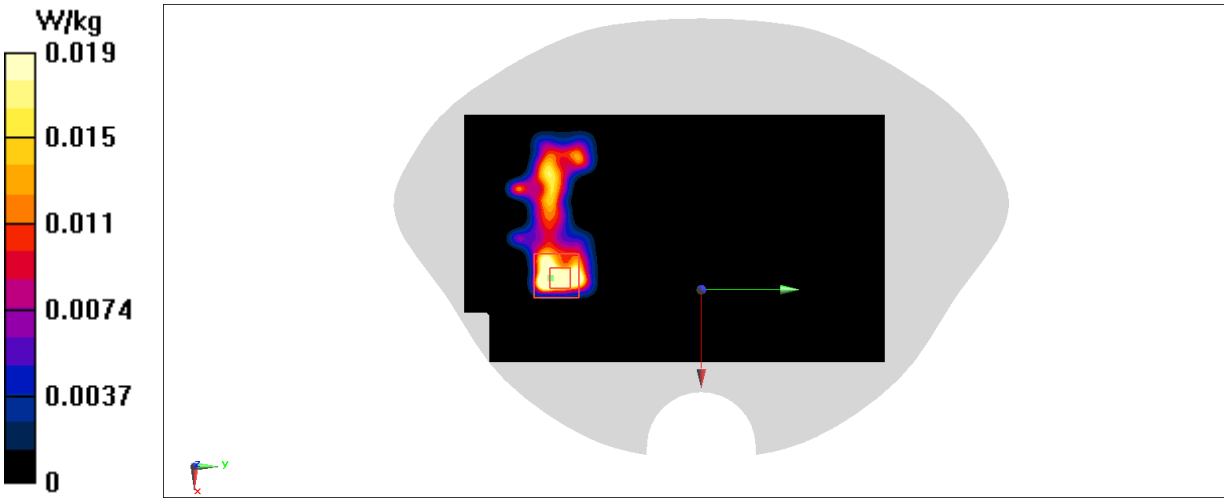



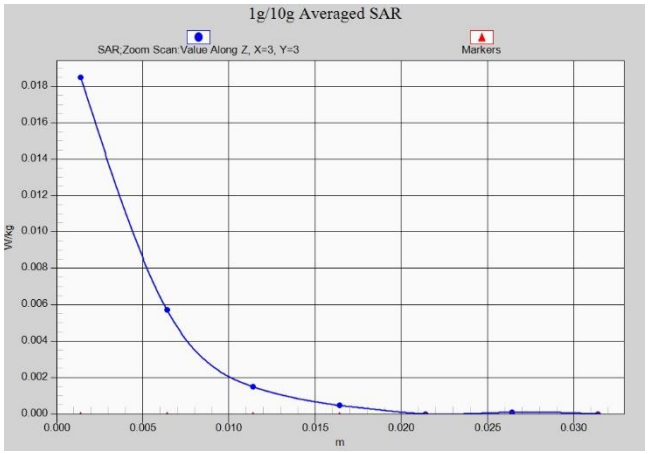

©Copyright. All rights reserved by CTTL.

**BT Body**
Date: 12/21/2022
Electronics: DAE4 Sn1588
Medium: H700-6000M
Medium parameters used: f = 2480 MHz; $\sigma$ = 1.861 S/m; $\varepsilon r$ = 38.849; $\rho$ = 1000 kg/m3
Ambient Temperature:23.3℃ Liquid Temperature: 22.5℃
Communication System: UID 0, Bluetooth (0) Frequency: 2480 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7548 ConvF(7.32, 7.32, 7.32)

**Area Scan (101x171x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0519 W/kg

**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.56 V/m; Power Drift = 0.05dB
Peak SAR (extrapolated) = 0.0310 W/kg
**SAR(1 g) = 0.00941 W/kg; SAR(10 g) = 0.00309 W/kg**
Maximum value of SAR (measured) = 0.0185 W/kg




©Copyright. All rights reserved by CTTL.

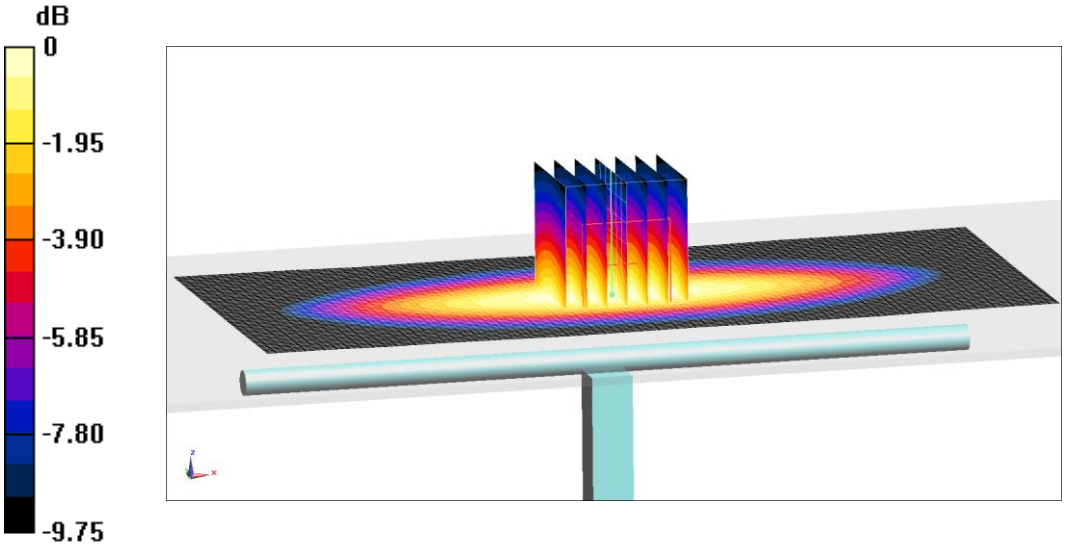
# ANNEX B System Verification Results

## 750MHz

Date: 12/12/2022
Electronics: DAE4 Sn1331
Medium: Head 750MHz
Medium parameters used: f = 750MHz; $\sigma$ =0.916 mho/m; $\varepsilon_r$ = 42.78; $\rho$ = 1000 kg/m$^3$
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: CW Frequency: 750MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7548 ConvF(10.3,10.3,10.3)

**System Validation /Area Scan (81x191x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =63.45 V/m; Power Drift = 0.06
**Fast SAR: SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.35 W/kg**
Maximum value of SAR (interpolated) = 2.77 W/kg

**System Validation /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =63.45 V/m; Power Drift = 0.06
Peak SAR (extrapolated) = 3.21 W/kg
**SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.39 W/kg**
Maximum value of SAR (measured) = 2.84 W/kg




0 dB = 2.84 W/kg = 4.53 dB W/kg

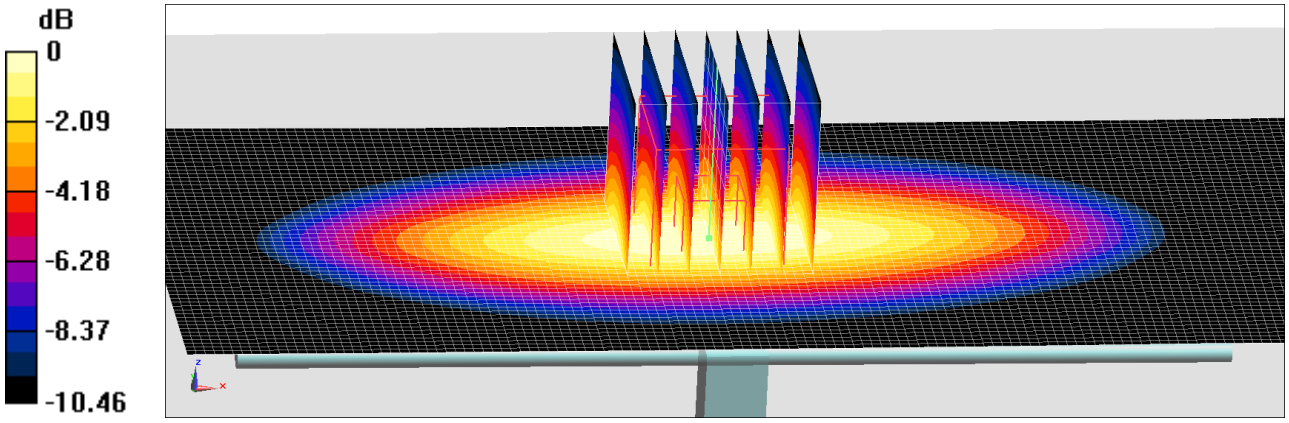
**Fig.B.1 validation 750MHz 250mW**

©Copyright. All rights reserved by CTTL.

**835MHz**
Date: 12/15/2022
Electronics: DAE4 Sn1331
Medium: H700-6000
Medium parameters used: f = 835 MHz; $\sigma$ = 0.893 S/m; $\varepsilon r$ = 42.75; $\rho$ = 1000 kg/m3
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(10.3, 10.3, 10.3)

Area Scan (51x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 56.95 V/m; Power Drift = -0.03 dB
**Fast SAR: SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.52 W/kg**
Maximum value of SAR (interpolated) = 3.11 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.95 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.49 W/kg
**SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.54 W/kg**
Maximum value of SAR (measured) = 3.08 W/kg




0 dB = 3.08 W/kg = 4.89 dBW/kg

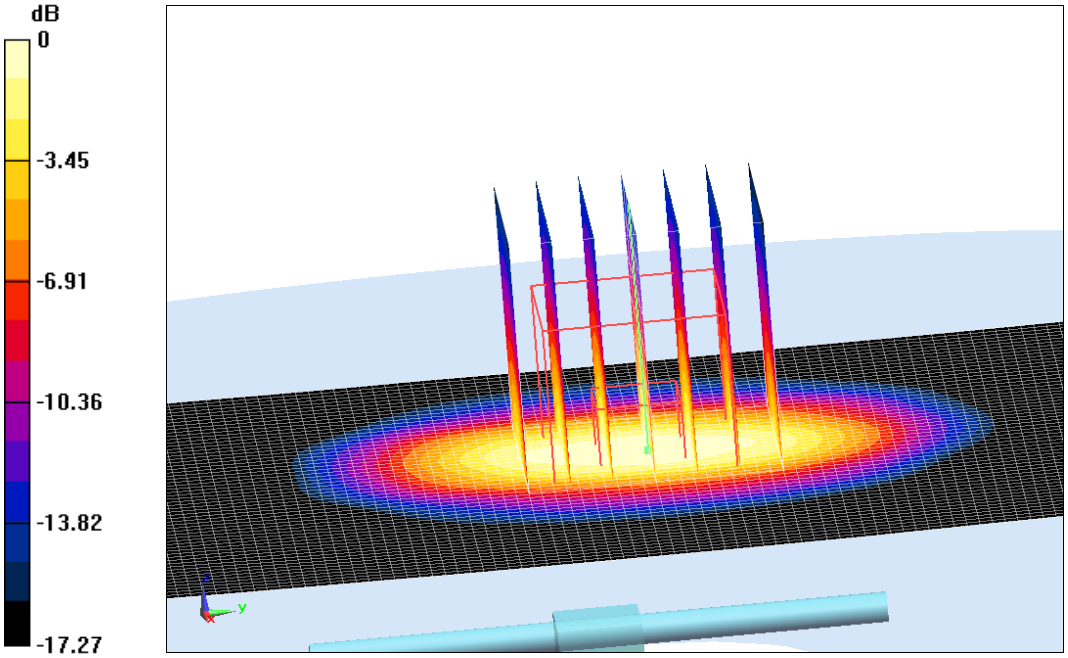
**Fig.B.2 validation 835 MHz 250mW**

©Copyright. All rights reserved by CTTL.

**1900MHz**
Date: 12/19/2021
Electronics: DAE4 Sn1331
Medium: Head 1900MHz
Medium parameters used: f = 1900MHz; $\sigma$ =1.403 mho/m; $\varepsilon_r$ = 40.56; $\rho$ = 1000 kg/m$^3$
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: CW Frequency: 1900MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7548 ConvF(7.8,7.8,7.8)

**System Validation /Area Scan (81x191x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value =105.57 V/m; Power Drift = -0.11 dB
**Fast SAR: SAR(1 g) = 9.82 W/kg; SAR(10 g) =5.15 W/kg**
Maximum value of SAR (interpolated) = 15.32 W/kg

**System Validation /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =105.57 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 18.36 W/kg
**SAR(1 g) = 9.78 W/kg; SAR(10 g) = 5.12 W/kg**
Maximum value of SAR (measured) = 15.11 W/kg




0 dB = 15.11 W/kg = 11.79 dB W/kg

**Fig.B.3 validation 1900MHz 250mW**

©Copyright. All rights reserved by CTTL.

**2450MHz**

Date:12/21/2022

Electronics: DAE4 Sn1331

Medium: Head 2450MHz

Medium parameters used: f = 2450MHz; $\sigma$ =1.811 mho/m; $\varepsilon_r$ = 39.02; $\rho$ = 1000 kg/m$^3$

Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃

Communication System: CW Frequency: 2450MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7548 ConvF(7.32,7.32,7.32)

**System Validation /Area Scan (81x191x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value =117.34 V/m; Power Drift = -0.02 dB

**Fast SAR: SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.27 W/kg**

Maximum value of SAR (interpolated) = 21.89 W/kg

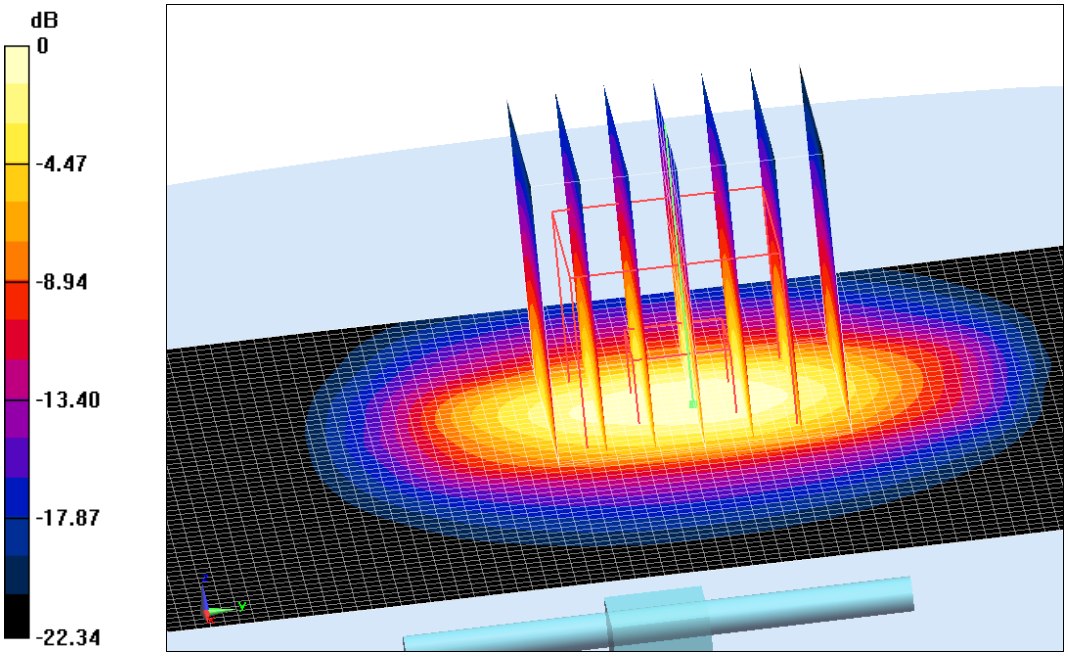
**System Validation /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =117.34 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 26.23 W/kg

**SAR(1 g) = 13.44 W/kg; SAR(10 g) = 6.29 W/kg**

Maximum value of SAR (measured) = 21.84 W/kg




0 dB = 21.84 W/kg = 13.39 dB W/kg

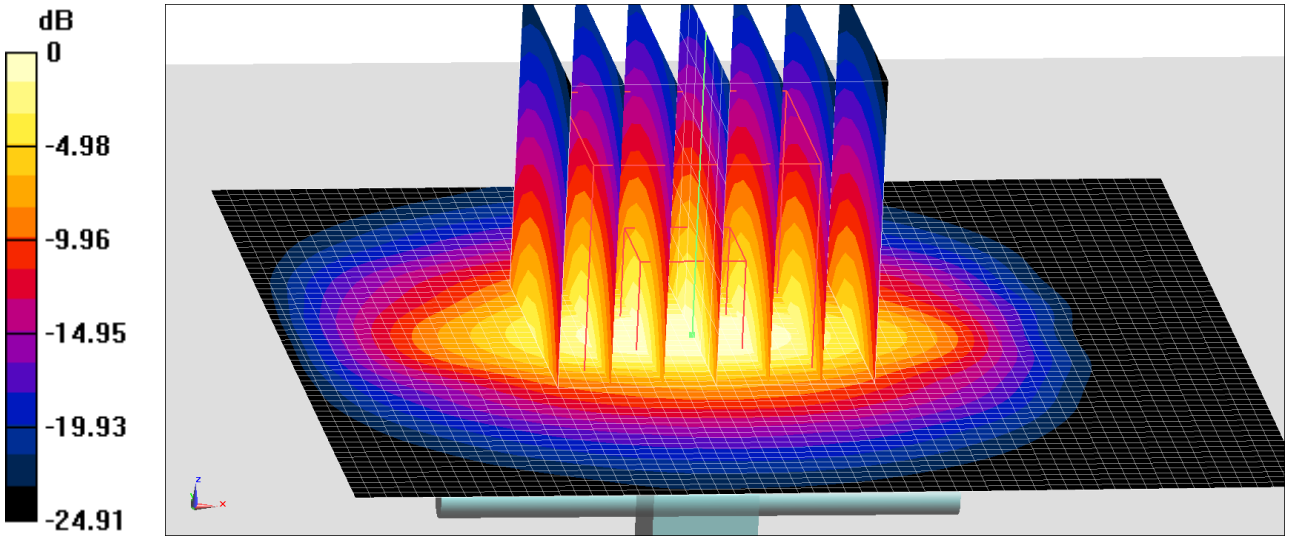
**Fig.B.4 validation 2450MHz 250mW**

©Copyright. All rights reserved by CTTL.

**2600MHz**
Date: 12/22/2022
Electronics: DAE4 Sn1331
Medium: H700-6000
Medium parameters used: f = 2600 MHz; $\sigma$ = 1.92 S/m; $\varepsilon$r =38.87; $\rho$ = 1000 kg/m3
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(7.12, 7.12, 7.12)

Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 104.67 V/m; Power Drift = 0.11 dB
**Fast SAR: SAR(1 g) = 14.25 W/kg; SAR(10 g) = 6.45 W/kg**
Maximum value of SAR (interpolated) = 24.67 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.67 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 31.78 W/kg
**SAR(1 g) = 14.23 W/kg; SAR(10 g) = 6.42 W/kg**
Maximum value of SAR (measured) = 24.98W/kg




0 dB = 24.98 W/kg = 13.98 dBW/kg

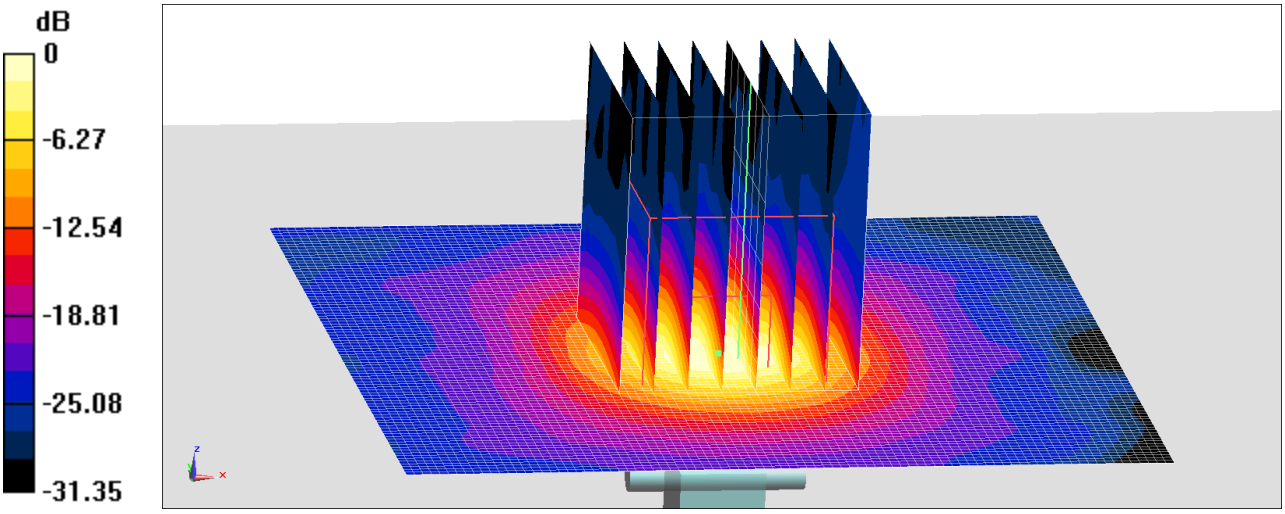
**Fig.B.5 validation 2600MHz 250mW**

©Copyright. All rights reserved by CTTL.

**5250MHz**
Date: 12/24/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 5250 MHz; $\sigma$ = 4.623 S/m; $\varepsilon_r$ = 35.57; $\rho$ = 1000 kg/m$^3$
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: UID 0, CW (0) Frequency: 5250 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(4.98, 4.98, 4.98)

**System Performance Check/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (91x91x1):**
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.1 W/kg

**System Performance Check/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (7x7x11)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.96 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 33.6 W/kg
**SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.28 W/kg**
Maximum value of SAR (measured) = 19.0 W/kg




0 dB = 19.0 W/kg = 12.79 dBW/kg

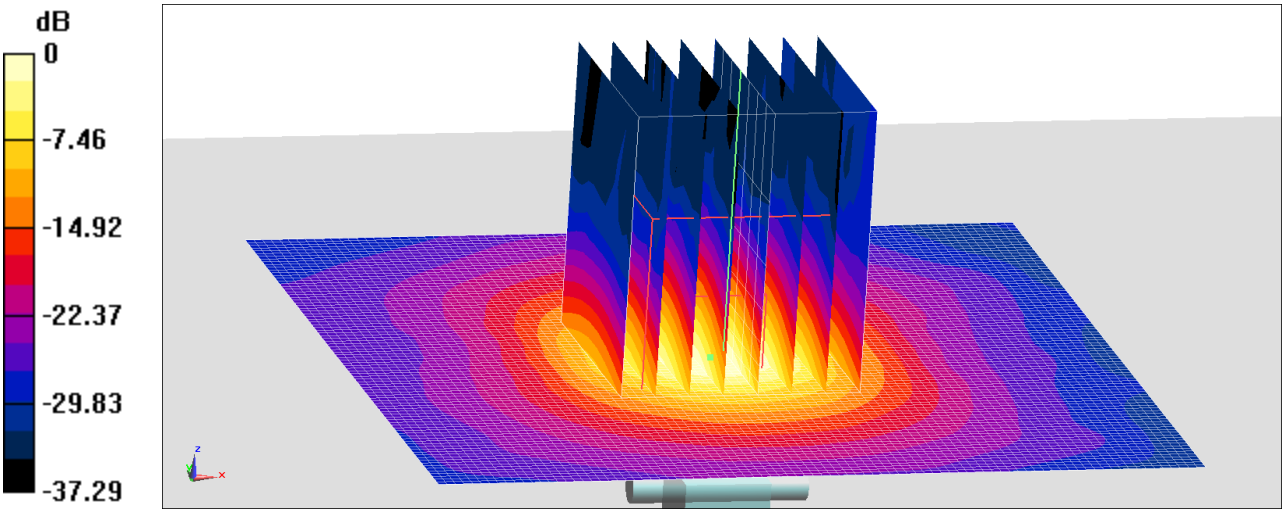
**Fig.B.6 validation 5250 MHz 100mW**

©Copyright. All rights reserved by CTTL.

**5600MHz**
Date: 12/25/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 5600 MHz; $\sigma$ = 4.87 S/m; $\varepsilon_r$ = 35.38; $\rho$ = 1000 kg/m$^3$
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: UID 0, CW (0) Frequency: 5600 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(4.57, 4.57, 4.57)

**System Performance Check/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (91x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.4 W/kg

**System Performance Check/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan 2 (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.38 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 37.3 W/kg
**SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.34 W/kg**
Maximum value of SAR (measured) = 19.2 W/kg




0 dB = 19.2 W/kg = 12.83 dBW/kg

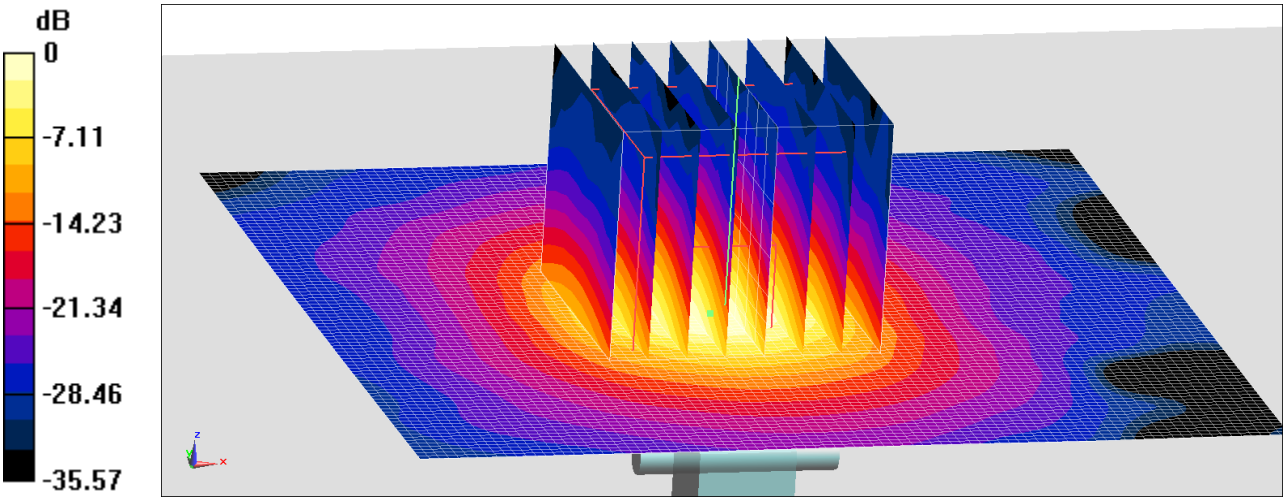
**Fig.B.7 validation 5600 MHz 100mW**

©Copyright. All rights reserved by CTTL.

**5750MHz**
Date: 12/26/2022
Electronics: DAE4 Sn1331
Medium: H700-6000M
Medium parameters used: f = 5750 MHz; $\sigma$ = 5.124 S/m; $\varepsilon_r$ = 35.89; $\rho$ = 1000 kg/m$^3$
Ambient Temperature: 22.9℃ Liquid Temperature: 22.5℃
Communication System: UID 0, CW (0) Frequency: 5750 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7548 ConvF(4.64, 4.64, 4.64)

**System Performance Check/d=10mm, Pin=100mW, f=5750 MHz/Area Scan (91x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.2 W/kg

**System Performance Check/d=10mm, Pin=100mW, f=5750 MHz/Zoom Scan 2 (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.44 V/m; Power Drift =0.12 dB
Peak SAR (extrapolated) = 36.9 W/kg
**SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.25 W/kg**
Maximum value of SAR (measured) = 19.3 W/kg




0 dB = 19.3 W/kg = 12.86 dBW/kg

**Fig.B.8 validation 5750 MHz 100mW**

©Copyright. All rights reserved by CTTL.

The SAR system verification must be required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR.

**Table B.1 Comparison between area scan and zoom scan for system verification**

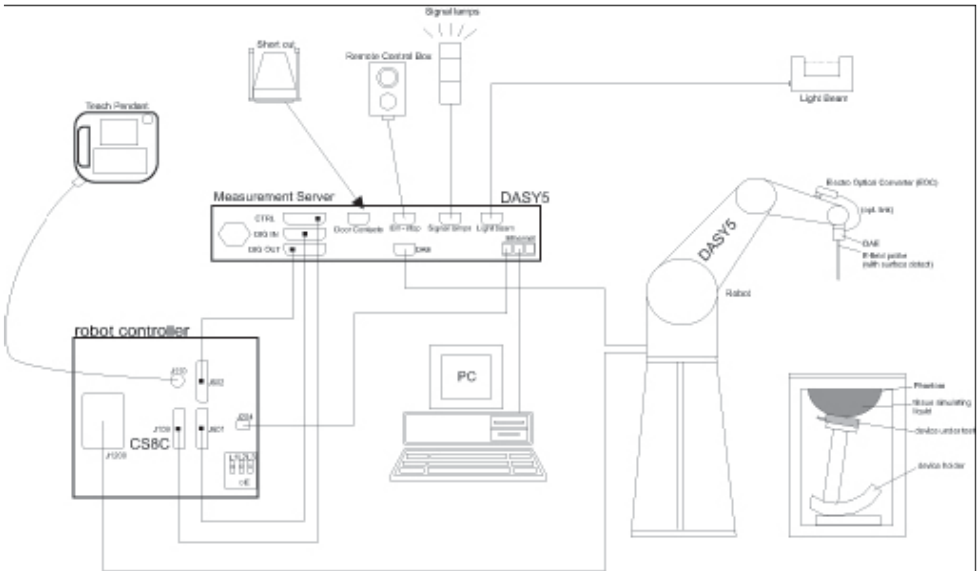
| Date | Band | Position | Area scan (1g) | Zoom scan (1g) | Drift (%) |
|---|---|---|---|---|---|
| 2022-12-12 | 750MHz | Head | 2.14 | 2.18 | -1.83 |
| 2022-12-15 | 835MHz | Head | 2.35 | 2.38 | -1.26 |
| 2022-12-19 | 1900MHz | Head | 9.82 | 9.78 | 0.41 |
| 2022-12-21 | 2450MHz | Head | 13.4 | 13.44 | -0.30 |
| 2022-12-22 | 2600MHz | Head | 14.25 | 14.23 | 0.14 |

©Copyright. All rights reserved by CTTL.

# ANNEX C SAR Measurement Setup

## C.1 Measurement Set-up

The Dasy4 or DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:




**Picture C.1SAR Lab Test Measurement Set-up**

- A standard high precision 6-axis robot (StäubliTX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY4 or DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as
- warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

©Copyright. All rights reserved by CTTL.

## C.2 Dasy4 or DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 or DASY5 software reads the reflection durning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

**Probe Specifications:**

**Model:** ES3DV3, EX3DV4
**Frequency** 10MHz — 6.0GHz(EX3DV4)
**Range:** 10MHz — 4GHz(ES3DV3)
**Calibration:** In head and body simulating tissue at Frequencies from 835 up to 5800MHz
**Linearity:** ± 0.2 dB(30 MHz to 6 GHz) for EX3DV4
± 0.2 dB(30 MHz to 4 GHz) for ES3DV3
**DynamicRange:** 10 mW/kg — 100W/kg
**Probe Length:** 330 mm
**Probe Tip**
**Length:** 20 mm
**Body Diameter:** 12 mm
**Tip Diameter:** 2.5 mm (3.9 mm for ES3DV3)
**Tip-Center:** 1 mm (2.0mm for ES3DV3)
**Application:** SAR Dosimetry Testing
Compliance tests ofmobile phones
Dosimetry in strong gradient fields

**Picture C.2Near-field Probe**

**Picture C.3E-field Probe**

## C.3 E-field Probe Calibration

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm$^2$) using an RF Signal generator, TEM cell, and RF Power Meter.

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or

©Copyright. All rights reserved by CTTL.

other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm$^2$.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where:

$\Delta$t = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

$\Delta$T = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m$^3$).

## C.4 Other Test Equipment

### C.4.1 Data Acquisition Electronics(DAE)

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**PictureC.4: DAE**

©Copyright. All rights reserved by CTTL.

### C.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90XL; DASY5: RX160L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

**Picture C.5DASY 4**

**Picture C.6DASY 5**

### C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (dasy4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128MB), RAM (DASY4: 64 MB, DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

©Copyright. All rights reserved by CTTL.

Picture C.7 Server for DASY 4

Picture C.8 Server for DASY 5

### C.4.4 Device Holder for Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

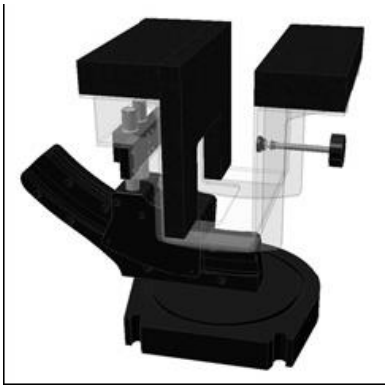
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon$=3 and loss tangent $\delta$=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.

**Picture C.9-1: Device Holder**



**Picture C.9-2: Laptop Extension Kit**

©Copyright. All rights reserved by CTTL.

### C.4.5 Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to
Represent the 90$^{th}$ percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2±0. 2 mm
Filling Volume: Approx. 25 liters
Dimensions: 810 x l000 x 500 mm (H x L x W)
Available: Special

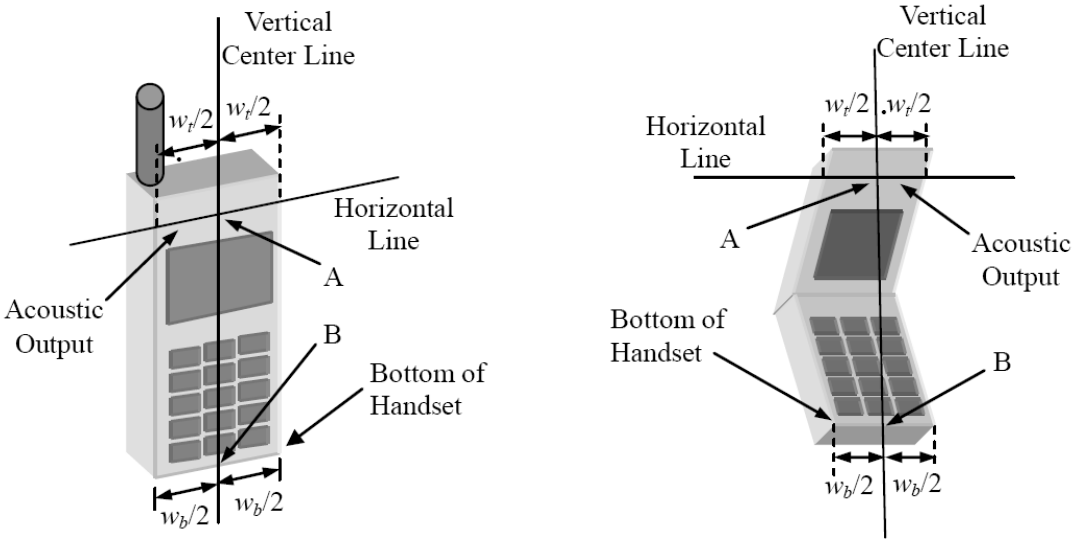
**Picture C.10: SAM Twin Phantom**

©Copyright. All rights reserved by CTTL.

# ANNEX D Position of the wireless device in relation to the phantom

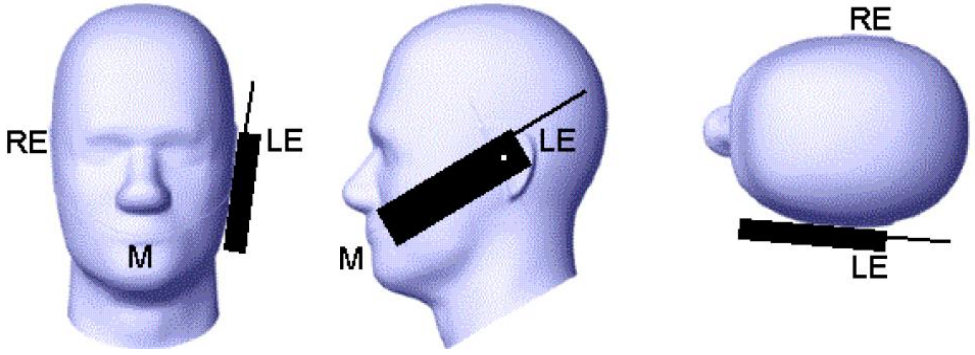
## D.1 General considerations

This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



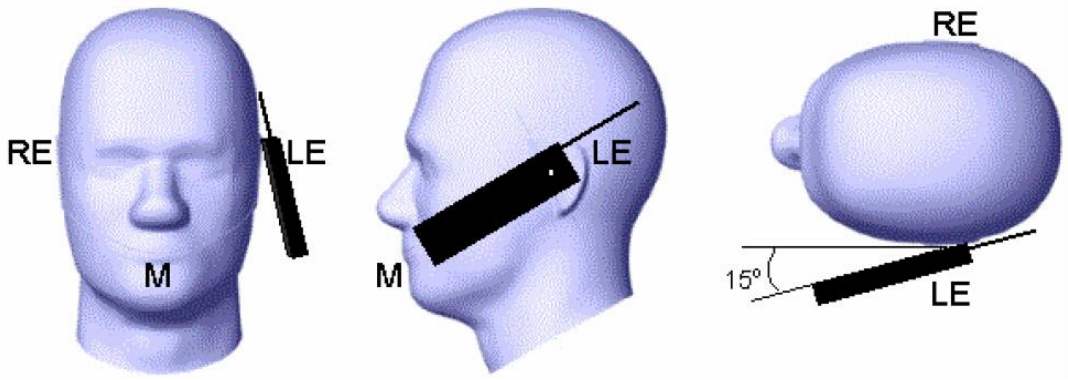

| | |
|---|---|
| $w_t$ | Width of the handset at the level of the acoustic |
| $w_b$ | Width of the bottom of the handset |
| A | Midpoint of the width $w_t$ of the handset at the level of the acoustic output |
| B | Midpoint of the width $w_b$ of the bottom of the handset |

**Picture D.1-a Typical “fixed” case handset  Picture D.1-b Typical “clam-shell” case handset**




**Picture D.2 Cheek position of the wireless device on the left side of SAM**

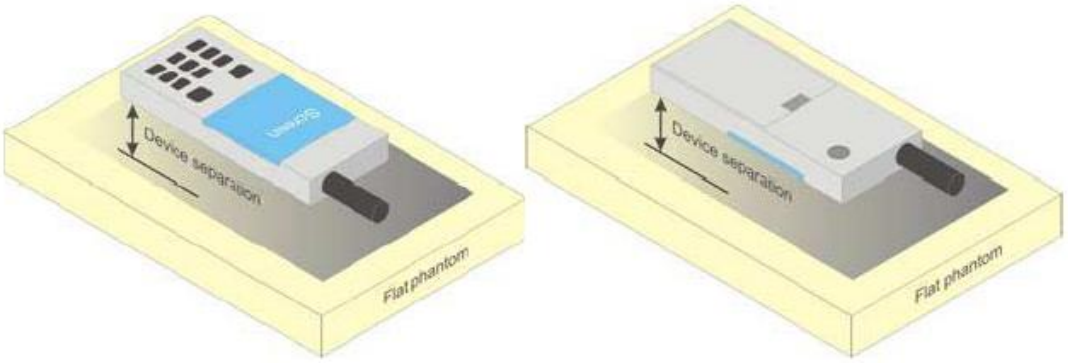
©Copyright. All rights reserved by CTTL.




**Picture D.3 Tilt position of the wireless device on the left side of SAM**

## D.2 Body-worn device

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



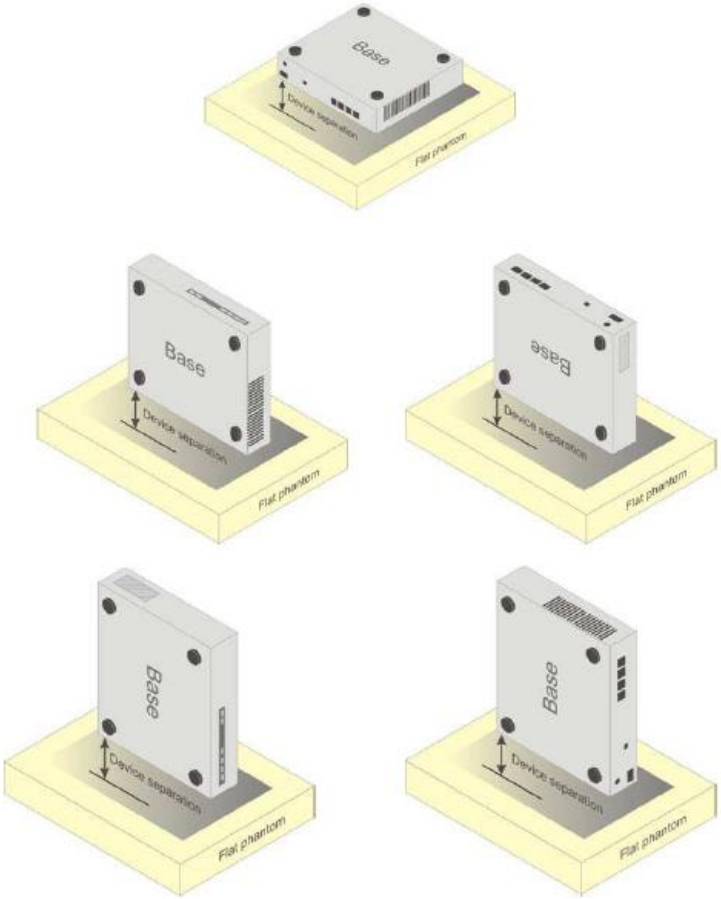

**Picture D.4Test positions for body-worn devices**

## D.3 Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified. Picture8.5 show positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.

©Copyright. All rights reserved by CTTL.




**Picture D.5 Test positions for desktop devices**

## D.4 DUT Setup Photos

**Picture D.6**

©Copyright. All rights reserved by CTTL.

# ANNEX E Equivalent Media Recipes

The liquid used for the frequency range of 800-3000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table E.1 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

**TableE.1: Composition of the Tissue Equivalent Matter**

| Frequency (MHz) | 835Head | 835Body | 1900 Head | 1900 Body | 2450 Head | 2450 Body | 5800 Head | 5800 Body |
|---|---|---|---|---|---|---|---|---|
| Ingredients (% by weight) | | | | | | | | |
| Water | 41.45 | 52.5 | 55.242 | 69.91 | 58.79 | 72.60 | 65.53 | 65.53 |
| Sugar | 56.0 | 45.0 | \ | \ | \ | \ | \ | \ |
| Salt | 1.45 | 1.4 | 0.306 | 0.13 | 0.06 | 0.18 | \ | \ |
| Preventol | 0.1 | 0.1 | \ | \ | \ | \ | \ | \ |
| Cellulose | 1.0 | 1.0 | \ | \ | \ | \ | \ | \ |
| Glycol Monobutyl | \ | \ | 44.452 | 29.96 | 41.15 | 27.22 | \ | \ |
| Diethylenglycol monohexylether | \ | \ | \ | \ | \ | \ | 17.24 | 17.24 |
| Triton X-100 | \ | \ | \ | \ | \ | \ | 17.24 | 17.24 |
| Dielectric Parameters Target Value | ε=41.5 σ=0.90 | ε=55.2 σ=0.97 | ε=40.0 σ=1.40 | ε=53.3 σ=1.52 | ε=39.2 σ=1.80 | ε=52.7 σ=1.95 | ε=35.3 σ=5.27 | ε=48.2 σ=6.00 |

**Note: There are a little adjustment respectively for 750, 1750, 2600, 5200, 5300 and 5600 based on the recipe of closest frequency in table E.1.**

©Copyright. All rights reserved by CTTL.

# ANNEX F System Validation

The SAR system must be validated against its performance specifications before it is deployed. When SAR probes, system components or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such components.

**Table F.1: System Validation for 7548**

| Probe SN. | Liquid name | Validation date | Frequency point | Status (OK or Not) |
|---|---|---|---|---|
| 7548 | Head 750MHz | August.2,2022 | 750 MHz | OK |
| 7548 | Head 900MHz | August.2,2022 | 900 MHz | OK |
| 7548 | Head 1450MHz | August.2,2022 | 1450 MHz | OK |
| 7548 | Head 1750MHz | August.2,2022 | 1750 MHz | OK |
| 7548 | Head 1900MHz | August.2,2022 | 1900 MHz | OK |
| 7548 | Head 2000MHz | August.3,2022 | 2000 MHz | OK |
| 7548 | Head 2300MHz | August.3,2022 | 2300 MHz | OK |
| 7548 | Head 2450MHz | August.3,2022 | 2450 MHz | OK |
| 7548 | Head 2600MHz | August.3,2022 | 2600 MHz | OK |
| 7548 | Head 3300MHz | August.3,2022 | 3300 MHz | OK |
| 7548 | Head 3500MHz | August.3,2022 | 3500 MHz | OK |
| 7548 | Head 3700MHz | August.3,2022 | 3700 MHz | OK |
| 7548 | Head 5250MHz | August.4,2022 | 5250 MHz | OK |
| 7548 | Head 5600MHz | August.4,2022 | 5600 MHz | OK |
| 7548 | Head 5750MHz | August.4,2022 | 5750 MHz | OK |

©Copyright. All rights reserved by CTTL.

# ANNEX G Probe Calibration Certificate

## Probe 7548 Calibration Certificate

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client CTTL Certificate No: Z22-60260

### CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN : 7548 |
| Calibration Procedure(s) | FF-Z11-004-02<br>Calibration Procedures for Dosimetric E-field Probes |
| Calibration date: | August 01, 2022 |

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power Meter NRP2 | 101919 | 14-Jun-22(CTTL, No.J22X04181) | Jun-23 |
| Power sensor NRP-Z91 | 101547 | 14-Jun-22(CTTL, No.J22X04181) | Jun-23 |
| Power sensor NRP-Z91 | 101548 | 14-Jun-22(CTTL, No.J22X04181) | Jun-23 |
| Reference 10dBAttenuator | 18N50W-10dB | 20-Jan-21(CTTL, No.J21X00486) | Jan-23 |
| Reference 20dBAttenuator | 18N50W-20dB | 20-Jan-21(CTTL, No.J21X00485) | Jan-23 |
| Reference Probe EX3DV4 | SN 3846 | 20-May-22(SPEAG, No.EX3-3846_May22) | May-23 |
| DAE4 | SN 771 | 20-Jan-22(SPEAG, No.DAE4-771_Jan22) | Jan-23 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| SignalGenerator MG3700A | 6201052605 | 14-Jun-22(CTTL, No.J22X04182) | Jun-23 |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22(CTTL, No.J22X00406) | Jan-23 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Lin Hao | SAR Test Engineer | |
| Approved by: | Qi Dianyuan | SAR Project Leader | |

Issued: August 08, 2022

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z22-60260 Page 1 of 9

©Copyright. All rights reserved by CTTL.

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A,B,C,D | modulation dependent linearization parameters |
| Polarization Φ | Φ rotation around probe axis |
| Polarization θ | θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

**Calibration is Performed According to the Following Standards:**

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the $E^2$-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).



©Copyright. All rights reserved by CTTL. 

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

# DASY/EASY – Parameters of Probe: EX3DV4 – SN:7548

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (*k*=2) |
|---|---|---|---|---|
| Norm(μV/(V/m)²)[A] | 0.62 | 0.70 | 0.63 | ±10.0% |
| DCP(mV)[B] | 101.7 | 102.0 | 102.0 | |

## Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB√μV | C | D dB | VR mV | Unc[E] (*k*=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 193.2 | ±2.2% |
| | | Y | 0.0 | 0.0 | 1.0 | | 208.5 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 192.2 | |

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor *k*=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 4).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



©Copyright. All rights reserved by CTTL. 