

# FCC SAR Test Report

APPLICANT : Motorola Solutions, Inc.  
EQUIPMENT : WAVE TWO-WAY RADIO TLK 100  
BRAND NAME : Motorola  
MODEL NAME : TLK 100  
MODEL NUMBER : HK2112A  
FCC ID : AZ489FT7117  
STANDARD : FCC 47 CFR Part 2 (2.1093)  
ANSI/IEEE C95.1-1992  
IEEE 1528-2013

We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.



Approved by: Mark Qu / Manager



**Sporton International (Kunshan) Inc.**

**No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China**



## Table of Contents

|                                                             |    |
|-------------------------------------------------------------|----|
| 1. Statement of Compliance .....                            | 4  |
| 2. Administration Data .....                                | 5  |
| 3. Guidance Applied.....                                    | 5  |
| 4. Equipment Under Test (EUT) Information.....              | 6  |
| 4.1 General Information .....                               | 6  |
| 4.2 Specification of Accessory .....                        | 7  |
| 4.3 General LTE SAR Test and Reporting Considerations ..... | 8  |
| 5. RF Exposure Limits.....                                  | 9  |
| 5.1 Uncontrolled Environment.....                           | 9  |
| 5.2 Controlled Environment.....                             | 9  |
| 6. Specific Absorption Rate (SAR).....                      | 10 |
| 6.1 Introduction .....                                      | 10 |
| 6.2 SAR Definition.....                                     | 10 |
| 7. System Description and Setup .....                       | 11 |
| 7.1 E-Field Probe .....                                     | 12 |
| 7.2 Data Acquisition Electronics (DAE) .....                | 12 |
| 7.3 Phantom.....                                            | 13 |
| 7.4 Device Holder.....                                      | 14 |
| 8. Measurement Procedures .....                             | 15 |
| 8.1 Spatial Peak SAR Evaluation.....                        | 15 |
| 8.2 Power Reference Measurement.....                        | 16 |
| 8.3 Area Scan .....                                         | 16 |
| 8.4 Zoom Scan.....                                          | 17 |
| 8.5 Volume Scan Procedures.....                             | 17 |
| 8.6 Power Drift Monitoring.....                             | 17 |
| 9. Test Equipment List.....                                 | 18 |
| 10. System Verification .....                               | 19 |
| 10.1 Tissue Simulating Liquids.....                         | 19 |
| 10.2 Tissue Verification .....                              | 20 |
| 10.3 System Performance Check Results.....                  | 21 |
| 11. Conducted RF Output Power (Unit: dBm).....              | 22 |
| 12. Bluetooth Exclusions Applied .....                      | 34 |
| 13. Antenna Location .....                                  | 35 |
| 14. SAR Test Results .....                                  | 36 |
| 14.1 Face SAR.....                                          | 37 |
| 14.2 Body Worn Accessory SAR.....                           | 38 |
| 15. Simultaneous Transmission Analysis .....                | 40 |
| 15.1 Face Exposure Conditions .....                         | 41 |
| 15.2 Body-Worn Accessory Exposure Conditions .....          | 42 |
| 16. Uncertainty Assessment .....                            | 43 |
| 17. References.....                                         | 44 |
| Appendix A. Plots of System Performance Check               |    |
| Appendix B. Plots of High SAR Measurement                   |    |
| Appendix C. DASY Calibration Certificate                    |    |
| Appendix D. Test Setup Photos                               |    |

## History of this test report

| Report No. | Version | Description             | Issued Date   |
|------------|---------|-------------------------|---------------|
| FA850818   | 01      | Initial issue of report | Aug. 24, 2018 |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |



## **1. Statement of Compliance**

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Solutions, Inc., WAVE TWO-WAY RADIO TLK 100, TLK 100**, are as follows.

| Equipment Class  | Frequency Band |             | Highest SAR Summary       |                               | Highest Simultaneous Transmission<br>1g SAR (W/kg) |
|------------------|----------------|-------------|---------------------------|-------------------------------|----------------------------------------------------|
|                  |                |             | Face<br>(Separation 25mm) | Body-worn<br>(Separation 0mm) |                                                    |
|                  |                |             | 1g SAR (W/kg)             |                               |                                                    |
| Licensed         | LTE            | Band 13     | 0.62                      | 1.01                          | 1.19                                               |
|                  |                | Band 5      | 0.50                      | 0.77                          |                                                    |
|                  |                | Band 4      | 0.29                      | 0.37                          |                                                    |
|                  |                | Band 2      | 0.42                      | 0.39                          |                                                    |
| DTS              | WLAN           | 2.4GHz WLAN | <0.10                     | 0.18                          | 1.19                                               |
| NII              |                | 5GHz WLAN   | <0.10                     | <0.10                         | 1.05                                               |
| DSS              | 2.4GHz Band    | Bluetooth   |                           | 0.12                          | 1.13                                               |
| Date of Testing: |                |             | 2018/7/19 ~ 2018/8/8      |                               |                                                    |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.



## **2. Administration Data**

Sporton Lab is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No is CN5013.

| Testing Laboratory |                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Site          | Sporton International (Kunshan) Inc.                                                                                                             |
| Test Site Location | No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province<br>215335 China<br>TEL : +86-512-57900158<br>FAX : +86-512-57900958 |

| Applicant    |                                                                      |
|--------------|----------------------------------------------------------------------|
| Company Name | Motorola Solutions, Inc.                                             |
| Address      | 8000 West Sunrise Blvd., Ft Lauderdale, Florida 33322, United States |

| Manufacturer |                                                                      |
|--------------|----------------------------------------------------------------------|
| Company Name | Motorola Solutions, Inc.                                             |
| Address      | 8000 West Sunrise Blvd., Ft Lauderdale, Florida 33322, United States |

## **3. Guidance Applied**

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D05 SAR for LTE Devices v02r05

## **4. Equipment Under Test (EUT) Information**

### **4.1 General Information**

| Product Feature & Specification                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment Name                                                                                                                                                                                                                                                                                                                  | WAVE TWO-WAY RADIO TLK 100                                                                                                                                                                                                                                                                                                                                                                          |
| Brand Name                                                                                                                                                                                                                                                                                                                      | Motorola                                                                                                                                                                                                                                                                                                                                                                                            |
| Model Name                                                                                                                                                                                                                                                                                                                      | TLK 100                                                                                                                                                                                                                                                                                                                                                                                             |
| Model Number                                                                                                                                                                                                                                                                                                                    | HK2112A                                                                                                                                                                                                                                                                                                                                                                                             |
| FCC ID                                                                                                                                                                                                                                                                                                                          | AZ489FT7117                                                                                                                                                                                                                                                                                                                                                                                         |
| IMEI Code                                                                                                                                                                                                                                                                                                                       | 355661090007196                                                                                                                                                                                                                                                                                                                                                                                     |
| Wireless Technology and Frequency Range                                                                                                                                                                                                                                                                                         | LTE Band 2: 1850.7 MHz ~ 1909.3 MHz<br>LTE Band 4: 1710.7 MHz ~ 1754.3 MHz<br>LTE Band 5: 824.7 MHz ~ 848.3 MHz<br>LTE Band 13: 779.5 MHz ~ 784.5 MHz<br>WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz<br>WLAN 5.5GHz Band: 5500 MHz ~ 5720MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz<br>Bluetooth: 2402 MHz ~ 2480 MHz |
| Mode                                                                                                                                                                                                                                                                                                                            | LTE: QPSK, 16QAM<br>WLAN 2.4GHz 802.11b/g/n HT20/HT40<br>WLAN 5GHz 802.11a/n HT20/HT40<br>Bluetooth BR/EDR/LE                                                                                                                                                                                                                                                                                       |
| HW Version                                                                                                                                                                                                                                                                                                                      | P2.3                                                                                                                                                                                                                                                                                                                                                                                                |
| SW Version                                                                                                                                                                                                                                                                                                                      | TLK100_BASE_ENG_D01.00.02                                                                                                                                                                                                                                                                                                                                                                           |
| EUT Stage                                                                                                                                                                                                                                                                                                                       | Production Unit                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Remark:</b><br>1. This device has PTT (push-to-talk) function, so perform 25mm in-front-of the face SAR. For the device can't support held-to-ear operating mode, so no need to considering head SAR testing.<br>2. The device can use with assigned accessory manufacturer offered, so perform 0mm body worn accessory SAR. |                                                                                                                                                                                                                                                                                                                                                                                                     |

## 4.2 Specification of Accessory

| Specification of Accessory |                  |                                                      |            |           |
|----------------------------|------------------|------------------------------------------------------|------------|-----------|
| Battery                    | Brand Name       | MOTOROLA                                             | Model Name | PMNN4468A |
|                            | Power Rating     | 3.7~4.2Vdc,<br>2300mAh/8.5Wh                         | Type       | Li-ion    |
| Earphone 1                 | Brand Name       | Motorola                                             | Model Name | PMLN7189A |
|                            | Signal Line Type | 1.28 meter, non-shielded cable, without ferrite core |            |           |
| Earphone 2                 | Brand Name       | Motorola                                             | Model Name | PMLN7156A |
|                            | Signal Line Type | 1.18 meter, non-shielded cable, without ferrite core |            |           |
| Earphone 3                 | Brand Name       | Motorola                                             | Model Name | PMLN7158A |
|                            | Signal Line Type | 2.09meter, non-shielded cable, without ferrite core  |            |           |
| Earphone 4                 | Brand Name       | Motorola                                             | Model Name | PMLN7157A |
|                            | Signal Line Type | 1.65 meter, non-shielded cable, without ferrite core |            |           |
| Earphone 5                 | Brand Name       | Motorola                                             | Model Name | PMLN7159A |
|                            | Signal Line Type | 1.67 meter, non-shielded cable, without ferrite core |            |           |
| Swivel Carry Holster       | Brand Name       | Motorola                                             | Model Name | PMLN7932A |
| Belt Clip (Heavy-Duty)     | Brand Name       | Motorola                                             | Model Name | PMLN7128A |

| Specification of Antenna |                       |                                |
|--------------------------|-----------------------|--------------------------------|
| Antenna                  | Antenna Type          | Model Name                     |
| WWAN Main Antenna        | External Antenna      | SZ08171(Motorola #: HKAN4002A) |
|                          | FPC Connector Antenna | SZ0817N                        |
| WWAN Diversity Antenna   | PCB Antenna           | SZ08174                        |
| Bluetooth/WLAN Antenna   | Internal FPC Antenna  | SZ0817B                        |

### 4.3 General LTE SAR Test and Reporting Considerations

| Summarized necessary items addressed in KDB 941225 D05 v02r05           |                                                                                                                                                                                                        |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
| FCC ID                                                                  | AZ489FT7117                                                                                                                                                                                            |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| Equipment Name                                                          | WAVE TWO-WAY RADIO TLK 100                                                                                                                                                                             |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| Operating Frequency Range of each LTE transmission band                 | LTE Band 2: 1850.7 MHz ~ 1909.3 MHz<br>LTE Band 4: 1710.7 MHz ~ 1754.3 MHz<br>LTE Band 5: 824.7 MHz ~ 848.3 MHz<br>LTE Band 13: 779.5 MHz ~ 784.5 MHz                                                  |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| Channel Bandwidth                                                       | LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz<br>LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz<br>LTE Band 13: 5MHz, 10MHz                           |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| uplink modulations used                                                 | QPSK / 16QAM                                                                                                                                                                                           |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| LTE Voice / Data requirements                                           | Data only                                                                                                                                                                                              |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| LTE version                                                             | R8, Cat 1                                                                                                                                                                                              |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| LTE MPR permanently built-in by design                                  | Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3                                                                                                                                |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Modulation                                                                                                                                                                                             | Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> ) |                 |             |                  |             |                  | MPR (dB)    |                  |             |                  |             |
|                                                                         |                                                                                                                                                                                                        | 1.4 MHz                                                       | 3.0 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             | ≤ 2         |                  |             |                  |             |
|                                                                         | 64 QAM                                                                                                                                                                                                 | > 5                                                           | > 4             | > 8         | > 12             | > 16        | > 18             | ≤ 2         |                  |             |                  |             |
| 256 QAM                                                                 | ≥ 1                                                                                                                                                                                                    |                                                               |                 |             |                  |             | ≤ 5              |             |                  |             |                  |             |
| LTE A-MPR                                                               | In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)          |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| Spectrum plots for RB configuration                                     | A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report. |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| Transmission (H, M, L) channel numbers and frequencies in each LTE band |                                                                                                                                                                                                        |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
| LTE Band 2                                                              |                                                                                                                                                                                                        |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz                                                                                                                                                                                      |                                                               | Bandwidth 3 MHz |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|                                                                         | Ch. #                                                                                                                                                                                                  | Freq. (MHz)                                                   | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 18607                                                                                                                                                                                                  | 1850.7                                                        | 18615           | 1851.5      | 18625            | 1852.5      | 18650            | 1855        | 18675            | 1857.5      | 18700            | 1860        |
| M                                                                       | 18900                                                                                                                                                                                                  | 1880                                                          | 18900           | 1880        | 18900            | 1880        | 18900            | 1880        | 18900            | 1880        | 18900            | 1880        |
| H                                                                       | 19193                                                                                                                                                                                                  | 1909.3                                                        | 19185           | 1908.5      | 19175            | 1907.5      | 19150            | 1905        | 19125            | 1902.5      | 19100            | 1900        |
| LTE Band 4                                                              |                                                                                                                                                                                                        |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz                                                                                                                                                                                      |                                                               | Bandwidth 3 MHz |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             | Bandwidth 15 MHz |             | Bandwidth 20 MHz |             |
|                                                                         | Ch. #                                                                                                                                                                                                  | Freq. (MHz)                                                   | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 19957                                                                                                                                                                                                  | 1710.7                                                        | 19965           | 1711.5      | 19975            | 1712.5      | 20000            | 1715        | 20025            | 1717.5      | 20050            | 1720        |
| M                                                                       | 20175                                                                                                                                                                                                  | 1732.5                                                        | 20175           | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      | 20175            | 1732.5      |
| H                                                                       | 20393                                                                                                                                                                                                  | 1754.3                                                        | 20385           | 1753.5      | 20375            | 1752.5      | 20350            | 1750        | 20325            | 1747.5      | 20300            | 1745        |
| LTE Band 5                                                              |                                                                                                                                                                                                        |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 1.4 MHz                                                                                                                                                                                      |                                                               | Bandwidth 3 MHz |             | Bandwidth 5 MHz  |             | Bandwidth 10 MHz |             |                  |             |                  |             |
|                                                                         | Ch. #                                                                                                                                                                                                  | Freq. (MHz)                                                   | Ch. #           | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) | Ch. #            | Freq. (MHz) |
| L                                                                       | 20407                                                                                                                                                                                                  | 824.7                                                         | 20415           | 825.5       | 20425            | 826.5       | 20450            | 829         |                  |             |                  |             |
| M                                                                       | 20525                                                                                                                                                                                                  | 836.5                                                         | 20525           | 836.5       | 20525            | 836.5       | 20525            | 836.5       |                  |             |                  |             |
| H                                                                       | 20643                                                                                                                                                                                                  | 848.3                                                         | 20635           | 847.5       | 20625            | 846.5       | 20600            | 844         |                  |             |                  |             |
| LTE Band 13                                                             |                                                                                                                                                                                                        |                                                               |                 |             |                  |             |                  |             |                  |             |                  |             |
|                                                                         | Bandwidth 5 MHz                                                                                                                                                                                        |                                                               |                 |             | Bandwidth 10 MHz |             |                  |             |                  |             |                  |             |
|                                                                         | Channel #                                                                                                                                                                                              |                                                               | Freq.(MHz)      |             | Channel #        |             | Freq.(MHz)       |             |                  |             |                  |             |
| L                                                                       | 23205                                                                                                                                                                                                  |                                                               | 779.5           |             | 23230            |             | 782              |             |                  |             |                  |             |
| M                                                                       | 23230                                                                                                                                                                                                  |                                                               | 782             |             |                  |             |                  |             |                  |             |                  |             |
| H                                                                       | 23255                                                                                                                                                                                                  |                                                               | 784.5           |             |                  |             |                  |             |                  |             |                  |             |

## **5. RF Exposure Limits**

### **5.1 Uncontrolled Environment**

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

### **5.2 Controlled Environment**

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

**Limits for Occupational/Controlled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.4        | 8.0          | 20.0                           |

**Limits for General Population/Uncontrolled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.08       | 1.6          | 4.0                            |

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

## **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:

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

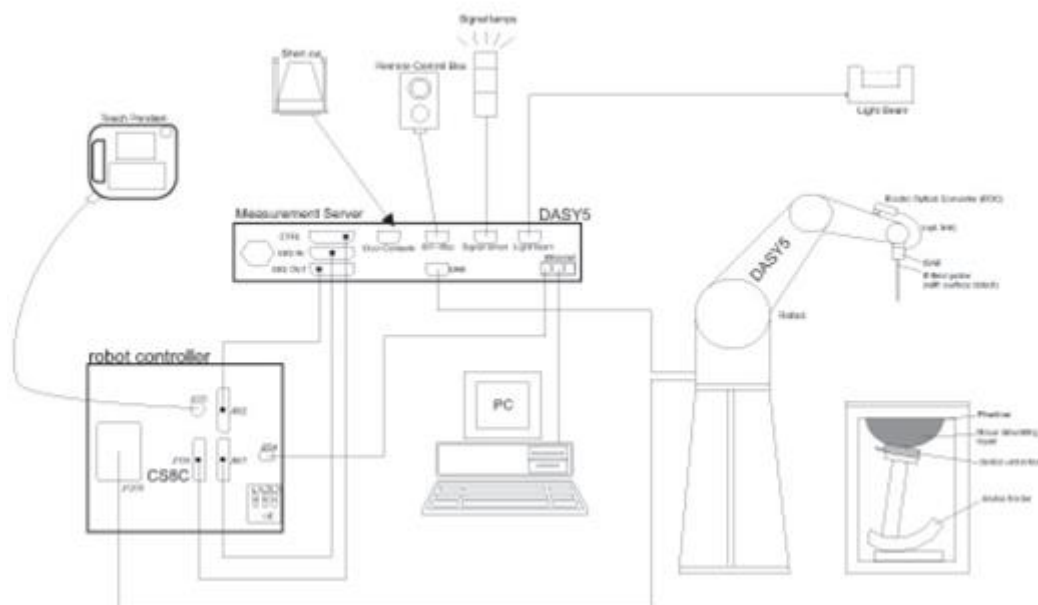
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

## 7. System Description and Setup

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot 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 or Win7 and the 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.

## 7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

### <EX3DV4 Probe>

|               |                                                                                                                                                           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction  | Symmetric design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Frequency     | 10 MHz – >6 GHz<br>Linearity: $\pm 0.2$ dB (30 MHz – 6 GHz)                                                                                               |
| Directivity   | $\pm 0.3$ dB in TSL (rotation around probe axis)<br>$\pm 0.5$ dB in TSL (rotation normal to probe axis)                                                   |
| Dynamic Range | 10 $\mu$ W/g – >100 mW/g<br>Linearity: $\pm 0.2$ dB (noise: typically <1 $\mu$ W/g)                                                                       |
| Dimensions    | Overall length: 337 mm (tip: 20 mm)<br>Tip diameter: 2.5 mm (body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm                      |



## 7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists 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 and 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 input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



Photo of DAE

### **7.3 Phantom**

#### **<SAM Twin Phantom>**

|                          |                                                         |                                                                                    |
|--------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Shell Thickness</b>   | 2 ± 0.2 mm;<br>Center ear point: 6 ± 0.2 mm             |  |
| <b>Filling Volume</b>    | Approx. 25 liters                                       |                                                                                    |
| <b>Dimensions</b>        | Length: 1000 mm; Width: 500 mm; Height: adjustable feet |                                                                                    |
| <b>Measurement Areas</b> | Left Hand, Right Hand, Flat Phantom                     |                                                                                    |

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

#### **<ELI Phantom>**

|                        |                                                  |                                                                                     |
|------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Shell Thickness</b> | 2 ± 0.2 mm (sagging: <1%)                        |  |
| <b>Filling Volume</b>  | Approx. 30 liters                                |                                                                                     |
| <b>Dimensions</b>      | Major ellipse axis: 600 mm<br>Minor axis: 400 mm |                                                                                     |

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

## 7.4 Device Holder

### <Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

### <Mounting Device for Laptops and other Body-Worn Transmitters>

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 positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Mounting Device for Laptops

## 8. Measurement Procedures

The measurement procedures are as follows:

### <Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

### <SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

### 8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

## **8.2 Power Reference Measurement**

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

## **8.3 Area Scan**

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

|                                                                                                        | $\leq 3$ GHz                                                                                                                                                                                                                                                           | $> 3$ GHz                                              |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | $5 \pm 1$ mm                                                                                                                                                                                                                                                           | $\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm     |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location              | $30^\circ \pm 1^\circ$                                                                                                                                                                                                                                                 | $20^\circ \pm 1^\circ$                                 |
| Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$                            | $\leq 2$ GHz: $\leq 15$ mm<br>$2 - 3$ GHz: $\leq 12$ mm                                                                                                                                                                                                                | $3 - 4$ GHz: $\leq 12$ mm<br>$4 - 6$ GHz: $\leq 10$ mm |
|                                                                                                        | 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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device. |                                                        |

### 8.4 Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

|                                                                                                                                                                                                                                                                                                             |                                           |                                                                                             | $\leq 3$ GHz                                         | $> 3$ GHz                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------|
| Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$                                                                                                                                                                                                                      |                                           |                                                                                             | $\leq 2$ GHz: $\leq 8$ mm<br>2 – 3 GHz: $\leq 5$ mm* | 3 – 4 GHz: $\leq 5$ mm*<br>4 – 6 GHz: $\leq 4$ mm*                            |
| Maximum zoom scan spatial resolution, normal to phantom surface                                                                                                                                                                                                                                             | uniform grid: $\Delta z_{\text{Zoom}}(n)$ |                                                                                             | $\leq 5$ mm                                          | 3 – 4 GHz: $\leq 4$ mm<br>4 – 5 GHz: $\leq 3$ mm<br>5 – 6 GHz: $\leq 2$ mm    |
|                                                                                                                                                                                                                                                                                                             | graded grid                               | $\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface | $\leq 4$ mm                                          | 3 – 4 GHz: $\leq 3$ mm<br>4 – 5 GHz: $\leq 2.5$ mm<br>5 – 6 GHz: $\leq 2$ mm  |
|                                                                                                                                                                                                                                                                                                             |                                           | $\Delta z_{\text{Zoom}}(n>1)$ : between subsequent points                                   | $\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$         |                                                                               |
| Minimum zoom scan volume                                                                                                                                                                                                                                                                                    | x, y, z                                   |                                                                                             | $\geq 30$ mm                                         | 3 – 4 GHz: $\geq 28$ mm<br>4 – 5 GHz: $\geq 25$ mm<br>5 – 6 GHz: $\geq 22$ mm |
| Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.                                                                                                                                                           |                                           |                                                                                             |                                                      |                                                                               |
| * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ 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. |                                           |                                                                                             |                                                      |                                                                               |

### 8.5 Volume Scan Procedures

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

### 8.6 Power Drift Monitoring

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

## 9. Test Equipment List

| Manufacturer  | Name of Equipment             | Type/Model    | Serial Number | Calibration |            |
|---------------|-------------------------------|---------------|---------------|-------------|------------|
|               |                               |               |               | Last Cal.   | Due Date   |
| SPEAG         | 750MHz System Validation Kit  | D750V3        | 1065          | 2017/12/4   | 2018/12/3  |
| SPEAG         | 835MHz System Validation Kit  | D835V2        | 4d091         | 2017/12/5   | 2018/12/4  |
| SPEAG         | 1750MHz System Validation Kit | D1750V2       | 1069          | 2017/12/5   | 2018/12/4  |
| SPEAG         | 1900MHz System Validation Kit | D1900V2       | 5d118         | 2017/12/6   | 2018/12/5  |
| SPEAG         | 2450MHz System Validation Kit | D2450V2       | 840           | 2017/12/7   | 2018/12/6  |
| SPEAG         | 5000MHz System Validation Kit | D5GHzV2       | 1006          | 2017/9/26   | 2018/9/25  |
| SPEAG         | Data Acquisition Electronics  | DAE4          | 1210          | 2018/5/28   | 2019/5/27  |
| SPEAG         | Data Acquisition Electronics  | DAE4          | 1338          | 2017/12/4   | 2018/12/3  |
| SPEAG         | Dosimetric E-Field Probe      | EX3DV4        | 3857          | 2018/5/31   | 2019/5/30  |
| SPEAG         | Dosimetric E-Field Probe      | EX3DV4        | 3954          | 2018/1/31   | 2019/1/30  |
| SPEAG         | SAM Twin Phantom              | QD 000 P40 CB | TP-1542       | NCR         | NCR        |
| SPEAG         | SAM Twin Phantom              | QD 000 P40 CB | TP-1644       | NCR         | NCR        |
| SPEAG         | SAM Twin Phantom              | QD 000 P40 CB | TP-1164       | NCR         | NCR        |
| SPEAG         | SAM Twin Phantom              | QD 000 P40 CB | TP-1842       | NCR         | NCR        |
| SPEAG         | Phone Positioner              | N/A           | N/A           | NCR         | NCR        |
| Anritsu       | Radio communication analyzer  | MT8820C       | 6201563814    | 2018/1/18   | 2019/1/17  |
| Agilent       | ENA Series Network Analyzer   | E5071C        | MY46111157    | 2018/4/17   | 2019/4/16  |
| SPEAG         | Dielectric Probe Kit          | DAK-3.5       | 1138          | 2017/11/28  | 2018/11/27 |
| R&S           | Signal Generator              | SML03         | 103818        | 2017/8/17   | 2018/8/16  |
| Anritsu       | Power Meter                   | ML2495A       | 1419002       | 2018/5/14   | 2019/5/13  |
| Anritsu       | Power Sensor                  | MA2411B       | 1339124       | 2018/5/14   | 2019/5/13  |
| Anritsu       | Power Meter                   | ML2495A       | 1218006       | 2017/10/6   | 2018/10/5  |
| Anritsu       | Power Sensor                  | MA2411B       | 1207363       | 2017/10/6   | 2018/10/5  |
| R&S           | CBT BLUETOOTH TESTER          | CBT           | 101246        | 2018/1/26   | 2019/1/25  |
| EXA           | Spectrum Analyzer             | FSV7          | 101742        | 2018/1/19   | 2019/1/18  |
| Testo         | Hygrometer                    | 608-H1        | 1241332096    | 2017/8/21   | 2018/8/20  |
| TES           | Liquid thermometer            | TES 1310      | 130023        | 2018/4/20   | 2019/4/19  |
| ARRA          | Power Divider                 | A3200-2       | N/A           | Note        |            |
| Agilent       | Dual Directional Coupler      | 778D          | 50422         | Note        |            |
| PASTERNAK     | Dual Directional Coupler      | PE2214-10     | N/A           | Note        |            |
| MCL           | Attenuation1                  | BW-S10W5+     | N/A           | Note        |            |
| MCL           | Attenuation2                  | BW-S10W5+     | N/A           | Note        |            |
| MCL           | Attenuation3                  | BW-S10W5+     | N/A           | Note        |            |
| AR            | Amplifier                     | 5S1G4         | 333096        | Note        |            |
| mini-circuits | Amplifier                     | ZVE-3W-83+    | 162601250     | Note        |            |

**Note:** Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

## 10. System Verification

### 10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

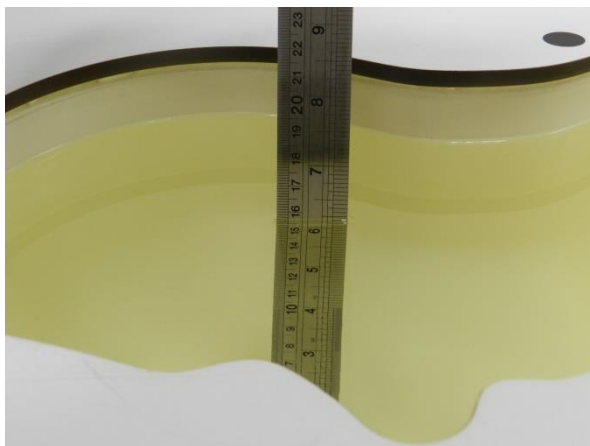


Fig 10.1 Photo of Liquid Height for Head SAR



Fig 10.2 Photo of Liquid Height for Body SAR

## 10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

| Frequency (MHz)  | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity ( $\sigma$ ) | Permittivity ( $\epsilon_r$ ) |
|------------------|-----------|-----------|---------------|----------|---------------|----------|---------------------------|-------------------------------|
| For Head         |           |           |               |          |               |          |                           |                               |
| 750              | 41.1      | 57.0      | 0.2           | 1.4      | 0.2           | 0        | 0.89                      | 41.9                          |
| 835              | 40.3      | 57.9      | 0.2           | 1.4      | 0.2           | 0        | 0.90                      | 41.5                          |
| 1800, 1900, 2000 | 55.2      | 0         | 0             | 0.3      | 0             | 44.5     | 1.40                      | 40.0                          |
| 2450             | 55.0      | 0         | 0             | 0        | 0             | 45.0     | 1.80                      | 39.2                          |
| For Body         |           |           |               |          |               |          |                           |                               |
| 750              | 51.7      | 47.2      | 0             | 0.9      | 0.1           | 0        | 0.96                      | 55.5                          |
| 835              | 50.8      | 48.2      | 0             | 0.9      | 0.1           | 0        | 0.97                      | 55.2                          |
| 1800, 1900, 2000 | 70.2      | 0         | 0             | 0.4      | 0             | 29.4     | 1.52                      | 53.3                          |
| 2450             | 68.6      | 0         | 0             | 0        | 0             | 31.4     | 1.95                      | 52.7                          |

### Simulating Liquid for 5GHz, Manufactured by SPEAG

| Ingredients        | (% by weight) |
|--------------------|---------------|
| Water              | 64~78%        |
| Mineral oil        | 11~18%        |
| Emulsifiers        | 9~15%         |
| Additives and Salt | 2~3%          |

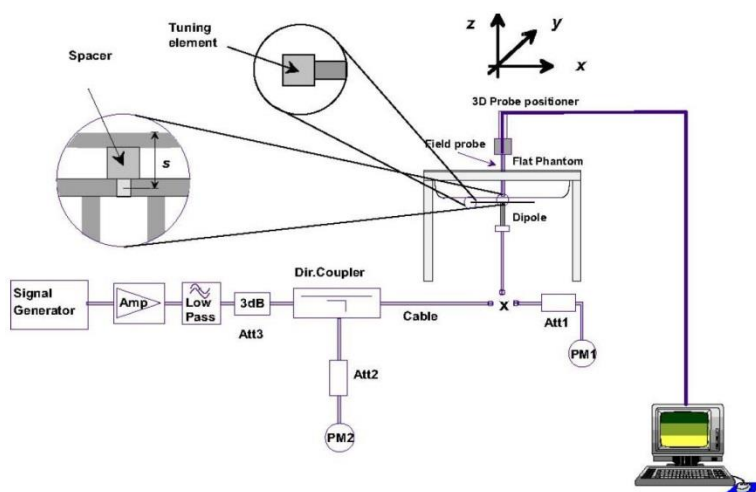
### <Tissue Dielectric Parameter Check Results>

| Frequency (MHz) | Tissue Type | Liquid Temp. (°C) | Conductivity ( $\sigma$ ) | Permittivity ( $\epsilon_r$ ) | Conductivity Target ( $\sigma$ ) | Permittivity Target ( $\epsilon_r$ ) | Delta ( $\sigma$ ) (%) | Delta ( $\epsilon_r$ ) (%) | Limit (%) | Date      |
|-----------------|-------------|-------------------|---------------------------|-------------------------------|----------------------------------|--------------------------------------|------------------------|----------------------------|-----------|-----------|
| 750             | Head        | 22.6              | 0.911                     | 42.828                        | 0.89                             | 41.90                                | 2.36                   | 2.21                       | ±5        | 2018/8/7  |
| 835             | Head        | 22.6              | 0.912                     | 42.084                        | 0.90                             | 41.50                                | 1.33                   | 1.41                       | ±5        | 2018/8/7  |
| 1750            | Head        | 22.9              | 1.365                     | 39.524                        | 1.37                             | 40.10                                | -0.36                  | -1.44                      | ±5        | 2018/8/7  |
| 1900            | Head        | 22.5              | 1.403                     | 39.504                        | 1.40                             | 40.00                                | 0.21                   | -1.24                      | ±5        | 2018/8/7  |
| 2450            | Head        | 22.7              | 1.837                     | 38.334                        | 1.80                             | 39.20                                | 2.06                   | -2.21                      | ±5        | 2018/8/8  |
| 5250            | Head        | 22.6              | 4.565                     | 36.009                        | 4.71                             | 35.90                                | -3.08                  | 0.30                       | ±5        | 2018/8/8  |
| 5600            | Head        | 22.6              | 4.968                     | 35.220                        | 5.07                             | 35.50                                | -2.01                  | -0.79                      | ±5        | 2018/8/8  |
| 5750            | Head        | 22.6              | 5.147                     | 34.924                        | 5.22                             | 35.40                                | -1.40                  | -1.34                      | ±5        | 2018/8/8  |
| 750             | Body        | 22.5              | 0.913                     | 57.193                        | 0.96                             | 55.50                                | -4.90                  | 3.05                       | ±5        | 2018/7/20 |
| 835             | Body        | 22.6              | 0.984                     | 56.510                        | 0.97                             | 55.20                                | 1.44                   | 2.37                       | ±5        | 2018/7/19 |
| 1750            | Body        | 22.7              | 1.491                     | 54.729                        | 1.49                             | 53.40                                | 0.07                   | 2.49                       | ±5        | 2018/7/19 |
| 1900            | Body        | 22.8              | 1.537                     | 53.469                        | 1.52                             | 53.30                                | 1.12                   | 0.32                       | ±5        | 2018/7/19 |
| 2450            | Body        | 22.6              | 2.017                     | 53.033                        | 1.95                             | 52.70                                | 3.44                   | 0.63                       | ±5        | 2018/7/21 |
| 5250            | Body        | 22.7              | 5.506                     | 47.956                        | 5.36                             | 48.90                                | 2.72                   | -1.93                      | ±5        | 2018/7/22 |
| 5600            | Body        | 22.8              | 5.954                     | 47.367                        | 5.77                             | 48.50                                | 3.19                   | -2.34                      | ±5        | 2018/7/22 |
| 5750            | Body        | 22.9              | 6.212                     | 46.182                        | 5.94                             | 48.30                                | 4.58                   | -4.39                      | ±5        | 2018/7/22 |

### 10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

| Date      | Frequency (MHz) | Tissue Type | Input Power (mW) | Dipole S/N | Probe S/N | DAE S/N | Measured 1g SAR (W/kg) | Targeted 1g SAR (W/kg) | Normalized 1g SAR (W/kg) | Deviation (%) |
|-----------|-----------------|-------------|------------------|------------|-----------|---------|------------------------|------------------------|--------------------------|---------------|
| 2018/8/7  | 750             | Head        | 250              | 1065       | 3857      | 1210    | 2.07                   | 8.33                   | 8.28                     | -0.60         |
| 2018/8/7  | 835             | Head        | 250              | 4d091      | 3857      | 1210    | 2.46                   | 9.48                   | 9.84                     | 3.80          |
| 2018/8/7  | 1750            | Head        | 250              | 1069       | 3857      | 1210    | 9.16                   | 37.00                  | 36.64                    | -0.97         |
| 2018/8/7  | 1900            | Head        | 250              | 5d118      | 3857      | 1210    | 9.72                   | 39.70                  | 38.88                    | -2.07         |
| 2018/8/8  | 2450            | Head        | 250              | 840        | 3857      | 1210    | 12.70                  | 52.60                  | 50.80                    | -3.42         |
| 2018/8/8  | 5250            | Head        | 100              | 1006       | 3857      | 1210    | 7.67                   | 78.30                  | 76.7                     | -2.04         |
| 2018/8/8  | 5600            | Head        | 100              | 1006       | 3857      | 1210    | 8.05                   | 85.00                  | 80.5                     | -5.29         |
| 2018/8/8  | 5750            | Head        | 100              | 1006       | 3857      | 1210    | 7.78                   | 78.50                  | 77.8                     | -0.89         |
| 2018/7/20 | 750             | Body        | 250              | 1065       | 3954      | 1338    | 2.15                   | 8.72                   | 8.6                      | -1.38         |
| 2018/7/19 | 835             | Body        | 250              | 4d091      | 3857      | 1210    | 2.57                   | 9.72                   | 10.28                    | 5.76          |
| 2018/7/19 | 1750            | Body        | 250              | 1069       | 3857      | 1210    | 9.34                   | 38.00                  | 37.36                    | -1.68         |
| 2018/7/19 | 1900            | Body        | 250              | 5d118      | 3857      | 1210    | 9.83                   | 40.40                  | 39.32                    | -2.67         |
| 2018/7/21 | 2450            | Body        | 250              | 840        | 3857      | 1210    | 13.50                  | 51.90                  | 54                       | 4.05          |
| 2018/7/22 | 5250            | Body        | 100              | 1006       | 3857      | 1210    | 7.72                   | 77.00                  | 77.2                     | 0.26          |
| 2018/7/22 | 5600            | Body        | 100              | 1006       | 3857      | 1210    | 8.13                   | 80.10                  | 81.3                     | 1.50          |
| 2018/7/22 | 5750            | Body        | 100              | 1006       | 3857      | 1210    | 7.51                   | 75.10                  | 75.1                     | 0.00          |



**Fig 10.3.1 System Performance Check Setup**

**Fig 10.3.2 Setup Photo**

## **11. Conducted RF Output Power (Unit: dBm)**

### **<LTE Conducted Power>**

#### **General Note:**

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, 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 for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, 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 are  $\leq 0.8$  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.
6. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. For LTE B4 / B5 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.



**<LTE Band 2>**

| BW [MHz]        | Modulation | RB Size | RB Offset | Power Low<br>Ch. / Freq. | Power Middle<br>Ch. / Freq. | Power High<br>Ch. / Freq. | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|------------|---------|-----------|--------------------------|-----------------------------|---------------------------|---------------------------|-------------|
| Channel         |            |         |           | 18700                    | 18900                       | 19100                     |                           |             |
| Frequency (MHz) |            |         |           | 1860                     | 1880                        | 1900                      |                           |             |
| 20              | QPSK       | 1       | 0         | 22.90                    | 22.69                       | 22.68                     |                           |             |
| 20              | QPSK       | 1       | 49        | 22.91                    | 22.93                       | 22.73                     | 24.5                      | 0           |
| 20              | QPSK       | 1       | 99        | 22.61                    | 22.90                       | 22.63                     | 23.5                      | 1           |
| 20              | QPSK       | 50      | 0         | 21.98                    | 21.86                       | 21.95                     |                           |             |
| 20              | QPSK       | 50      | 24        | 22.01                    | 22.07                       | 21.83                     |                           |             |
| 20              | QPSK       | 50      | 50        | 21.92                    | 21.94                       | 21.78                     |                           |             |
| 20              | QPSK       | 100     | 0         | 21.83                    | 21.79                       | 21.71                     | 23.5                      | 1           |
| 20              | 16QAM      | 1       | 0         | 21.84                    | 21.85                       | 21.71                     |                           |             |
| 20              | 16QAM      | 1       | 49        | 21.82                    | 21.74                       | 21.88                     |                           |             |
| 20              | 16QAM      | 1       | 99        | 21.74                    | 21.64                       | 21.63                     | 22.5                      | 2           |
| 20              | 16QAM      | 12      | 0         | 21.96                    | 22.01                       | 21.96                     |                           |             |
| 20              | 16QAM      | 12      | 44        | 22.00                    | 22.08                       | 21.78                     |                           |             |
| 20              | 16QAM      | 12      | 88        | 22.00                    | 22.08                       | 21.91                     |                           |             |
| 20              | 16QAM      | 27      | 0         | 20.57                    | 20.77                       | 20.72                     |                           |             |
| Channel         |            |         |           | 18675                    | 18900                       | 19125                     |                           |             |
| Frequency (MHz) |            |         |           | 1857.5                   | 1880                        | 1902.5                    |                           |             |
| 15              | QPSK       | 1       | 0         | 22.81                    | 22.90                       | 22.91                     |                           |             |
| 15              | QPSK       | 1       | 37        | 22.92                    | 22.75                       | 22.70                     | 24.5                      | 0           |
| 15              | QPSK       | 1       | 74        | 22.82                    | 22.92                       | 22.77                     | 23.5                      | 1           |
| 15              | QPSK       | 36      | 0         | 21.82                    | 21.70                       | 21.76                     |                           |             |
| 15              | QPSK       | 36      | 20        | 21.85                    | 21.77                       | 21.76                     |                           |             |
| 15              | QPSK       | 36      | 39        | 21.85                    | 21.91                       | 21.74                     |                           |             |
| 15              | QPSK       | 75      | 0         | 21.66                    | 21.71                       | 21.64                     | 23.5                      | 1           |
| 15              | 16QAM      | 1       | 0         | 21.64                    | 21.76                       | 21.79                     |                           |             |
| 15              | 16QAM      | 1       | 37        | 21.70                    | 21.75                       | 21.57                     |                           |             |
| 15              | 16QAM      | 1       | 74        | 21.66                    | 21.56                       | 21.53                     | 22.5                      | 2           |
| 15              | 16QAM      | 12      | 0         | 21.83                    | 22.00                       | 21.97                     |                           |             |
| 15              | 16QAM      | 12      | 31        | 21.81                    | 21.70                       | 21.56                     |                           |             |
| 15              | 16QAM      | 12      | 63        | 21.59                    | 21.86                       | 21.91                     |                           |             |
| 15              | 16QAM      | 27      | 0         | 20.59                    | 20.60                       | 20.57                     |                           |             |
| Channel         |            |         |           | 18650                    | 18900                       | 19150                     |                           |             |
| Frequency (MHz) |            |         |           | 1855                     | 1880                        | 1905                      |                           |             |
| 10              | QPSK       | 1       | 0         | 22.63                    | 22.50                       | 22.58                     |                           |             |
| 10              | QPSK       | 1       | 25        | 22.78                    | 22.81                       | 22.57                     | 24.5                      | 0           |
| 10              | QPSK       | 1       | 49        | 22.76                    | 22.80                       | 22.60                     | 23.5                      | 1           |
| 10              | QPSK       | 25      | 0         | 21.75                    | 21.73                       | 21.73                     |                           |             |
| 10              | QPSK       | 25      | 12        | 21.77                    | 21.72                       | 21.72                     |                           |             |
| 10              | QPSK       | 25      | 25        | 21.66                    | 21.78                       | 21.72                     |                           |             |
| 10              | QPSK       | 50      | 0         | 21.81                    | 21.73                       | 21.88                     | 23.5                      | 1           |
| 10              | 16QAM      | 1       | 0         | 21.62                    | 21.59                       | 21.98                     |                           |             |
| 10              | 16QAM      | 1       | 25        | 21.60                    | 21.50                       | 21.54                     |                           |             |
| 10              | 16QAM      | 1       | 49        | 21.52                    | 21.58                       | 21.52                     | 22.5                      | 2           |
| 10              | 16QAM      | 12      | 0         | 21.59                    | 21.44                       | 21.79                     |                           |             |
| 10              | 16QAM      | 12      | 19        | 21.90                    | 21.45                       | 21.42                     |                           |             |
| 10              | 16QAM      | 12      | 38        | 21.72                    | 21.53                       | 21.55                     |                           |             |
| 10              | 16QAM      | 27      | 0         | 20.52                    | 20.59                       | 20.50                     |                           |             |



| Channel         |       |    |    | 18625  | 18900 | 19175  | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|-------|----|----|--------|-------|--------|---------------------------|-------------|
| Frequency (MHz) |       |    |    | 1852.5 | 1880  | 1907.5 |                           |             |
| 5               | QPSK  | 1  | 0  | 22.61  | 22.59 | 22.56  | 24.5                      | 0           |
| 5               | QPSK  | 1  | 12 | 22.62  | 22.59 | 22.77  |                           |             |
| 5               | QPSK  | 1  | 24 | 22.51  | 22.56 | 22.51  |                           |             |
| 5               | QPSK  | 12 | 0  | 21.64  | 21.57 | 21.57  | 23.5                      | 1           |
| 5               | QPSK  | 12 | 7  | 21.74  | 21.50 | 21.56  |                           |             |
| 5               | QPSK  | 12 | 13 | 21.69  | 21.51 | 21.56  |                           |             |
| 5               | QPSK  | 25 | 0  | 21.71  | 21.57 | 21.70  |                           |             |
| 5               | 16QAM | 1  | 0  | 21.51  | 21.55 | 21.51  | 23.5                      | 1           |
| 5               | 16QAM | 1  | 12 | 21.59  | 21.53 | 21.53  |                           |             |
| 5               | 16QAM | 1  | 24 | 21.59  | 21.60 | 21.59  |                           |             |
| 5               | 16QAM | 12 | 0  | 20.79  | 20.57 | 20.50  | 22.5                      | 2           |
| 5               | 16QAM | 12 | 7  | 20.67  | 20.59 | 20.59  |                           |             |
| 5               | 16QAM | 12 | 13 | 20.68  | 20.60 | 20.50  |                           |             |
| 5               | 16QAM | 25 | 0  | 20.67  | 20.69 | 20.71  |                           |             |
| Channel         |       |    |    | 18615  | 18900 | 19185  | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
| Frequency (MHz) |       |    |    | 1851.5 | 1880  | 1908.5 |                           |             |
| 3               | QPSK  | 1  | 0  | 22.77  | 22.70 | 22.58  | 24.5                      | 0           |
| 3               | QPSK  | 1  | 8  | 22.72  | 22.61 | 22.77  |                           |             |
| 3               | QPSK  | 1  | 14 | 22.65  | 22.65 | 22.85  |                           |             |
| 3               | QPSK  | 8  | 0  | 21.82  | 21.77 | 21.66  | 23.5                      | 1           |
| 3               | QPSK  | 8  | 4  | 21.83  | 21.76 | 21.68  |                           |             |
| 3               | QPSK  | 8  | 7  | 21.78  | 21.83 | 21.80  |                           |             |
| 3               | QPSK  | 15 | 0  | 21.71  | 21.73 | 21.73  |                           |             |
| 3               | 16QAM | 1  | 0  | 21.65  | 21.53 | 21.61  | 23.5                      | 1           |
| 3               | 16QAM | 1  | 8  | 21.65  | 21.55 | 21.62  |                           |             |
| 3               | 16QAM | 1  | 14 | 21.63  | 21.55 | 21.61  |                           |             |
| 3               | 16QAM | 8  | 0  | 20.80  | 20.72 | 20.80  | 22.5                      | 2           |
| 3               | 16QAM | 8  | 4  | 20.75  | 20.69 | 20.87  |                           |             |
| 3               | 16QAM | 8  | 7  | 20.74  | 20.92 | 20.81  |                           |             |
| 3               | 16QAM | 15 | 0  | 20.76  | 20.78 | 20.80  |                           |             |
| Channel         |       |    |    | 18607  | 18900 | 19193  | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
| Frequency (MHz) |       |    |    | 1850.7 | 1880  | 1909.3 |                           |             |
| 1.4             | QPSK  | 1  | 0  | 22.74  | 22.68 | 22.60  | 24.5                      | 0           |
| 1.4             | QPSK  | 1  | 3  | 22.77  | 22.64 | 22.65  |                           |             |
| 1.4             | QPSK  | 1  | 5  | 22.67  | 22.56 | 22.70  |                           |             |
| 1.4             | QPSK  | 3  | 0  | 22.84  | 22.66 | 22.91  |                           |             |
| 1.4             | QPSK  | 3  | 1  | 22.75  | 22.81 | 22.83  |                           |             |
| 1.4             | QPSK  | 3  | 3  | 22.77  | 22.89 | 22.78  |                           |             |
| 1.4             | QPSK  | 6  | 0  | 21.74  | 21.62 | 21.50  | 23.5                      | 1           |
| 1.4             | 16QAM | 1  | 0  | 21.62  | 21.51 | 21.54  | 23.5                      | 1           |
| 1.4             | 16QAM | 1  | 3  | 21.73  | 21.57 | 21.51  |                           |             |
| 1.4             | 16QAM | 1  | 5  | 21.65  | 21.53 | 21.59  |                           |             |
| 1.4             | 16QAM | 3  | 0  | 21.59  | 21.59 | 21.89  |                           |             |
| 1.4             | 16QAM | 3  | 1  | 21.72  | 21.71 | 21.52  |                           |             |
| 1.4             | 16QAM | 3  | 3  | 21.75  | 21.70 | 21.55  |                           |             |
| 1.4             | 16QAM | 6  | 0  | 20.70  | 20.67 | 20.60  | 22.5                      | 2           |



**<LTE Band 4>**

| BW [MHz]        | Modulation | RB Size | RB Offset | Power Low<br>Ch. / Freq. | Power Middle<br>Ch. / Freq. | Power High<br>Ch. / Freq. | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|------------|---------|-----------|--------------------------|-----------------------------|---------------------------|---------------------------|-------------|
| Channel         |            |         |           | 20050                    | 20175                       | 20300                     | 25                        | 0           |
| Frequency (MHz) |            |         |           | 1720                     | 1732.5                      | 1745                      |                           |             |
| 20              | QPSK       | 1       | 0         | 23.71                    | 23.69                       | 23.88                     |                           |             |
| 20              | QPSK       | 1       | 49        | 24.17                    | 23.67                       | 23.86                     | 24                        | 1           |
| 20              | QPSK       | 1       | 99        | 23.71                    | 23.72                       | 23.68                     |                           |             |
| 20              | QPSK       | 50      | 0         | 22.95                    | 22.69                       | 22.70                     |                           |             |
| 20              | QPSK       | 50      | 24        | 22.78                    | 22.68                       | 22.92                     | 24                        | 1           |
| 20              | QPSK       | 50      | 50        | 22.69                    | 22.58                       | 22.85                     |                           |             |
| 20              | QPSK       | 100     | 0         | 22.68                    | 22.46                       | 22.59                     |                           |             |
| 20              | 16QAM      | 1       | 0         | 22.35                    | 22.45                       | 22.63                     | 24                        | 1           |
| 20              | 16QAM      | 1       | 49        | 22.35                    | 22.24                       | 22.56                     |                           |             |
| 20              | 16QAM      | 1       | 99        | 22.31                    | 22.26                       | 22.46                     |                           |             |
| 20              | 16QAM      | 12      | 0         | 22.60                    | 22.62                       | 22.95                     | 23                        | 2           |
| 20              | 16QAM      | 12      | 44        | 22.50                    | 22.60                       | 22.65                     |                           |             |
| 20              | 16QAM      | 12      | 88        | 22.55                    | 22.59                       | 22.65                     |                           |             |
| 20              | 16QAM      | 27      | 0         | 21.52                    | 21.39                       | 21.67                     | 25                        | 0           |
| Channel         |            |         |           | 20025                    | 20175                       | 20325                     |                           |             |
| Frequency (MHz) |            |         |           | 1717.5                   | 1732.5                      | 1747.5                    |                           |             |
| 15              | QPSK       | 1       | 0         | 23.65                    | 23.62                       | 23.90                     | 25                        | 0           |
| 15              | QPSK       | 1       | 37        | 23.81                    | 23.61                       | 23.97                     |                           |             |
| 15              | QPSK       | 1       | 74        | 23.48                    | 23.47                       | 23.88                     |                           |             |
| 15              | QPSK       | 36      | 0         | 22.57                    | 22.64                       | 22.89                     | 24                        | 1           |
| 15              | QPSK       | 36      | 20        | 22.71                    | 22.58                       | 22.81                     |                           |             |
| 15              | QPSK       | 36      | 39        | 22.64                    | 22.55                       | 22.74                     |                           |             |
| 15              | QPSK       | 75      | 0         | 22.46                    | 22.59                       | 22.39                     | 24                        | 1           |
| 15              | 16QAM      | 1       | 0         | 22.49                    | 22.45                       | 22.63                     |                           |             |
| 15              | 16QAM      | 1       | 37        | 22.33                    | 22.45                       | 22.69                     |                           |             |
| 15              | 16QAM      | 1       | 74        | 22.36                    | 22.22                       | 22.62                     | 23                        | 2           |
| 15              | 16QAM      | 12      | 0         | 22.67                    | 22.67                       | 22.76                     |                           |             |
| 15              | 16QAM      | 12      | 31        | 22.69                    | 22.58                       | 22.66                     |                           |             |
| 15              | 16QAM      | 12      | 63        | 22.56                    | 22.68                       | 22.66                     | 25                        | 0           |
| 15              | 16QAM      | 27      | 0         | 21.66                    | 21.70                       | 21.83                     |                           |             |
| Channel         |            |         |           | 20000                    | 20175                       | 20350                     |                           |             |
| Frequency (MHz) |            |         |           | 1715                     | 1732.5                      | 1750                      |                           |             |
| 10              | QPSK       | 1       | 0         | 23.35                    | 23.42                       | 23.54                     | 25                        | 0           |
| 10              | QPSK       | 1       | 25        | 23.73                    | 23.43                       | 23.85                     |                           |             |
| 10              | QPSK       | 1       | 49        | 23.65                    | 23.52                       | 23.81                     |                           |             |
| 10              | QPSK       | 25      | 0         | 22.52                    | 22.61                       | 22.70                     | 24                        | 1           |
| 10              | QPSK       | 25      | 12        | 22.65                    | 22.54                       | 22.84                     |                           |             |
| 10              | QPSK       | 25      | 25        | 22.68                    | 22.51                       | 22.75                     |                           |             |
| 10              | QPSK       | 50      | 0         | 22.62                    | 22.57                       | 22.72                     | 24                        | 1           |
| 10              | 16QAM      | 1       | 0         | 22.31                    | 22.36                       | 22.62                     |                           |             |
| 10              | 16QAM      | 1       | 25        | 22.38                    | 22.35                       | 22.62                     |                           |             |
| 10              | 16QAM      | 1       | 49        | 22.30                    | 22.34                       | 22.68                     | 23                        | 2           |
| 10              | 16QAM      | 12      | 0         | 22.45                    | 22.51                       | 22.64                     |                           |             |
| 10              | 16QAM      | 12      | 19        | 22.52                    | 22.52                       | 22.67                     |                           |             |
| 10              | 16QAM      | 12      | 38        | 22.47                    | 22.52                       | 22.81                     | 25                        | 0           |
| 10              | 16QAM      | 27      | 0         | 21.67                    | 21.63                       | 21.73                     |                           |             |



| Channel         |       |    |    | 19975  | 20175  | 20375  | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|-------|----|----|--------|--------|--------|---------------------------|-------------|
| Frequency (MHz) |       |    |    | 1712.5 | 1732.5 | 1752.5 |                           |             |
| 5               | QPSK  | 1  | 0  | 23.61  | 23.51  | 23.72  | 25                        | 0           |
| 5               | QPSK  | 1  | 12 | 23.82  | 23.50  | 23.81  |                           |             |
| 5               | QPSK  | 1  | 24 | 23.63  | 23.66  | 23.64  |                           |             |
| 5               | QPSK  | 12 | 0  | 22.44  | 22.60  | 22.75  | 24                        | 1           |
| 5               | QPSK  | 12 | 7  | 22.54  | 22.57  | 22.75  |                           |             |
| 5               | QPSK  | 12 | 13 | 22.49  | 22.55  | 22.70  |                           |             |
| 5               | QPSK  | 25 | 0  | 22.55  | 22.52  | 22.71  | 24                        | 1           |
| 5               | 16QAM | 1  | 0  | 22.17  | 22.39  | 22.55  |                           |             |
| 5               | 16QAM | 1  | 12 | 22.18  | 22.35  | 22.29  |                           |             |
| 5               | 16QAM | 1  | 24 | 22.19  | 22.26  | 22.64  | 23                        | 2           |
| 5               | 16QAM | 12 | 0  | 21.23  | 21.40  | 21.44  |                           |             |
| 5               | 16QAM | 12 | 7  | 21.30  | 21.50  | 21.43  |                           |             |
| 5               | 16QAM | 12 | 13 | 21.48  | 21.48  | 21.59  | 23                        | 2           |
| 5               | 16QAM | 25 | 0  | 21.53  | 21.53  | 21.61  |                           |             |
| Channel         |       |    |    | 19965  | 20175  | 20385  | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
| Frequency (MHz) |       |    |    | 1711.5 | 1732.5 | 1753.5 |                           |             |
| 3               | QPSK  | 1  | 0  | 23.67  | 23.56  | 23.86  | 25                        | 0           |
| 3               | QPSK  | 1  | 8  | 23.88  | 23.39  | 23.53  |                           |             |
| 3               | QPSK  | 1  | 14 | 23.70  | 23.74  | 23.63  |                           |             |
| 3               | QPSK  | 8  | 0  | 22.59  | 22.59  | 22.53  | 24                        | 1           |
| 3               | QPSK  | 8  | 4  | 22.46  | 22.66  | 22.53  |                           |             |
| 3               | QPSK  | 8  | 7  | 22.49  | 22.57  | 22.54  |                           |             |
| 3               | QPSK  | 15 | 0  | 22.63  | 22.64  | 22.57  | 24                        | 1           |
| 3               | 16QAM | 1  | 0  | 22.29  | 22.43  | 22.57  |                           |             |
| 3               | 16QAM | 1  | 8  | 22.23  | 22.37  | 22.07  |                           |             |
| 3               | 16QAM | 1  | 14 | 22.14  | 22.43  | 22.42  | 23                        | 2           |
| 3               | 16QAM | 8  | 0  | 21.25  | 21.58  | 21.36  |                           |             |
| 3               | 16QAM | 8  | 4  | 21.59  | 21.56  | 21.56  |                           |             |
| 3               | 16QAM | 8  | 7  | 21.39  | 21.64  | 21.59  | 23                        | 2           |
| 3               | 16QAM | 15 | 0  | 21.33  | 21.58  | 21.59  |                           |             |
| Channel         |       |    |    | 19957  | 20175  | 20393  | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
| Frequency (MHz) |       |    |    | 1710.7 | 1732.5 | 1754.3 |                           |             |
| 1.4             | QPSK  | 1  | 0  | 23.57  | 23.78  | 23.56  | 25                        | 0           |
| 1.4             | QPSK  | 1  | 3  | 23.71  | 23.81  | 23.76  |                           |             |
| 1.4             | QPSK  | 1  | 5  | 23.54  | 23.74  | 23.58  |                           |             |
| 1.4             | QPSK  | 3  | 0  | 23.65  | 23.86  | 23.82  |                           |             |
| 1.4             | QPSK  | 3  | 1  | 23.70  | 23.90  | 23.84  |                           |             |
| 1.4             | QPSK  | 3  | 3  | 23.70  | 23.72  | 23.75  |                           |             |
| 1.4             | QPSK  | 6  | 0  | 22.61  | 22.59  | 22.69  | 24                        | 1           |
| 1.4             | 16QAM | 1  | 0  | 22.48  | 22.54  | 22.47  | 24                        | 1           |
| 1.4             | 16QAM | 1  | 3  | 22.48  | 22.51  | 22.60  |                           |             |
| 1.4             | 16QAM | 1  | 5  | 22.50  | 22.52  | 22.59  |                           |             |
| 1.4             | 16QAM | 3  | 0  | 22.55  | 22.61  | 22.64  |                           |             |
| 1.4             | 16QAM | 3  | 1  | 22.67  | 22.72  | 22.65  |                           |             |
| 1.4             | 16QAM | 3  | 3  | 22.76  | 22.73  | 22.46  |                           |             |
| 1.4             | 16QAM | 6  | 0  | 21.46  | 21.65  | 21.63  | 23                        | 2           |

**<LTE Band 5>**

| BW [MHz]        | Modulation | RB Size | RB Offset | Power Low<br>Ch. / Freq. | Power Middle<br>Ch. / Freq. | Power High<br>Ch. / Freq. | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|------------|---------|-----------|--------------------------|-----------------------------|---------------------------|---------------------------|-------------|
| Channel         |            |         |           | 20450                    | 20525                       | 20600                     | 24.5                      | 0           |
| Frequency (MHz) |            |         |           | 829                      | 836.5                       | 844                       |                           |             |
| 10              | QPSK       | 1       | 0         | 22.62                    | 22.82                       | 22.68                     |                           |             |
| 10              | QPSK       | 1       | 25        | 22.90                    | 22.65                       | 23.10                     | 23.5                      | 1           |
| 10              | QPSK       | 1       | 49        | 22.61                    | 22.60                       | 22.63                     |                           |             |
| 10              | QPSK       | 25      | 0         | 21.85                    | 21.67                       | 21.74                     |                           |             |
| 10              | QPSK       | 25      | 12        | 21.76                    | 21.73                       | 21.88                     | 23.5                      | 1           |
| 10              | QPSK       | 25      | 25        | 21.72                    | 21.75                       | 21.74                     |                           |             |
| 10              | QPSK       | 50      | 0         | 21.79                    | 21.71                       | 21.83                     |                           |             |
| 10              | 16QAM      | 1       | 0         | 21.50                    | 21.58                       | 21.62                     | 23.5                      | 1           |
| 10              | 16QAM      | 1       | 25        | 21.67                    | 21.54                       | 21.73                     |                           |             |
| 10              | 16QAM      | 1       | 49        | 21.59                    | 21.61                       | 21.52                     |                           |             |
| 10              | 16QAM      | 12      | 0         | 21.76                    | 21.87                       | 21.75                     | 22.5                      | 2           |
| 10              | 16QAM      | 12      | 19        | 21.81                    | 21.81                       | 21.88                     |                           |             |
| 10              | 16QAM      | 12      | 38        | 21.70                    | 21.74                       | 21.55                     |                           |             |
| 10              | 16QAM      | 27      | 0         | 20.65                    | 20.63                       | 20.73                     | 24.5                      | 0           |
| Channel         |            |         |           | 20425                    | 20525                       | 20625                     |                           |             |
| Frequency (MHz) |            |         |           | 826.5                    | 836.5                       | 846.5                     |                           |             |
| 5               | QPSK       | 1       | 0         | 22.86                    | 22.81                       | 22.88                     | 24.5                      | 0           |
| 5               | QPSK       | 1       | 12        | 22.80                    | 22.89                       | 23.09                     |                           |             |
| 5               | QPSK       | 1       | 24        | 22.76                    | 22.73                       | 22.61                     |                           |             |
| 5               | QPSK       | 12      | 0         | 21.83                    | 21.77                       | 21.92                     | 23.5                      | 1           |
| 5               | QPSK       | 12      | 7         | 21.80                    | 21.76                       | 21.81                     |                           |             |
| 5               | QPSK       | 12      | 13        | 21.80                    | 21.75                       | 21.82                     |                           |             |
| 5               | QPSK       | 25      | 0         | 21.78                    | 21.79                       | 21.74                     | 23.5                      | 1           |
| 5               | 16QAM      | 1       | 0         | 21.52                    | 21.57                       | 21.60                     |                           |             |
| 5               | 16QAM      | 1       | 12        | 21.58                    | 21.55                       | 21.55                     |                           |             |
| 5               | 16QAM      | 1       | 24        | 21.50                    | 21.52                       | 21.56                     | 22.5                      | 2           |
| 5               | 16QAM      | 12      | 0         | 20.96                    | 20.61                       | 20.84                     |                           |             |
| 5               | 16QAM      | 12      | 7         | 20.99                    | 20.91                       | 20.67                     |                           |             |
| 5               | 16QAM      | 12      | 13        | 20.93                    | 20.72                       | 20.71                     | 24.5                      | 0           |
| 5               | 16QAM      | 25      | 0         | 20.91                    | 20.82                       | 20.69                     |                           |             |
| Channel         |            |         |           | 20415                    | 20525                       | 20635                     |                           |             |
| Frequency (MHz) |            |         |           | 825.5                    | 836.5                       | 847.5                     | 24.5                      | 0           |
| 3               | QPSK       | 1       | 0         | 22.78                    | 22.75                       | 22.90                     |                           |             |
| 3               | QPSK       | 1       | 8         | 22.94                    | 22.68                       | 22.88                     |                           |             |
| 3               | QPSK       | 1       | 14        | 22.96                    | 22.81                       | 22.60                     | 23.5                      | 1           |
| 3               | QPSK       | 8       | 0         | 21.95                    | 21.91                       | 21.94                     |                           |             |
| 3               | QPSK       | 8       | 4         | 21.91                    | 21.86                       | 21.80                     |                           |             |
| 3               | QPSK       | 8       | 7         | 21.83                    | 21.74                       | 21.78                     | 23.5                      | 1           |
| 3               | QPSK       | 15      | 0         | 21.87                    | 21.80                       | 21.76                     |                           |             |
| 3               | 16QAM      | 1       | 0         | 21.50                    | 21.53                       | 21.85                     |                           |             |
| 3               | 16QAM      | 1       | 8         | 21.51                    | 21.58                       | 21.58                     | 22.5                      | 2           |
| 3               | 16QAM      | 1       | 14        | 21.52                    | 21.51                       | 21.51                     |                           |             |
| 3               | 16QAM      | 8       | 0         | 20.86                    | 20.74                       | 20.93                     |                           |             |
| 3               | 16QAM      | 8       | 4         | 20.84                    | 20.80                       | 20.74                     | 24.5                      | 0           |
| 3               | 16QAM      | 8       | 7         | 20.85                    | 20.77                       | 20.77                     |                           |             |
| 3               | 16QAM      | 15      | 0         | 20.77                    | 20.68                       | 20.66                     |                           |             |



| Channel         |       |   |   | 20407 | 20525 | 20643 | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|-------|---|---|-------|-------|-------|---------------------------|-------------|
| Frequency (MHz) |       |   |   | 824.7 | 836.5 | 848.3 |                           |             |
| 1.4             | QPSK  | 1 | 0 | 22.61 | 22.62 | 22.57 | 24.5                      | 0           |
| 1.4             | QPSK  | 1 | 3 | 22.74 | 22.63 | 22.71 |                           |             |
| 1.4             | QPSK  | 1 | 5 | 22.64 | 22.56 | 22.50 |                           |             |
| 1.4             | QPSK  | 3 | 0 | 22.79 | 22.76 | 22.73 |                           |             |
| 1.4             | QPSK  | 3 | 1 | 22.85 | 22.94 | 22.79 |                           |             |
| 1.4             | QPSK  | 3 | 3 | 22.76 | 22.73 | 22.66 |                           |             |
| 1.4             | QPSK  | 6 | 0 | 21.65 | 21.63 | 21.66 | 23.5                      | 1           |
| 1.4             | 16QAM | 1 | 0 | 21.77 | 21.75 | 21.54 | 23.5                      | 1           |
| 1.4             | 16QAM | 1 | 3 | 21.90 | 21.58 | 21.92 |                           |             |
| 1.4             | 16QAM | 1 | 5 | 21.84 | 21.51 | 21.53 |                           |             |
| 1.4             | 16QAM | 3 | 0 | 21.56 | 21.57 | 21.76 |                           |             |
| 1.4             | 16QAM | 3 | 1 | 21.73 | 21.52 | 21.88 |                           |             |
| 1.4             | 16QAM | 3 | 3 | 21.75 | 21.62 | 21.85 |                           |             |
| 1.4             | 16QAM | 6 | 0 | 20.62 | 20.54 | 20.73 | 22.5                      | 2           |

**<LTE Band 13>**

| BW [MHz]        | Modulation | RB Size | RB Offset | Power Low<br>Ch. / Freq. | Power Middle<br>Ch. / Freq. | Power High<br>Ch. / Freq. | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
|-----------------|------------|---------|-----------|--------------------------|-----------------------------|---------------------------|---------------------------|-------------|
| Channel         |            |         |           | 23230                    |                             |                           |                           |             |
| Frequency (MHz) |            |         |           | 782                      |                             |                           |                           |             |
| 10              | QPSK       | 1       | 0         |                          | 23.05                       |                           | 25                        | 0           |
| 10              | QPSK       | 1       | 25        |                          | 23.37                       |                           |                           |             |
| 10              | QPSK       | 1       | 49        |                          | 23.10                       |                           |                           |             |
| 10              | QPSK       | 25      | 0         |                          | 22.11                       |                           | 24                        | 1           |
| 10              | QPSK       | 25      | 12        |                          | 22.05                       |                           |                           |             |
| 10              | QPSK       | 25      | 25        |                          | 22.15                       |                           |                           |             |
| 10              | QPSK       | 50      | 0         |                          | 22.10                       |                           | 24                        | 1           |
| 10              | 16QAM      | 1       | 0         |                          | 22.01                       |                           |                           |             |
| 10              | 16QAM      | 1       | 25        |                          | 22.22                       |                           |                           |             |
| 10              | 16QAM      | 1       | 49        |                          | 22.14                       |                           | 23                        | 2           |
| 10              | 16QAM      | 12      | 0         |                          | 22.07                       |                           |                           |             |
| 10              | 16QAM      | 12      | 19        |                          | 22.12                       |                           |                           |             |
| 10              | 16QAM      | 12      | 38        |                          | 22.15                       |                           |                           |             |
| 10              | 16QAM      | 27      | 0         |                          | 21.30                       |                           |                           |             |
| Channel         |            |         |           | 23205                    | 23230                       | 23255                     | Tune-up<br>limit<br>(dBm) | MPR<br>(dB) |
| Frequency (MHz) |            |         |           | 779.5                    | 782                         | 784.5                     |                           |             |
| 5               | QPSK       | 1       | 0         | 23.09                    | 23.01                       | 23.19                     | 25                        | 0           |
| 5               | QPSK       | 1       | 12        | 23.36                    | 23.07                       | 23.27                     |                           |             |
| 5               | QPSK       | 1       | 24        | 23.27                    | 23.21                       | 23.15                     |                           |             |
| 5               | QPSK       | 12      | 0         | 22.07                    | 22.05                       | 22.29                     | 24                        | 1           |
| 5               | QPSK       | 12      | 7         | 22.21                    | 22.08                       | 22.33                     |                           |             |
| 5               | QPSK       | 12      | 13        | 22.03                    | 22.19                       | 22.16                     |                           |             |
| 5               | QPSK       | 25      | 0         | 22.04                    | 22.12                       | 22.26                     | 24                        | 1           |
| 5               | 16QAM      | 1       | 0         | 22.12                    | 22.08                       | 22.13                     |                           |             |
| 5               | 16QAM      | 1       | 12        | 22.26                    | 22.11                       | 22.57                     |                           |             |
| 5               | 16QAM      | 1       | 24        | 22.19                    | 22.08                       | 22.10                     | 23                        | 2           |
| 5               | 16QAM      | 12      | 0         | 21.12                    | 21.09                       | 21.24                     |                           |             |
| 5               | 16QAM      | 12      | 7         | 21.23                    | 21.02                       | 21.18                     |                           |             |
| 5               | 16QAM      | 12      | 13        | 21.06                    | 21.12                       | 21.13                     |                           |             |
| 5               | 16QAM      | 25      | 0         | 21.18                    | 21.06                       | 21.39                     |                           |             |

**<WLAN Conducted Power>**
**General Note:**

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, 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 for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.<sup>18</sup> The initial test position procedure is described in the following:
  - a. When the reported SAR of the initial test position is  $\leq 0.4$  W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
  - b. When the reported SAR of the test position is  $> 0.4$  W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is  $\leq 0.8$  W/kg or all required test position are tested.
  - c. For all positions/configurations, when the reported SAR is  $> 0.8$  W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested.

**<2.4GHz WLAN>**

|             | Mode         | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|-------------|--------------|---------|-----------------|---------------------|---------------|--------------|
| 2.4GHz WLAN | 802.11b      | CH 1    | 2412            | 18.76               | 20.00         | 100.00       |
|             |              | CH 6    | 2437            | 19.15               | 20.00         |              |
|             |              | CH 11   | 2462            | 18.61               | 20.00         |              |
|             | 802.11g      | CH 1    | 2412            | 14.69               | 16.00         | 95.00        |
|             |              | CH 6    | 2437            | 15.30               | 16.00         |              |
|             |              | CH 11   | 2462            | 14.85               | 16.00         |              |
|             | 802.11n-HT20 | CH 1    | 2412            | 13.46               | 15.00         | 95.00        |
|             |              | CH 6    | 2437            | 14.17               | 15.00         |              |
|             |              | CH 11   | 2462            | 13.63               | 15.00         |              |
|             | 802.11n-HT40 | CH 3    | 2422            | 11.10               | 12.00         | 90.35        |
|             |              | CH 6    | 2437            | 10.60               | 12.00         |              |
|             |              | CH 9    | 2452            | 10.25               | 12.00         |              |

**<5GHz WLAN >**

|             | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
| 5.2GHz WLAN | 802.11a 6Mbps     | 36      | 5180            | <b>15.26</b>        | 16.00         | 92.53        |
|             |                   | 40      | 5200            | 15.20               | 16.00         |              |
|             |                   | 44      | 5220            | 15.13               | 16.00         |              |
|             |                   | 48      | 5240            | 15.01               | 16.00         |              |
|             | 802.11n-HT20 MCS0 | 36      | 5180            | 13.04               | 14.00         | 92.36        |
|             |                   | 40      | 5200            | 12.89               | 14.00         |              |
|             |                   | 44      | 5220            | 12.86               | 14.00         |              |
|             |                   | 48      | 5240            | 12.74               | 14.00         |              |
|             | 802.11n-HT40 MCS0 | 38      | 5190            | 12.30               | 13.00         | 89.73        |
|             |                   | 46      | 5230            | 12.11               | 13.00         |              |

|             | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
| 5.3GHz WLAN | 802.11a 6Mbps     | 52      | 5260            | <b>15.14</b>        | 16.00         | 92.53        |
|             |                   | 56      | 5280            | 14.95               | 16.00         |              |
|             |                   | 60      | 5300            | 14.83               | 16.00         |              |
|             |                   | 64      | 5320            | 14.63               | 16.00         |              |
|             | 802.11n-HT20 MCS0 | 52      | 5260            | 13.30               | 14.00         | 92.36        |
|             |                   | 56      | 5280            | 13.16               | 14.00         |              |
|             |                   | 60      | 5300            | 13.08               | 14.00         |              |
|             |                   | 64      | 5320            | 12.91               | 14.00         |              |
|             | 802.11n-HT40 MCS0 | 54      | 5270            | 12.15               | 13.00         | 89.73        |
|             |                   | 62      | 5310            | 11.83               | 13.00         |              |

| 5.5GHz WLAN | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
|             | 802.11a 6Mbps     | 100     | 5500            | 14.84               | 16.00         | 92.53        |
|             |                   | 116     | 5580            | 14.88               | 16.00         |              |
|             |                   | 124     | 5620            | 14.87               | 16.00         |              |
|             |                   | 132     | 5660            | 14.73               | 16.00         |              |
|             |                   | 140     | 5700            | 14.69               | 16.00         |              |
|             |                   | 144     | 5720            | 14.82               | 16.00         |              |
|             | 802.11n-HT20 MCS0 | 100     | 5500            | 13.03               | 14.00         | 92.36        |
|             |                   | 116     | 5580            | 13.02               | 14.00         |              |
|             |                   | 124     | 5620            | 12.97               | 14.00         |              |
|             |                   | 132     | 5660            | 13.04               | 14.00         |              |
|             |                   | 140     | 5700            | 13.00               | 14.00         |              |
|             |                   | 144     | 5720            | 13.06               | 14.00         |              |
|             | 802.11n-HT40 MCS0 | 102     | 5510            | 11.95               | 13.00         | 89.73        |
|             |                   | 110     | 5550            | 12.00               | 13.00         |              |
|             |                   | 126     | 5630            | 11.98               | 13.00         |              |
|             |                   | 134     | 5670            | 11.89               | 13.00         |              |
|             |                   | 142     | 5710            | 11.94               | 13.00         |              |

| 5.8GHz WLAN | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
|             | 802.11a MCS0      | 149     | 5745            | 14.56               | 16.00         | 92.53        |
|             |                   | 157     | 5785            | 14.64               | 16.00         |              |
|             |                   | 165     | 5825            | 15.12               | 16.00         |              |
|             | 802.11n-HT20 MCS0 | 149     | 5745            | 12.39               | 14.00         | 92.36        |
|             |                   | 157     | 5785            | 12.49               | 14.00         |              |
|             |                   | 165     | 5825            | 13.03               | 14.00         |              |
|             | 802.11n-HT40 MCS0 | 151     | 5755            | 11.79               | 13.00         | 89.73        |
|             |                   | 159     | 5795            | 12.04               | 13.00         |              |

**<2.4GHz Bluetooth>**
**General Note:**

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 76.79% as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation

| Mode   | Channel | Frequency (MHz) | Data Rate   | Tune-up Limit (dBm) |
|--------|---------|-----------------|-------------|---------------------|
|        |         |                 | 1Mbps       |                     |
| BR/EDR | CH 00   | 2402            | 8.63        | 10.50               |
|        | CH 39   | 2441            | <b>9.78</b> | 11.50               |
|        | CH 78   | 2480            | 9.27        | 11.00               |

| Mode          | Channel | Frequency (MHz) | Average power (dBm) |
|---------------|---------|-----------------|---------------------|
|               |         |                 | GFSK                |
| LE            | CH 00   | 2402            | -0.57               |
|               | CH 19   | 2440            | <b>0.60</b>         |
|               | CH 39   | 2480            | 0.40                |
| Tune-up Limit |         |                 | 1.00                |

## **12. Bluetooth Exclusions Applied**

| Mode Band        | Max Average power(dBm) |      |
|------------------|------------------------|------|
|                  | BR/EDR                 | LE   |
| 2.4GHz Bluetooth | 11.50                  | 1.00 |

**Note:**

- Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances*  $\leq 50$  mm are determined by:  

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$
for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR
  - f(GHz) is the RF channel transmit frequency in GHz
  - Power and distance are rounded to the nearest mW and mm before calculation
  - The result is rounded to one decimal place for comparison

| Bluetooth Max Power (dBm) | Separation Distance (mm) | Frequency (GHz) | exclusion thresholds |
|---------------------------|--------------------------|-----------------|----------------------|
| 11.50                     | 25                       | 2.48            | 0.9                  |

**Note:**

Per KDB 447498 D01v06, when the minimum test separation distance is 25 mm, a distance of 25 mm is applied to determine SAR test exclusion. The test exclusion threshold is 0.9 which is  $\leq 3$ , SAR testing is not required.



### **13. Antenna Location**

Please refer to appendix D for SAR test setup photo.

## 14. SAR Test Results

### General Note:

- Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
  - For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor
  - For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor
- Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
  - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
- Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8W/kg.
- This device has PTT (push-to-talk) function, so perform 25mm in-front-of the face SAR.
- The device can use with assigned accessory manufacturer offered, so perform 0mm body worn accessory SAR.  
For Swivel Carry Holster, when using body-worn accessory, the device can enclose the holster with front face or back face, so for body-worn SAR testing, evaluated front/back face when enclose to the holster. There is a swivel belt clip adhere to holster, only rotation for using.
- Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

### LTE Note:

- Per KDB 941225 D05v02r05, 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 for RB offsets at the upper edge, middle and lower edge of each required test channel.
- Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
- Per KDB 941225 D05v02r05, 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 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.
- Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
- Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
- For LTE B5 / B4 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

### WLAN Note:

- Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
- Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
- When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
- For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
- During SAR testing the WLAN transmission was verified using a spectrum analyzer.



### 14.1 Face SAR

#### <LTE SAR>

| Plot No. | Band        | BW (MHz) | Modulation | RB Size | RB Offset | Test Position    | Battery   | Antenna           | Carry Accessory | Gap (mm) | Ch.   | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|-------------|----------|------------|---------|-----------|------------------|-----------|-------------------|-----------------|----------|-------|-------------|---------------------|---------------------|------------------------|------------------|------------------------|------------------------|
| 01       | LTE Band 13 | 10M      | QPSK       | 1       | 25        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 23230 | 782         | 23.37               | 25.00               | 1.455                  | 0.11             | 0.423                  | 0.616                  |
|          | LTE Band 13 | 10M      | QPSK       | 25      | 25        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 23230 | 782         | 22.15               | 24.00               | 1.531                  | 0.01             | 0.374                  | 0.573                  |
| 02       | LTE Band 5  | 10M      | QPSK       | 1       | 25        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 20525 | 836.5       | 22.65               | 24.50               | 1.531                  | 0.05             | 0.325                  | 0.498                  |
|          | LTE Band 5  | 10M      | QPSK       | 25      | 12        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 20525 | 836.5       | 21.73               | 23.50               | 1.503                  | 0.08             | 0.269                  | 0.404                  |
| 03       | LTE Band 4  | 20M      | QPSK       | 1       | 49        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 20175 | 1732.5      | 23.67               | 25.00               | 1.358                  | -0.05            | 0.211                  | 0.287                  |
|          | LTE Band 4  | 20M      | QPSK       | 50      | 0         | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 20175 | 1732.5      | 22.69               | 24.00               | 1.352                  | 0.02             | 0.178                  | 0.241                  |
| 04       | LTE Band 2  | 20M      | QPSK       | 1       | 49        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 18900 | 1880        | 22.93               | 24.50               | 1.435                  | 0.01             | 0.295                  | 0.423                  |
|          | LTE Band 2  | 20M      | QPSK       | 50      | 24        | In front of face | PMNN4468A | SZ08171 & SZ0817N | -               | 25       | 18900 | 1880        | 22.07               | 23.50               | 1.390                  | -0.03            | 0.223                  | 0.310                  |

#### <WLAN 2.4GHz SAR>

| Plot No. | Band       | Mode          | Test Position    | Battery   | Antenna | Carry Accessory | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|------------|---------------|------------------|-----------|---------|-----------------|----------|-----|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
| 05       | WLAN2.4GHz | 802.11b 1Mbps | In front of face | PMNN4468A | SZ0817B | -               | 25       | 6   | 2437        | 19.15               | 20.00               | 1.216                  | 100          | 1.000                     | 0.13             | 0.041                  | 0.050                  |

#### <WLAN 5GHz SAR>

| Plot No. | Band       | Mode          | Test Position    | Battery   | Antenna | Carry Accessory | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|------------|---------------|------------------|-----------|---------|-----------------|----------|-----|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
| 06       | WLAN5.3GHz | 802.11a 6Mbps | In front of face | PMNN4468A | SZ0817B | -               | 25       | 52  | 5260        | 15.14               | 16                  | 1.219                  | 92.53        | 1.081                     | -0.03            | 0.00932                | 0.012                  |
| 07       | WLAN5.5GHz | 802.11a 6Mbps | In front of face | PMNN4468A | SZ0817B | -               | 25       | 116 | 5580        | 14.88               | 16                  | 1.294                  | 92.53        | 1.081                     | -0.08            | 0.039                  | 0.054                  |
| 08       | WLAN5.8GHz | 802.11a 6Mbps | In front of face | PMNN4468A | SZ0817B | -               | 25       | 165 | 5825        | 15.12               | 16                  | 1.225                  | 92.53        | 1.081                     | -0.09            | 0.026                  | 0.035                  |

**14.2 Body Worn Accessory SAR****<LTE SAR>**

| Plot No. | Band        | BW (MHz) | Modulation | RB Size | RB Offset | Test Position | Battery   | Antenna           | Carry Accessory | Gap (mm) | Ch.   | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|-------------|----------|------------|---------|-----------|---------------|-----------|-------------------|-----------------|----------|-------|-------------|---------------------|---------------------|------------------------|------------------|------------------------|------------------------|
|          | LTE Band 13 | 10M      | QPSK       | 1       | 25        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 23230 | 782         | 23.37               | 25.00               | 1.455                  | -0.13            | 0.546                  | 0.795                  |
|          | LTE Band 13 | 10M      | QPSK       | 25      | 25        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 23230 | 782         | 22.15               | 24.00               | 1.531                  | -0.09            | 0.446                  | 0.683                  |
|          | LTE Band 13 | 10M      | QPSK       | 1       | 25        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 23230 | 782         | 23.37               | 25.00               | 1.455                  | -0.1             | 0.604                  | 0.879                  |
|          | LTE Band 13 | 10M      | QPSK       | 25      | 25        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 23230 | 782         | 22.15               | 24.00               | 1.531                  | -0.01            | 0.483                  | 0.740                  |
|          | LTE Band 13 | 10M      | QPSK       | 50      | 0         | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 23230 | 782         | 22.10               | 24.00               | 1.549                  | -0.08            | 0.463                  | 0.717                  |
| 09       | LTE Band 13 | 10M      | QPSK       | 1       | 25        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 23230 | 782         | 23.37               | 25.00               | 1.455                  | -0.07            | 0.693                  | 1.009                  |
|          | LTE Band 13 | 10M      | QPSK       | 25      | 25        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 23230 | 782         | 22.15               | 24.00               | 1.531                  | 0.05             | 0.517                  | 0.792                  |
|          | LTE Band 13 | 10M      | QPSK       | 50      | 0         | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 23230 | 782         | 22.10               | 24.00               | 1.549                  | 0.03             | 0.508                  | 0.787                  |
|          | LTE Band 5  | 10M      | QPSK       | 1       | 25        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20525 | 836.5       | 22.65               | 24.50               | 1.531                  | -0.01            | 0.371                  | 0.568                  |
|          | LTE Band 5  | 10M      | QPSK       | 25      | 12        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20525 | 836.5       | 21.73               | 23.50               | 1.503                  | -0.05            | 0.290                  | 0.436                  |
|          | LTE Band 5  | 10M      | QPSK       | 1       | 25        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20525 | 836.5       | 22.65               | 24.50               | 1.531                  | 0.03             | 0.427                  | 0.654                  |
|          | LTE Band 5  | 10M      | QPSK       | 25      | 12        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20525 | 836.5       | 21.73               | 23.50               | 1.503                  | 0.01             | 0.331                  | 0.498                  |
| 10       | LTE Band 5  | 10M      | QPSK       | 1       | 25        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 20525 | 836.5       | 22.65               | 24.50               | 1.531                  | -0.03            | 0.505                  | 0.773                  |
|          | LTE Band 5  | 10M      | QPSK       | 25      | 12        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 20525 | 836.5       | 21.73               | 23.50               | 1.503                  | -0.03            | 0.397                  | 0.597                  |
| 11       | LTE Band 4  | 20M      | QPSK       | 1       | 49        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20175 | 1732.5      | 23.67               | 25.00               | 1.358                  | -0.02            | 0.270                  | 0.367                  |
|          | LTE Band 4  | 20M      | QPSK       | 50      | 0         | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20175 | 1732.5      | 22.69               | 24.00               | 1.352                  | 0.01             | 0.206                  | 0.279                  |
|          | LTE Band 4  | 20M      | QPSK       | 1       | 49        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20175 | 1732.5      | 23.67               | 25.00               | 1.358                  | -0.02            | 0.205                  | 0.278                  |
|          | LTE Band 4  | 20M      | QPSK       | 50      | 0         | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 20175 | 1732.5      | 22.69               | 24.00               | 1.352                  | -0.08            | 0.157                  | 0.212                  |
|          | LTE Band 4  | 20M      | QPSK       | 1       | 49        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 20175 | 1732.5      | 23.67               | 25.00               | 1.358                  | -0.05            | 0.257                  | 0.349                  |
|          | LTE Band 4  | 20M      | QPSK       | 50      | 0         | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 20175 | 1732.5      | 22.69               | 24.00               | 1.352                  | -0.06            | 0.208                  | 0.281                  |



| Plot No. | Band       | BW (MHz) | Modulation | RB Size | RB Offset | Test Position | Battery   | Antenna           | Carry Accessory | Gap (mm) | Ch.   | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|------------|----------|------------|---------|-----------|---------------|-----------|-------------------|-----------------|----------|-------|-------------|---------------------|---------------------|------------------------|------------------|------------------------|------------------------|
|          | LTE Band 2 | 20M      | QPSK       | 1       | 49        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 18900 | 1880        | 22.93               | 24.50               | 1.435                  | -0.04            | 0.238                  | 0.342                  |
|          | LTE Band 2 | 20M      | QPSK       | 50      | 24        | Front Face    | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 18900 | 1880        | 22.07               | 23.50               | 1.390                  | 0.02             | 0.186                  | 0.259                  |
|          | LTE Band 2 | 20M      | QPSK       | 1       | 49        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 18900 | 1880        | 22.93               | 24.50               | 1.435                  | -0.06            | 0.188                  | 0.270                  |
|          | LTE Band 2 | 20M      | QPSK       | 50      | 24        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7932A       | 0        | 18900 | 1880        | 22.07               | 23.50               | 1.390                  | -0.17            | 0.146                  | 0.203                  |
| 12       | LTE Band 2 | 20M      | QPSK       | 1       | 49        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 18900 | 1880        | 22.93               | 24.50               | 1.435                  | -0.08            | 0.272                  | 0.390                  |
|          | LTE Band 2 | 20M      | QPSK       | 50      | 24        | Back Face     | PMNN4468A | SZ08171 & SZ0817N | PMLN7128A       | 0        | 18900 | 1880        | 22.07               | 23.50               | 1.390                  | -0.07            | 0.218                  | 0.303                  |

## &lt;WLAN 2.4GHz SAR&gt;

| Plot No. | Band       | Mode          | Test Position | Battery   | Antenna | Carry Accessory | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|------------|---------------|---------------|-----------|---------|-----------------|----------|-----|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
|          | WLAN2.4GHz | 802.11b 1Mbps | Front Face    | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 6   | 2437        | 19.15               | 20.00               | 1.216                  | 100          | 1.000                     | -0.01            | 0.080                  | 0.097                  |
|          | WLAN2.4GHz | 802.11b 1Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 6   | 2437        | 19.15               | 20.00               | 1.216                  | 100          | 1.000                     | -0.11            | 0.043                  | 0.052                  |
| 13       | WLAN2.4GHz | 802.11b 1Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7128A       | 0        | 6   | 2437        | 19.15               | 20.00               | 1.216                  | 100          | 1.000                     | -0.09            | 0.145                  | 0.176                  |

## &lt;Bluetooth SAR&gt;

| Plot No. | Band      | Mode  | Test Position | Battery   | Antenna | Carry Accessory | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|-----------|-------|---------------|-----------|---------|-----------------|----------|-----|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
|          | Bluetooth | 1Mbps | Front Face    | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 39  | 2441        | 9.78                | 11.50               | 1.486                  | 76.79        | 1.085                     | -0.08            | 0.003                  | 0.005                  |
|          | Bluetooth | 1Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 39  | 2441        | 9.78                | 11.50               | 1.486                  | 76.79        | 1.085                     | -0.13            | 0.009                  | 0.014                  |
| 14       | Bluetooth | 1Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7128A       | 0        | 39  | 2441        | 9.78                | 11.50               | 1.486                  | 76.79        | 1.085                     | -0.19            | 0.074                  | 0.119                  |

## &lt;WLAN 5GHz SAR&gt;

| Plot No. | Band       | Mode          | Test Position | Battery   | Antenna | Carry Accessory | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|------------|---------------|---------------|-----------|---------|-----------------|----------|-----|-------------|---------------------|---------------------|------------------------|--------------|---------------------------|------------------|------------------------|------------------------|
|          | WLAN5.3GHz | 802.11a 6Mbps | Front Face    | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 52  | 5260        | 15.14               | 16.00               | 1.219                  | 92.53        | 1.081                     | -0.01            | 0.011                  | 0.014                  |
|          | WLAN5.3GHz | 802.11a 6Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 52  | 5260        | 15.14               | 16.00               | 1.219                  | 92.53        | 1.081                     | -0.1             | 0.006                  | 0.008                  |
| 15       | WLAN5.3GHz | 802.11a 6Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7128A       | 0        | 52  | 5260        | 15.14               | 16.00               | 1.219                  | 92.53        | 1.081                     | -0.18            | 0.017                  | 0.022                  |
| 16       | WLAN5.5GHz | 802.11a 6Mbps | Front Face    | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 116 | 5580        | 14.88               | 16.00               | 1.294                  | 92.53        | 1.081                     | -0.01            | 0.061                  | 0.085                  |
|          | WLAN5.5GHz | 802.11a 6Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 116 | 5580        | 14.88               | 16.00               | 1.294                  | 92.53        | 1.081                     | -0.04            | 0.049                  | 0.069                  |
|          | WLAN5.5GHz | 802.11a 6Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7128A       | 0        | 116 | 5580        | 14.88               | 16.00               | 1.294                  | 92.53        | 1.081                     | -0.03            | 0.027                  | 0.038                  |
| 17       | WLAN5.8GHz | 802.11a 6Mbps | Front Face    | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 165 | 5825        | 15.12               | 16.00               | 1.225                  | 92.53        | 1.081                     | -0.04            | 0.036                  | 0.048                  |
|          | WLAN5.8GHz | 802.11a 6Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7932A       | 0        | 165 | 5825        | 15.12               | 16.00               | 1.225                  | 92.53        | 1.081                     | -0.09            | 0.027                  | 0.035                  |
|          | WLAN5.8GHz | 802.11a 6Mbps | Back Face     | PMNN4468A | SZ0817B | PMLN7128A       | 0        | 165 | 5825        | 15.12               | 16.00               | 1.225                  | 92.53        | 1.081                     | -0.05            | 0.027                  | 0.036                  |

## 15. Simultaneous Transmission Analysis

| No. | Simultaneous Transmission Configurations | WAVE TWO-WAY RADIO TLK 100 |           |
|-----|------------------------------------------|----------------------------|-----------|
|     |                                          | Face                       | Body-worn |
| 1.  | LTE + WLAN2.4GHz                         | Yes                        | Yes       |
| 2.  | LTE + WLAN5GHz                           | Yes                        | Yes       |
| 3.  | LTE + Bluetooth                          | Yes                        | Yes       |

**General Note:**

- WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
- All licensed modes share the same antenna part and cannot transmit simultaneously
- EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
- The worst case 5 GHz WLAN SAR for each configuration was used for SAR summation.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
  - Scalar SAR summation  $< 1.6\text{W/kg}$ .
  - $\text{SPLSR} = (\text{SAR}_1 + \text{SAR}_2)^{1.5} / (\text{min. separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$ , where  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the coordinates of the extrapolated peak SAR locations in the zoom scan.
  - If  $\text{SPLSR} \leq 0.04$ , simultaneously transmission SAR measurement is not necessary.
  - Simultaneously transmission SAR measurement, and the reported multi-band SAR  $< 1.6\text{W/kg}$ .
- For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v06 based on the formula below.
  - $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$  for test separation distances  $\leq 50 \text{ mm}$ ; where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.
  - When the minimum separation distance is  $< 5\text{mm}$ , the distance is used 5mm to determine SAR test exclusion.
  - 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is  $> 50 \text{ mm}$ .

| Bluetooth<br>Max Power | Exposure Position       | Face       |
|------------------------|-------------------------|------------|
|                        | Test separation         | 25 mm      |
| 11.50 dBm              | Estimated 1g SAR (W/kg) | 0.119 W/kg |

**15.1 Face Exposure Conditions**

| WWAN Band |         | Exposure Position            | 1                | 2                | 3                | 4                      | 1+2<br>Summed<br>1g SAR<br>(W/kg) | 1+3<br>Summed<br>1g SAR<br>(W/kg) | 1+4<br>Summed<br>1g SAR<br>(W/kg) |
|-----------|---------|------------------------------|------------------|------------------|------------------|------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|           |         |                              | WWAN             | 2.4GHz<br>WLAN   | 5GHz<br>WLAN     | Bluetooth<br>Estimated |                                   |                                   |                                   |
|           |         |                              | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg)       |                                   |                                   |                                   |
| LTE       | Band 13 | In the front of face at 25mm | 0.616            | 0.050            | 0.054            | 0.119                  | 0.67                              | 0.67                              | 0.74                              |
|           | Band 5  | In the front of face at 25mm | 0.498            | 0.050            | 0.054            | 0.119                  | 0.55                              | 0.55                              | 0.62                              |
|           | Band 4  | In the front of face at 25mm | 0.287            | 0.050            | 0.054            | 0.119                  | 0.34                              | 0.34                              | 0.41                              |
|           | Band 2  | In the front of face at 25mm | 0.423            | 0.050            | 0.054            | 0.119                  | 0.47                              | 0.48                              | 0.54                              |

**15.2 Body-Worn Accessory Exposure Conditions**

| WWAN Band |         | Exposure Position                      | 1                | 2                | 3                | 4                | 1+2<br>Summed<br>1g SAR<br>(W/kg) | 1+3<br>Summed<br>1g SAR<br>(W/kg) | 1+4<br>Summed<br>1g SAR<br>(W/kg) |
|-----------|---------|----------------------------------------|------------------|------------------|------------------|------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|           |         |                                        | WWAN             | 2.4GHz<br>WLAN   | 5GHz<br>WLAN     | Bluetooth        |                                   |                                   |                                   |
|           |         |                                        | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) | 1g SAR<br>(W/kg) |                                   |                                   |                                   |
| LTE       | Band 13 | Front Face at 0mm Swivel Carry Holster | 0.795            | 0.097            | 0.085            | 0.005            | 0.89                              | 0.88                              | 0.80                              |
|           |         | Back Face at 0mm Swivel Carry Holster  | 0.879            | 0.052            | 0.069            | 0.014            | 0.93                              | 0.95                              | 0.89                              |
|           |         | Back Face at 0mm Belt Clip             | 1.009            | 0.176            | 0.038            | 0.119            | 1.19                              | 1.05                              | 1.13                              |
|           | Band 5  | Front Face at 0mm Swivel Carry Holster | 0.568            | 0.097            | 0.085            | 0.005            | 0.67                              | 0.65                              | 0.57                              |
|           |         | Back Face at 0mm Swivel Carry Holster  | 0.654            | 0.052            | 0.069            | 0.014            | 0.71                              | 0.72                              | 0.67                              |
|           |         | Back Face at 0mm Belt Clip             | 0.773            | 0.176            | 0.038            | 0.119            | 0.95                              | 0.81                              | 0.89                              |
|           | Band 4  | Front Face at 0mm Swivel Carry Holster | 0.367            | 0.097            | 0.085            | 0.005            | 0.46                              | 0.45                              | 0.37                              |
|           |         | Back Face at 0mm Swivel Carry Holster  | 0.278            | 0.052            | 0.069            | 0.014            | 0.33                              | 0.35                              | 0.29                              |
|           |         | Back Face at 0mm Belt Clip             | 0.349            | 0.176            | 0.038            | 0.119            | 0.53                              | 0.39                              | 0.47                              |
|           | Band 2  | Front Face at 0mm Swivel Carry Holster | 0.342            | 0.097            | 0.085            | 0.005            | 0.44                              | 0.43                              | 0.35                              |
|           |         | Back Face at 0mm Swivel Carry Holster  | 0.270            | 0.052            | 0.069            | 0.014            | 0.32                              | 0.34                              | 0.28                              |
|           |         | Back Face at 0mm Belt Clip             | 0.390            | 0.176            | 0.038            | 0.119            | 0.57                              | 0.43                              | 0.51                              |

**Test Engineer : Nick Hu**



## **16. Uncertainty Assessment**

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg. The expanded SAR measurement uncertainty must be  $\leq 30\%$ , for a confidence interval of  $k = 2$ . If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg. Therefore, the measurement uncertainty table is not required in this report.

## **17. References**

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] ANSI/IEEE Std. C95.1-1992, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", September 1992
- [3] IEEE Std. 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [6] FCC KDB 865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations" Oct 2015.
- [7] FCC KDB 447498 D02 v02r01, "SAR Measurement Procedures for USB Dongle Transmitters", Oct 2015.
- [8] FCC KDB 648474 D04 v01r03, "SAR Evaluation Considerations for Wireless Handsets", Oct 2015.
- [9] FCC KDB 248227 D01 v02r02, "SAR Guidance for IEEE 802.11 (WiFi) Transmitters", Oct 2015.
- [10] FCC KDB 941225 D05 v02r05, "SAR Evaluation Considerations for LTE Devices", Dec 2015



---

## ***Appendix A. Plots of System Performance Check***

The plots are shown as follows.

**System Check\_Head\_750MHz****DUT: D750V3 - SN:1065**

Communication System: UID 0, CW (0); Frequency: 750 MHz; Duty Cycle: 1:1

Medium: HSL\_750 Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.911$  S/m;  $\epsilon_r = 42.828$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(9.92, 9.92, 9.92); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM3; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.83 W/kg

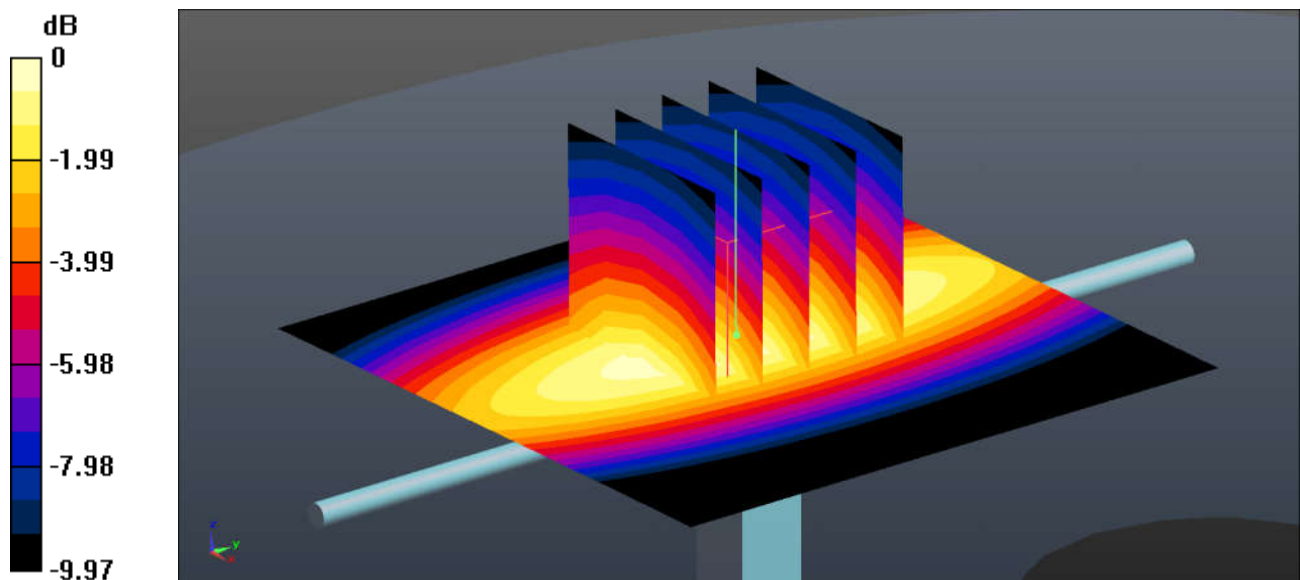
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 50.65 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 2.90 W/kg

**SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.38 W/kg**

Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

**System Check\_Head\_835MHz****DUT: D835V2 - SN:4d091**

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL\_835 Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.912$  S/m;  $\epsilon_r = 42.084$ ;  $\rho = 1000$

kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(9.51, 9.51, 9.51); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM3; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.07 W/kg

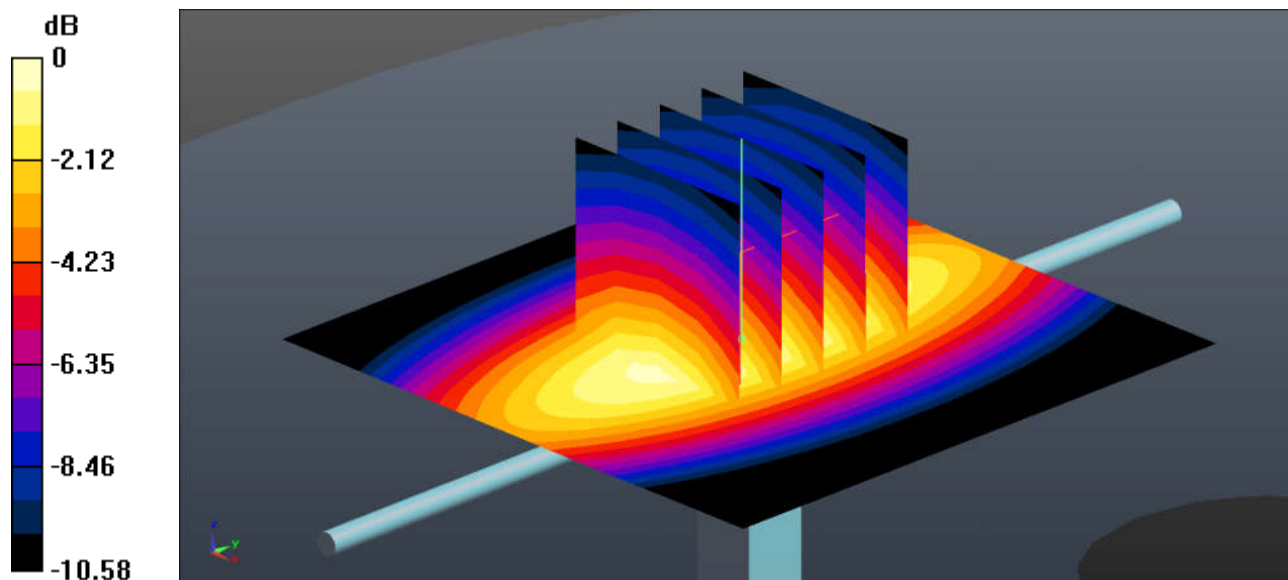
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 53.41 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 3.60 W/kg

**SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.62 W/kg**

Maximum value of SAR (measured) = 3.10 W/kg



0 dB = 3.10 W/kg = 4.91 dBW/kg

**System Check\_Head\_1750MHz****DUT: D1750V2 - SN:1069**

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: HSL\_1750 Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.365$  S/m;  $\epsilon_r = 39.524$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.9 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(8.29, 8.29, 8.29); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 13.1 W/kg

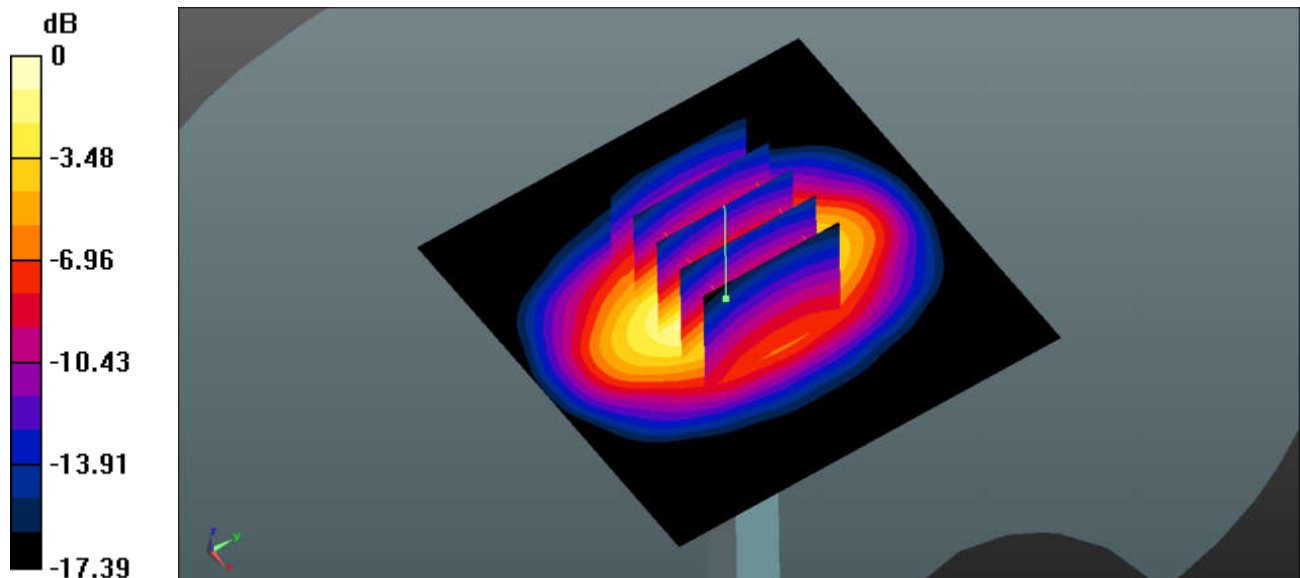
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 86.45 V/m; Power Drift = -0.010 dB

Peak SAR (extrapolated) = 16.7 W/kg

**SAR(1 g) = 9.16 W/kg; SAR(10 g) = 4.85 W/kg**

Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

**System Check\_Head\_1900MHz****DUT: D1900V2 - SN:5d118**

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL\_1900 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.403$  S/m;  $\epsilon_r = 39.504$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.5 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(8.04, 8.04, 8.04); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 14.2 W/kg

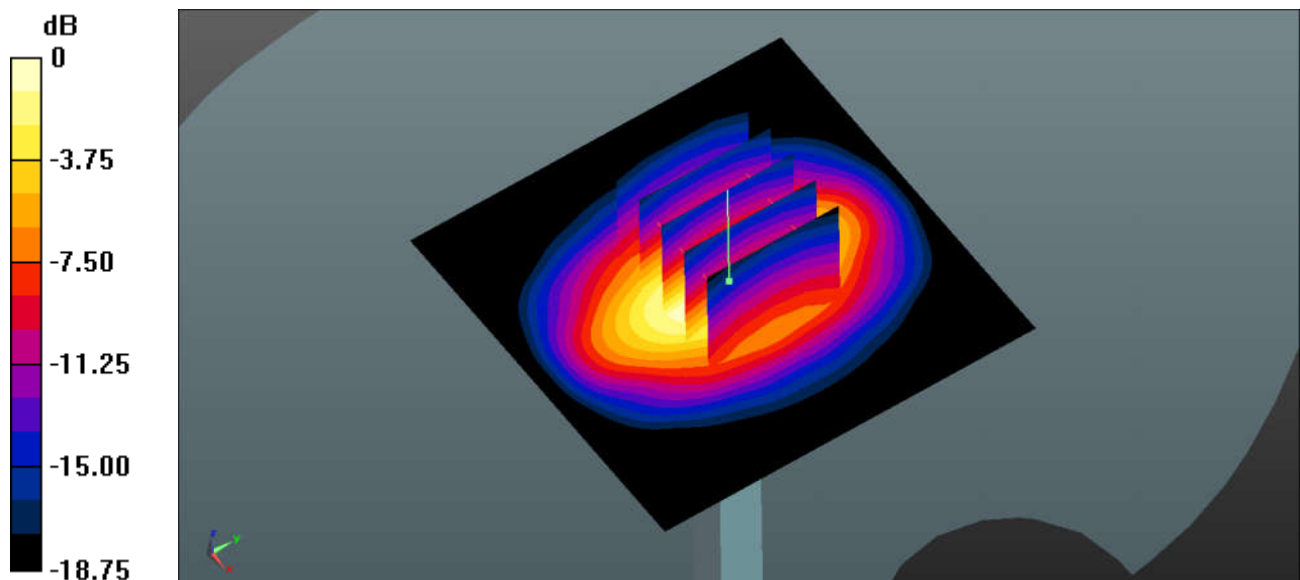
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 88.65 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 18.2 W/kg

**SAR(1 g) = 9.72 W/kg; SAR(10 g) = 4.97 W/kg**

Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

**System Check\_Head\_2450MHz****DUT: D2450V2 - SN:840**

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL\_2450 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.837$  S/m;  $\epsilon_r = 38.334$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(7.56, 7.56, 7.56); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM3; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (71x71x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 20.7 W/kg

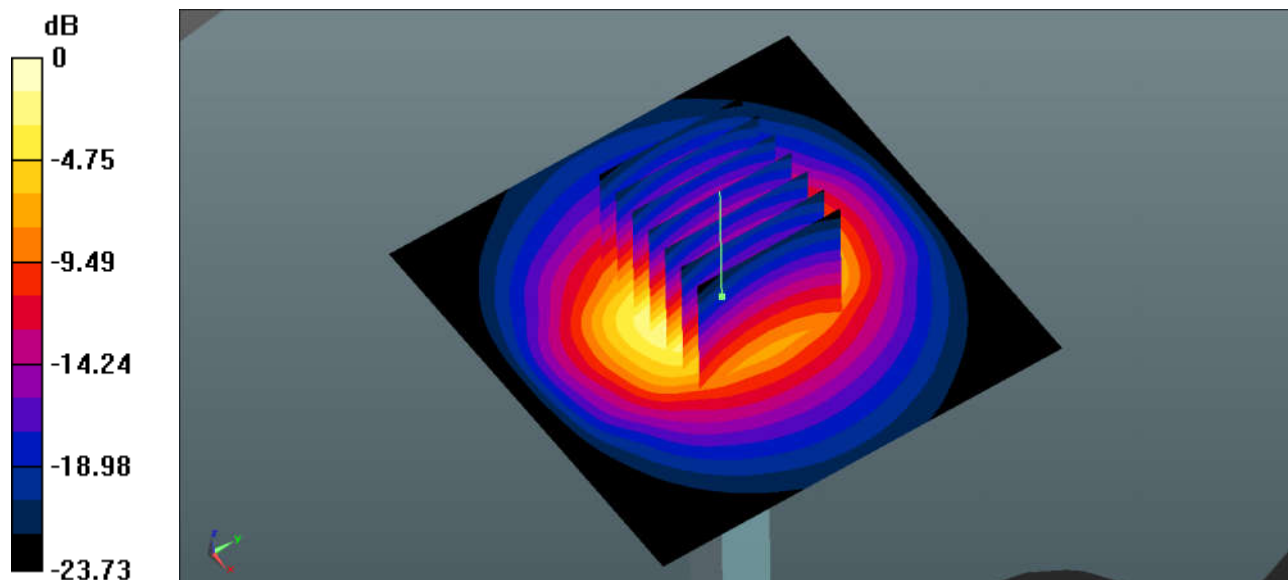
**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.01 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 27.9 W/kg

**SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.74 W/kg**

Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

**System Check\_Head\_5250MHz****DUT: D5GHzV2-SN:1006**

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium: HSL\_5000 Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.565$  S/m;  $\epsilon_r = 36.009$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(5.2, 5.2, 5.2); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=100mW/Area Scan (71x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 17.5 W/kg

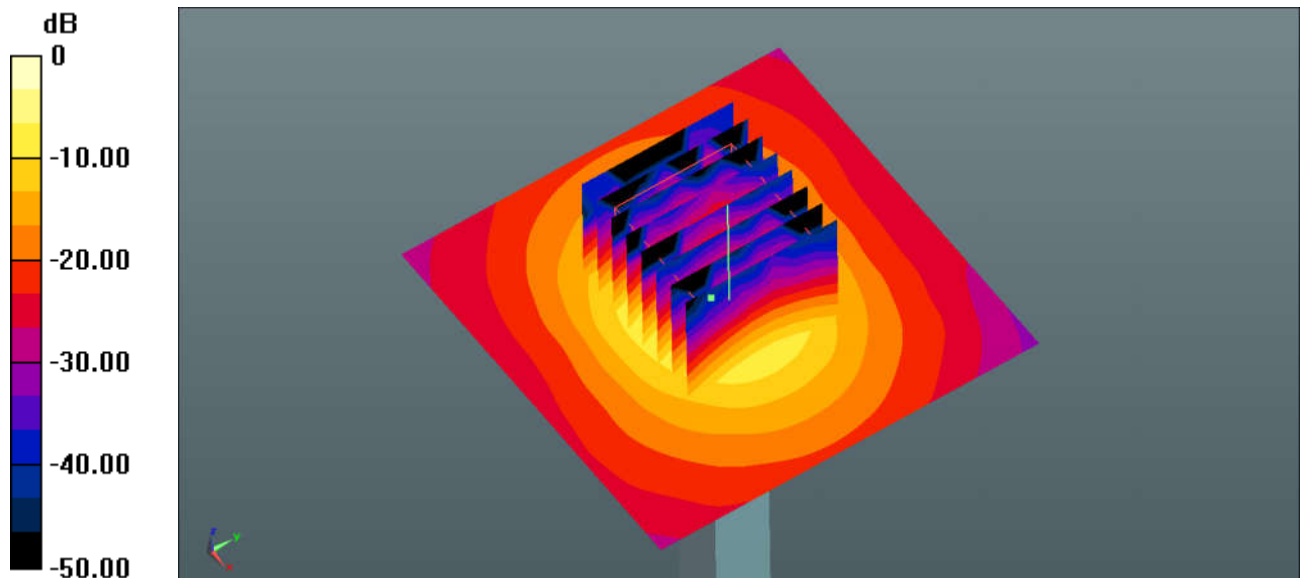
**Pin=100mW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 43.51 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 29.8 W/kg

**SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.26 W/kg**

Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

**System Check\_Head\_5600MHz****DUT: D5GHzV2-SN:1006**

Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: HSL\_5000 Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.968$  S/m;  $\epsilon_r = 35.22$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.94, 4.94, 4.94); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=100mW/Area Scan (71x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 17.7 W/kg

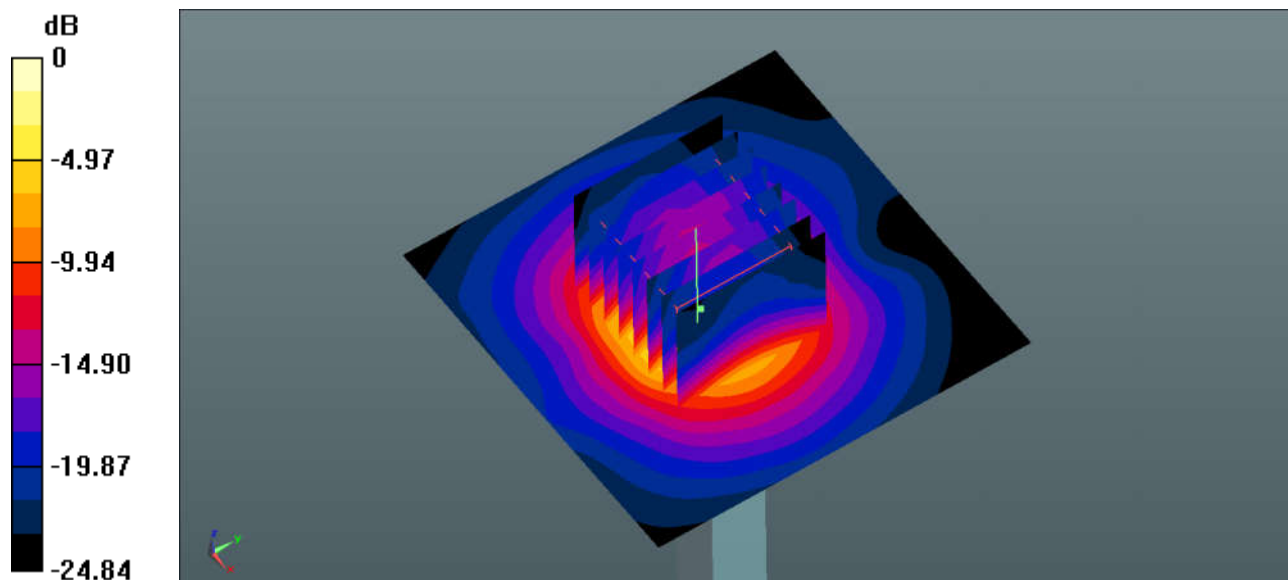
**Pin=100mW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 39.38 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 28.2 W/kg

**SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.29 W/kg**

Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

**System Check\_Head\_5750MHz****DUT: D5GHzV2-SN:1167**

Communication System: UID 0, CW (0); Frequency: 5750 MHz; Duty Cycle: 1:1

Medium: HSL\_5000 Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.147$  S/m;  $\epsilon_r = 34.924$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(5.23, 5.23, 5.23); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=100mW/Area Scan (71x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 16.9 W/kg

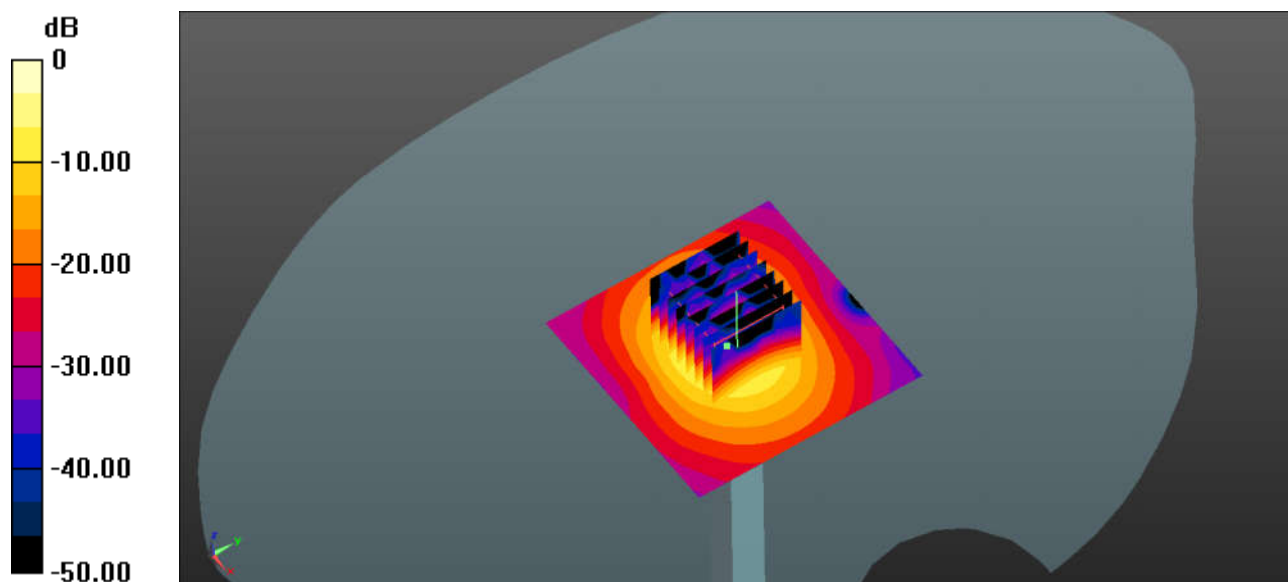
**Pin=100mW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 37.84 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 31.4 W/kg

**SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.22 W/kg**

Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

**System Check\_Body\_750MHz****DUT: D750V3-SN:1065**

Communication System: UID 0, CW (0); Frequency: 750 MHz; Duty Cycle: 1:1

Medium: MSL\_750 Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.913$  S/m;  $\epsilon_r = 57.193$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.5 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3954; ConvF(10.21, 10.21, 10.21); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.82 W/kg

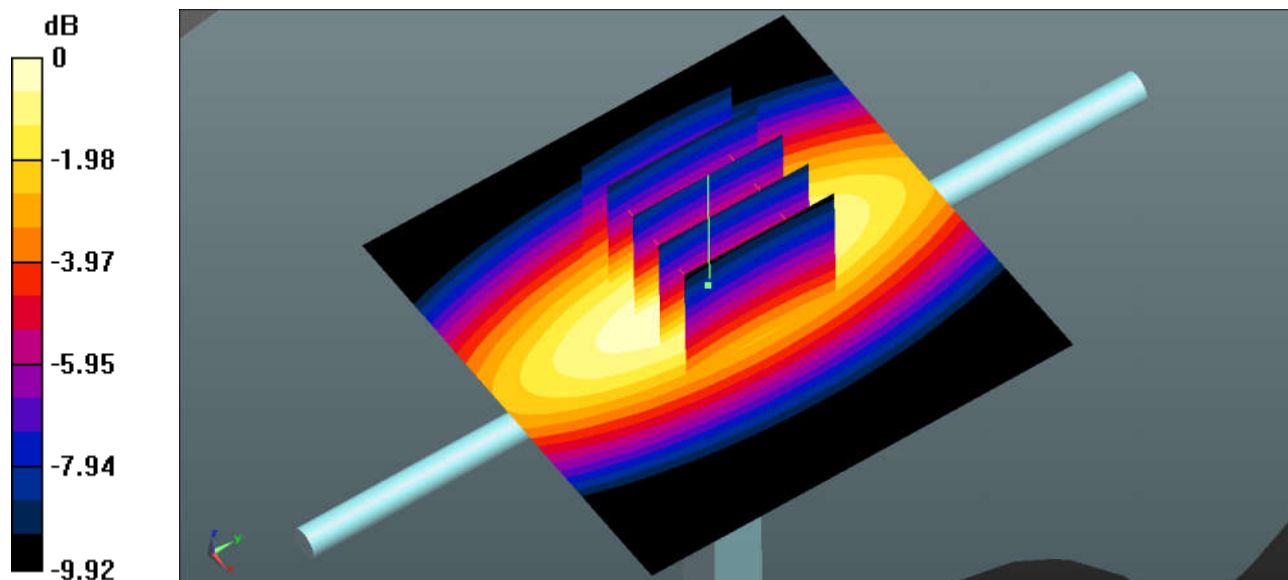
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 57.97 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.19 W/kg

**SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.44 W/kg**

Maximum value of SAR (measured) = 2.82 W/kg



0 dB = 2.82 W/kg = 4.50 dBW/kg

**System Check\_Body\_835MHz****DUT: D835V2 - SN:4d091**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL\_835 Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.984$  S/m;  $\epsilon_r = 56.51$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(9.49, 9.49, 9.49); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.36 W/kg

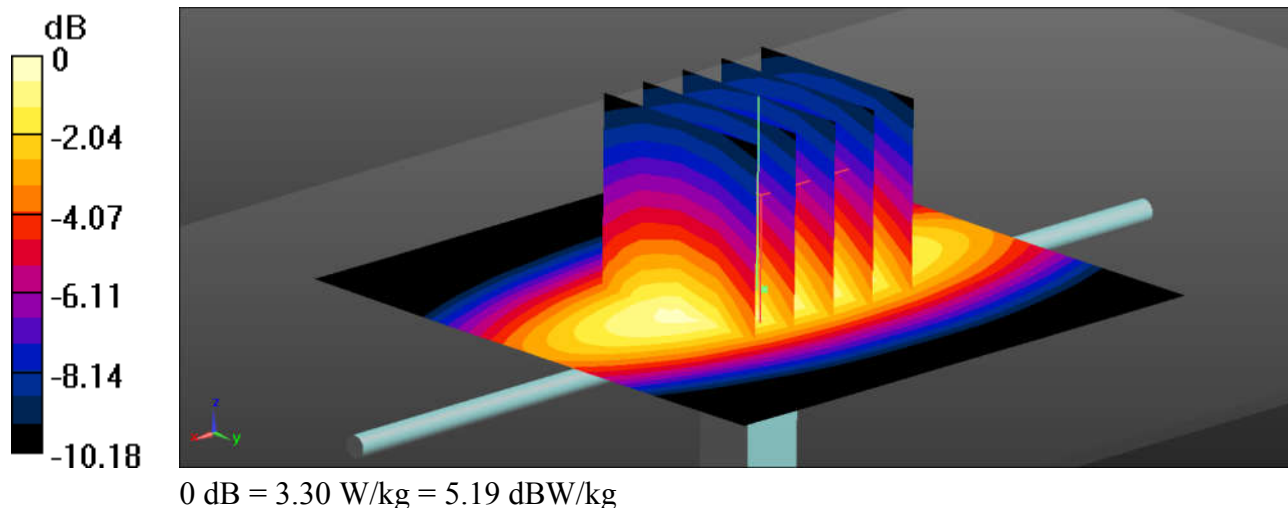
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 54.11 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.95 W/kg

**SAR(1 g) = 2.57 W/kg; SAR(10 g) = 1.69 W/kg**

Maximum value of SAR (measured) = 3.30 W/kg



**System Check\_Body\_1750MHz****DUT: D1750V2 - SN:1069**

Communication System: UID 0, CW (0); Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: MSL\_1750 Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.491$  S/m;  $\epsilon_r = 54.729$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(8.15, 8.15, 8.15); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 13.2 W/kg

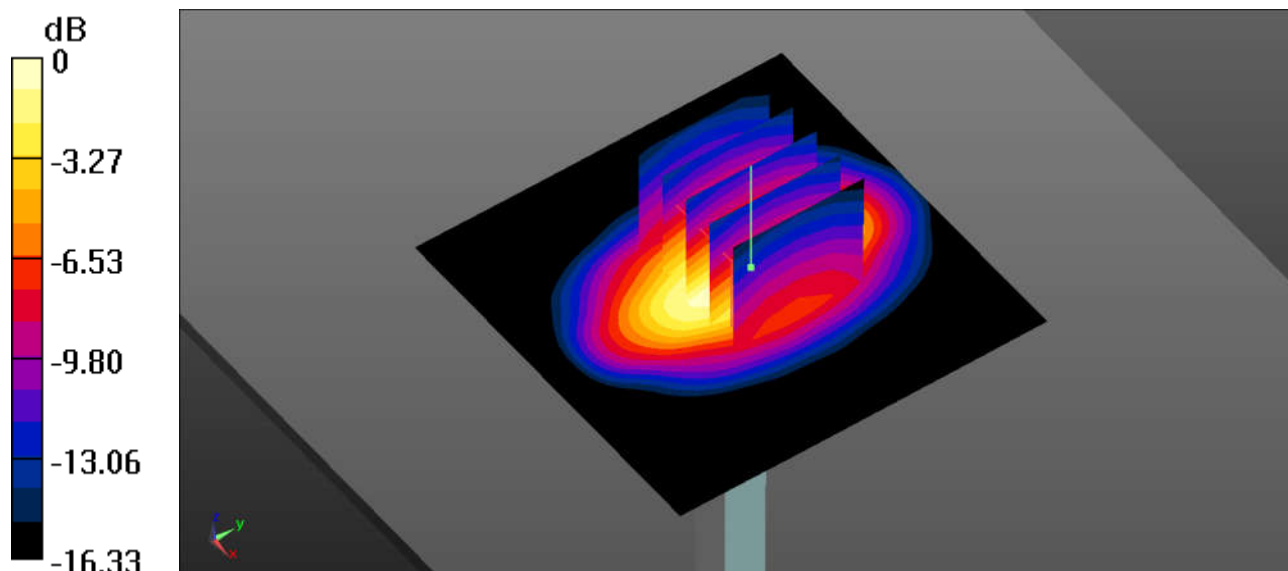
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 82.54 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 16.0 W/kg

**SAR(1 g) = 9.34 W/kg; SAR(10 g) = 5.06 W/kg**

Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.14 dBW/kg

**System Check\_Body\_1900MHz****DUT: D1900V2 - SN:5d118**

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL\_1900 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.537$  S/m;  $\epsilon_r = 53.469$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(7.82, 7.82, 7.82); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 13.9 W/kg

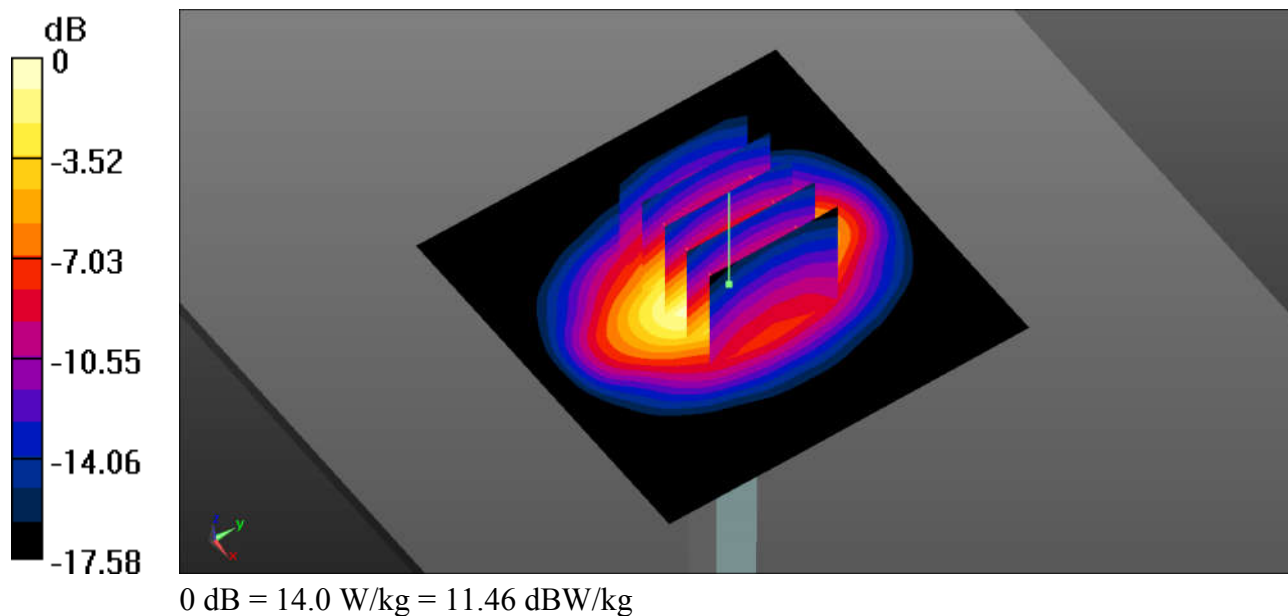
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 84.90 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 17.4 W/kg

**SAR(1 g) = 9.83 W/kg; SAR(10 g) = 5.13 W/kg**

Maximum value of SAR (measured) = 14.0 W/kg



**System Check\_Body\_2450MHz****DUT: D2450V2 - SN:840**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL\_2450 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.017$  S/m;  $\epsilon_r = 53.033$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(7.42, 7.42, 7.42); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (81x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 20.3 W/kg

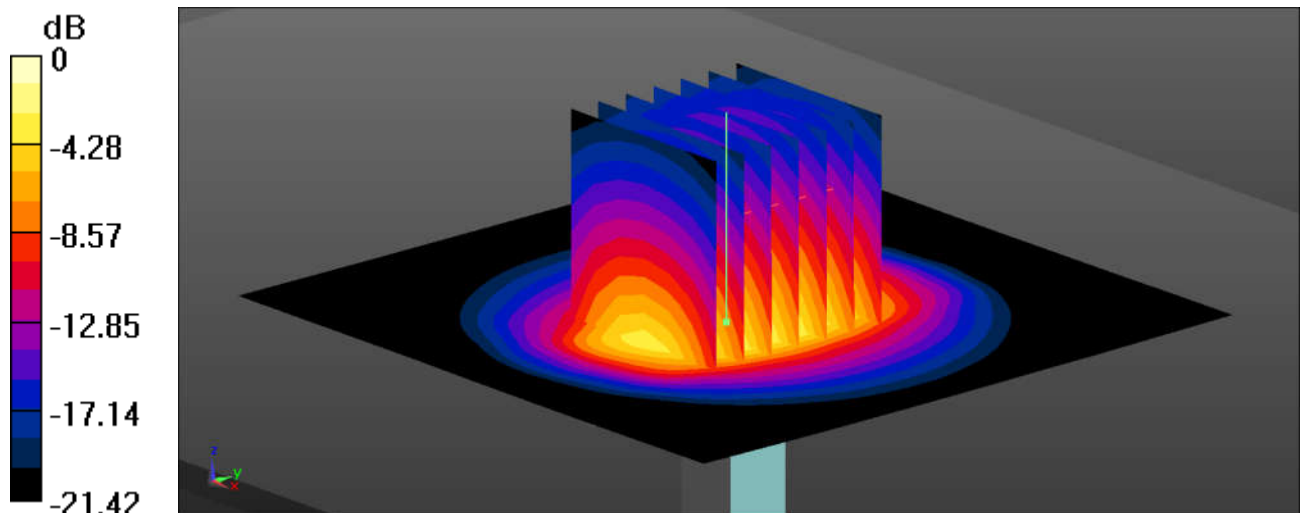
**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.32 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 26.7 W/kg

**SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.38 W/kg**

Maximum value of SAR (measured) = 20.2 W/kg



0 dB = 20.2 W/kg = 13.05 dBW/kg

**System Check\_Body\_5250MHz****DUT: D5GHzV2-SN:1006**

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium: MSL\_5000 3 Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.506$  S/m;  $\epsilon_r = 47.956$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.4, 4.4, 4.4); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW/Area Scan (71x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 17.3 W/kg

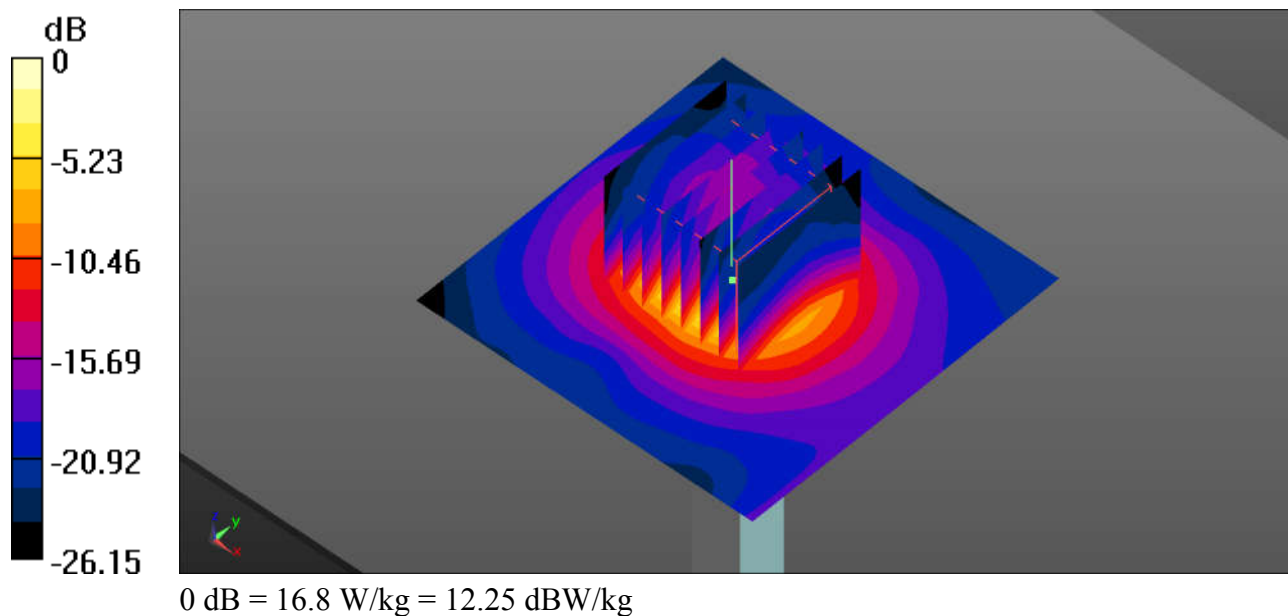
**CW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 39.99 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.6 W/kg

**SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.34 W/kg**

Maximum value of SAR (measured) = 16.8 W/kg



**System Check\_Body\_5600MHz****DUT: D5GHzV2-SN:1006**

Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: MSL\_5000 3 Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.954$  S/m;  $\epsilon_r = 47.367$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(3.98, 3.98, 3.98); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW/Area Scan (71x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 19.9 W/kg

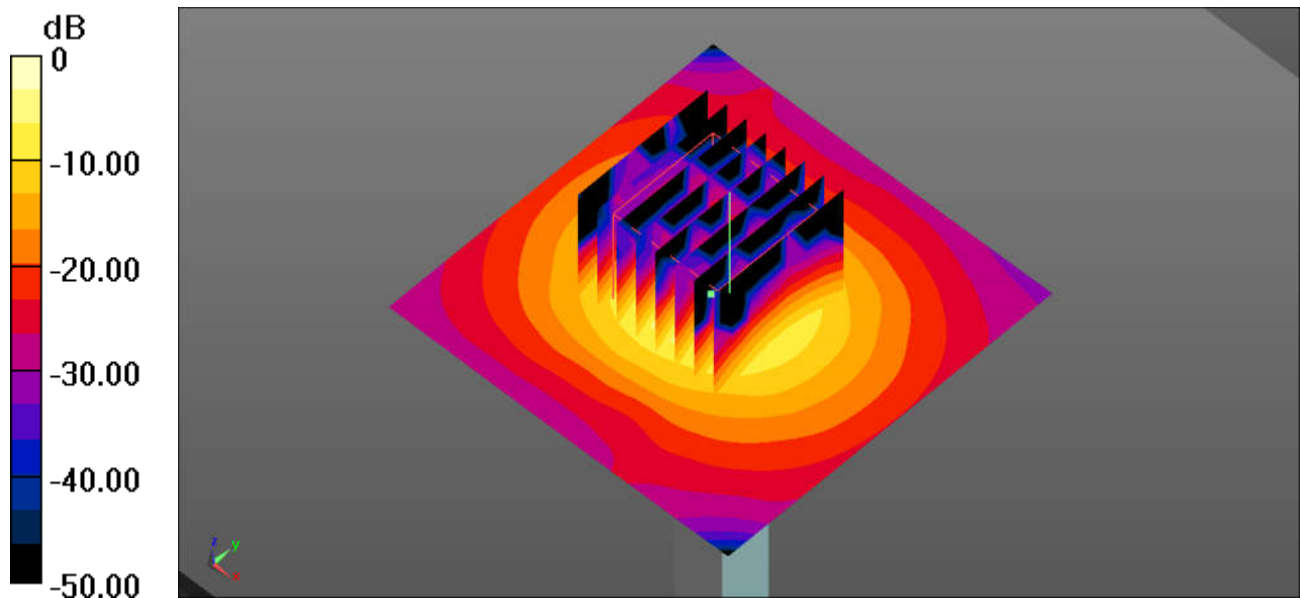
**CW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 40.11 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 35.2 W/kg

**SAR(1 g) = 8.13 W/kg; SAR(10 g) = 2.28 W/kg**

Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

**System Check\_Body\_5750MHz****DUT: D5GHzV2-SN:1006**

Communication System: UID 0, CW (0); Frequency: 5750 MHz; Duty Cycle: 1:1

Medium: MSL\_5000 Medium parameters used:  $f = 5750$  MHz;  $\sigma = 6.212$  S/m;  $\epsilon_r = 46.182$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.9 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.31, 4.31, 4.31); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=100mW/Area Scan (71x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 19.1 W/kg

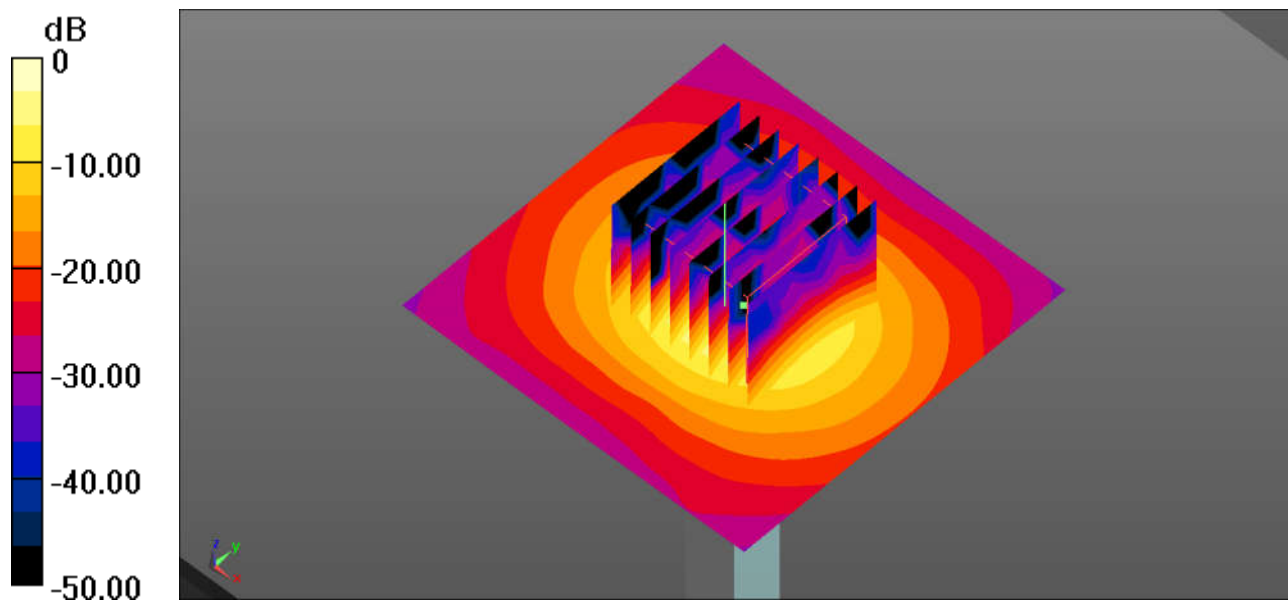
**Pin=100mW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 36.85 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 33.9 W/kg

**SAR(1 g) = 7.51 W/kg; SAR(10 g) = 2.11 W/kg**

Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg



---

## ***Appendix B. Plots of High SAR Measurement***

The plots are shown as follows.

**01\_LTE Band 13\_10M\_QPSK\_1RB\_25Offset\_Face\_25mm\_Ch23230**

Communication System: UID 0, FDD\_LTE (0); Frequency: 782 MHz; Duty Cycle: 1:1

Medium: HSL\_750 Medium parameters used:  $f = 782$  MHz;  $\sigma = 0.863$  S/m;  $\epsilon_r = 42.727$ ;  $\rho = 1000$

kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.92, 9.92, 9.92); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM3; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch23230/Area Scan (61x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.519 W/kg

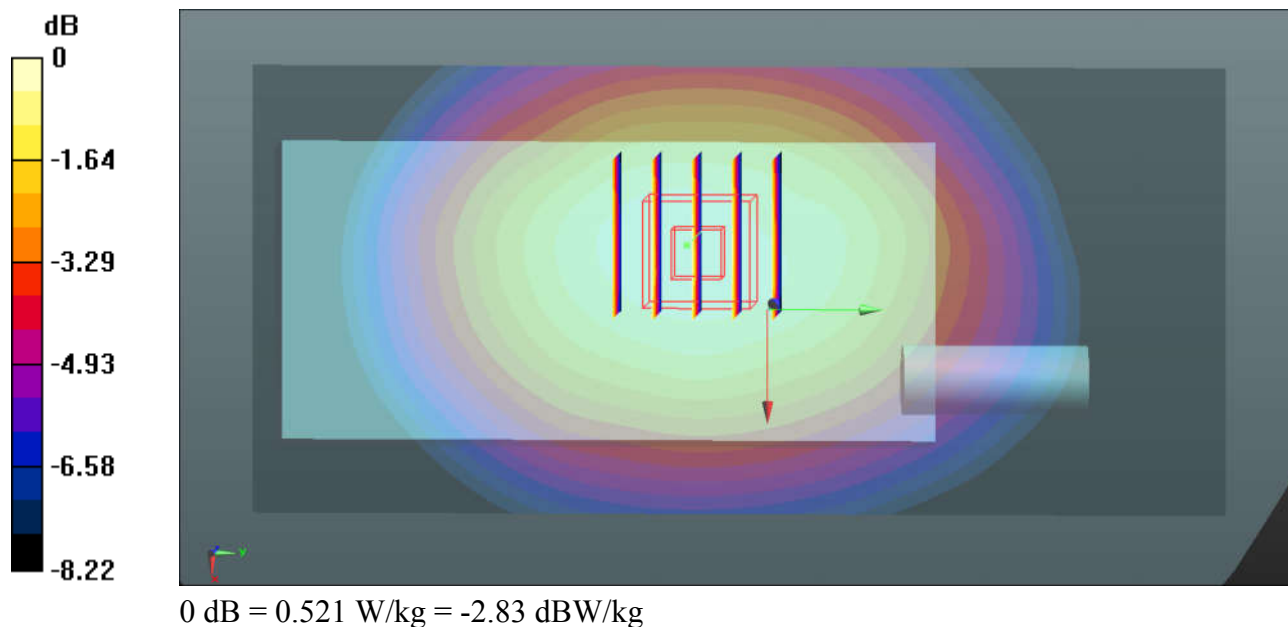
**Ch23230/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.99 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.572 W/kg

**SAR(1 g) = 0.423 W/kg; SAR(10 g) = 0.315 W/kg**

Maximum value of SAR (measured) = 0.521 W/kg



**02\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_face\_25mm\_Ch20525**

Communication System: UID 0, FDD\_LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1  
Medium: HSL\_835 Medium parameters used:  $f = 836.5$  MHz;  $\sigma = 0.914$  S/m;  $\epsilon_r = 42.066$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(9.51, 9.51, 9.51); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM3; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (61x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.396 W/kg

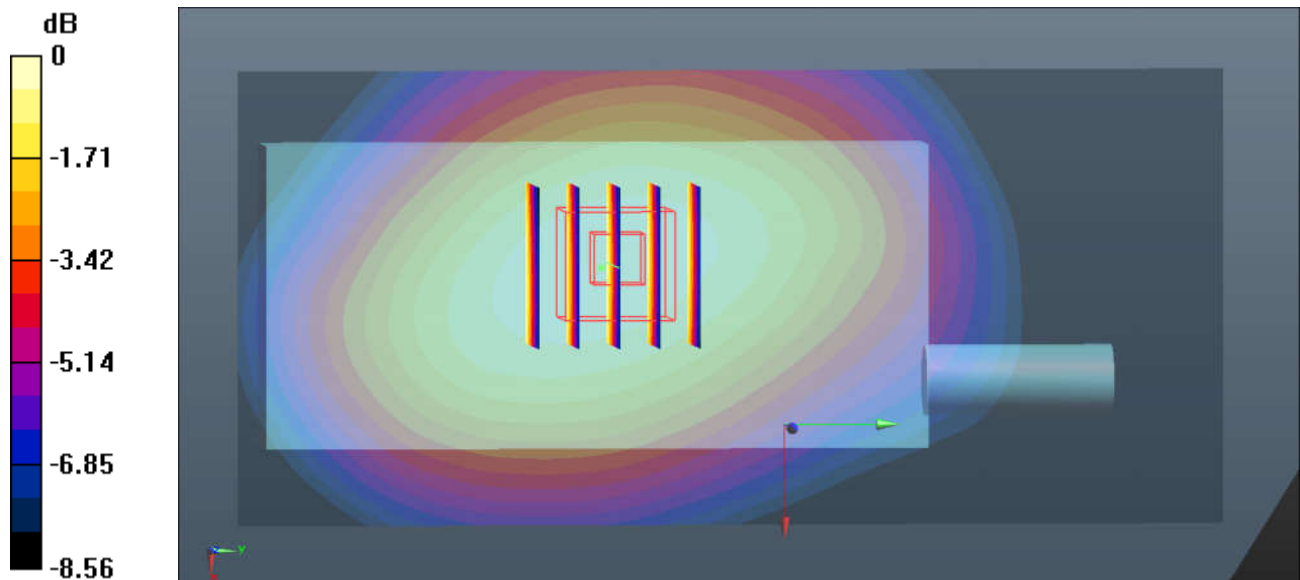
**Ch20525/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.82 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.436 W/kg

**SAR(1 g) = 0.325 W/kg; SAR(10 g) = 0.239 W/kg**

Maximum value of SAR (measured) = 0.399 W/kg



0 dB = 0.399 W/kg = -3.99 dBW/kg

**03\_LTE Band 4\_20M\_QPSK\_1RB\_49Offset\_face\_25mm\_Ch20175**

Communication System: UID 0, FDD\_LTE (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1  
Medium: HSL\_1750 Medium parameters used (interpolated):  $f = 1732.5$  MHz;  $\sigma = 1.347$  S/m;  $\epsilon_r = 39.604$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.9 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(8.29, 8.29, 8.29); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20175/Area Scan (51x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.290 W/kg

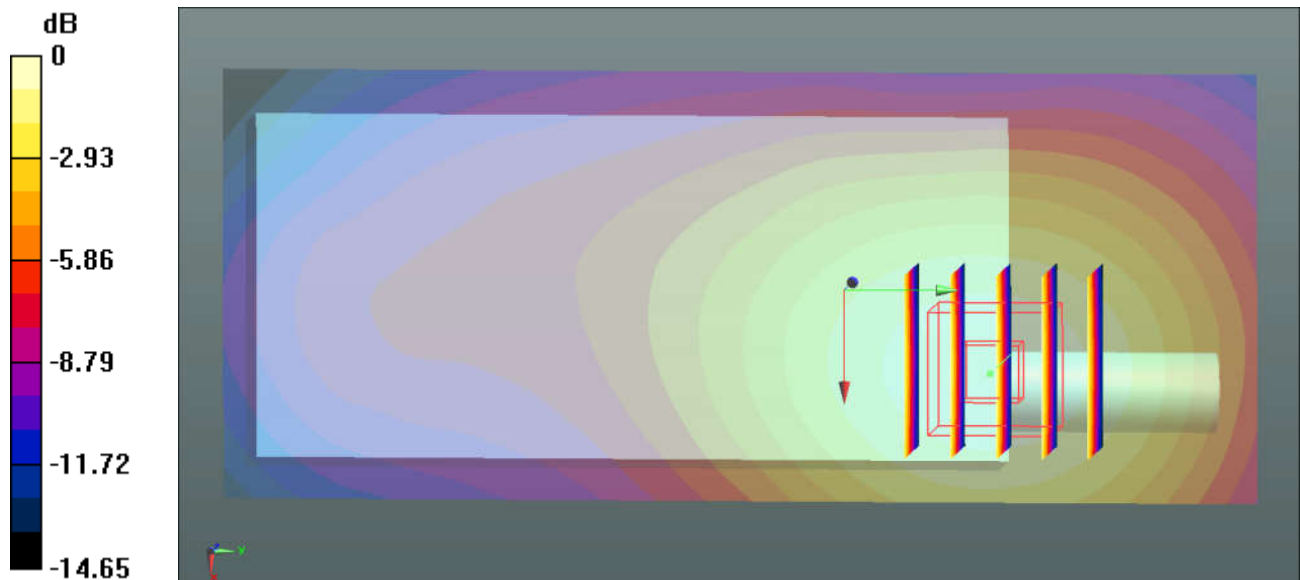
**Ch20175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.24 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.351 W/kg

**SAR(1 g) = 0.211 W/kg; SAR(10 g) = 0.132 W/kg**

Maximum value of SAR (measured) = 0.298 W/kg



0 dB = 0.298 W/kg = -5.26 dBW/kg

**04\_LTE Band 2\_20M\_QPSK\_1RB\_49Offset\_face\_25mm\_Ch18900**

Communication System: UID 0, FDD\_LTE (0); Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: HSL\_1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.381$  S/m;  $\epsilon_r = 39.62$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.5 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(8.04, 8.04, 8.04); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch18900/Area Scan (51x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.410 W/kg

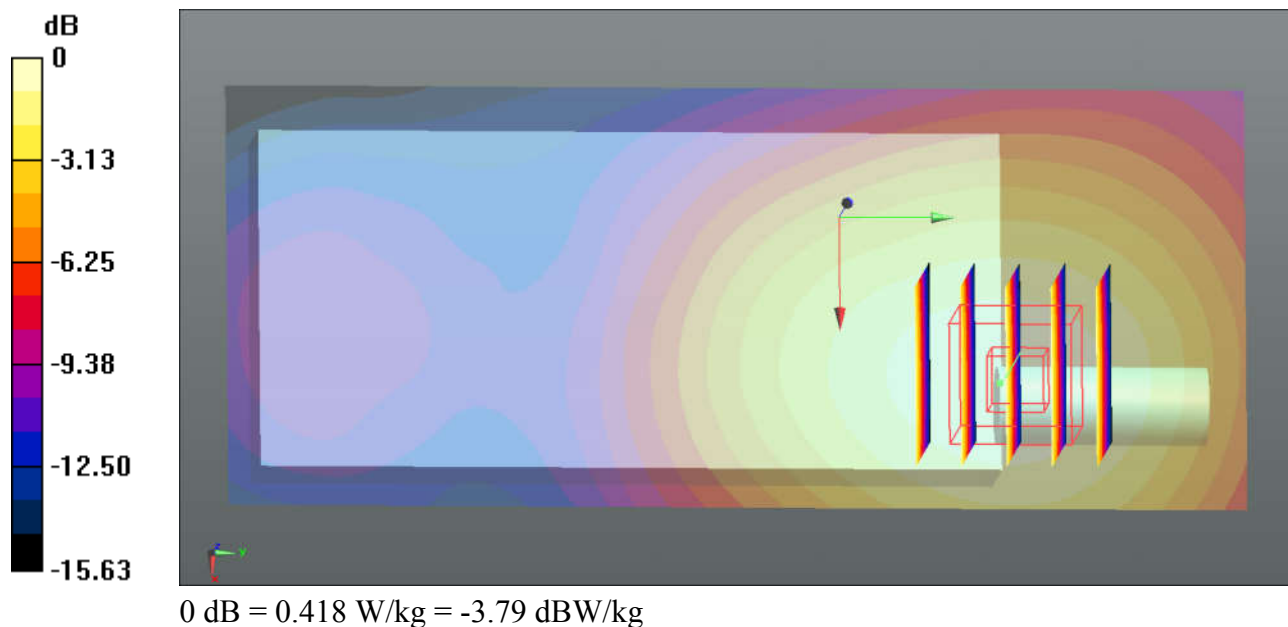
**Ch18900/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.95 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.494 W/kg

**SAR(1 g) = 0.295 W/kg; SAR(10 g) = 0.181 W/kg**

Maximum value of SAR (measured) = 0.418 W/kg



**05\_WLAN2.4GHz\_802.11b 1Mbps\_face\_25mm\_Ch6**

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL\_2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.822$  S/m;  $\epsilon_r = 38.384$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.56, 7.56, 7.56); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM3; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch6/Area Scan (81x161x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0655 W/kg

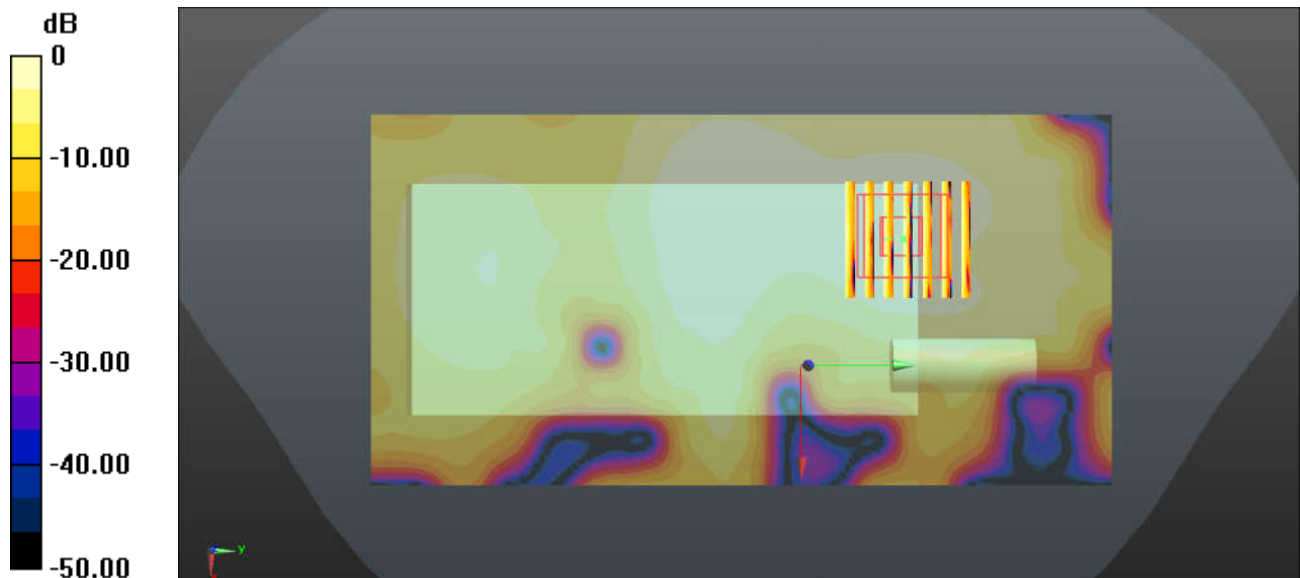
**Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.674 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.0810 W/kg

**SAR(1 g) = 0.041 W/kg; SAR(10 g) = 0.019 W/kg**

Maximum value of SAR (measured) = 0.0643 W/kg



0 dB = 0.0643 W/kg = -11.92 dBW/kg

**06\_WLAN5GHz\_802.11a 6Mbps\_face\_25mm\_Ch52**

Communication System: UID 0, WIFI (0); Frequency: 5260 MHz; Duty Cycle: 1:1.081

Medium: HSL\_5000 Medium parameters used:  $f = 5260$  MHz;  $\sigma = 4.579$  S/m;  $\epsilon_r = 35.987$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(5.2, 5.2, 5.2); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch52/Area Scan (81x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0544 W/kg

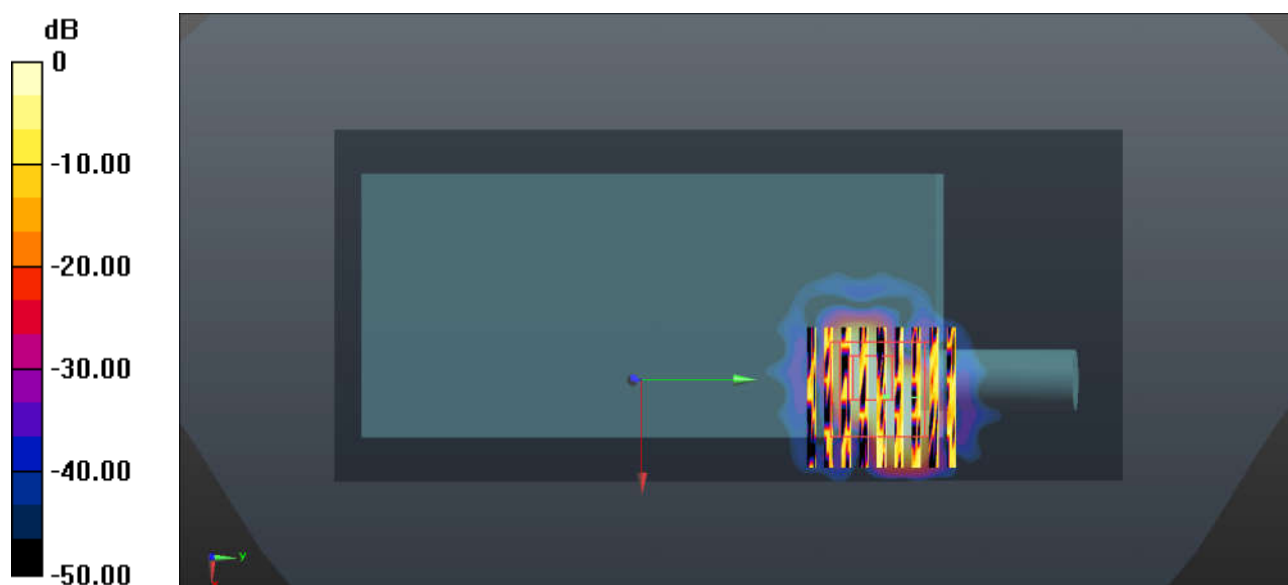
**Ch52/Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 0 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.170 W/kg

**SAR(1 g) = 0.00932 W/kg; SAR(10 g) = 0.00188 W/kg**

Maximum value of SAR (measured) = 0.0277 W/kg



0 dB = 0.0277 W/kg = -15.58 dBW/kg

**07\_WLAN5GHz\_802.11a 6Mbps\_face\_25mm\_Ch116**

Communication System: UID 0, WIFI (0); Frequency: 5580 MHz; Duty Cycle: 1:1.081

Medium: HSL\_5000 Medium parameters used:  $f = 5580$  MHz;  $\sigma = 4.94$  S/m;  $\epsilon_r = 35.266$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.94, 4.94, 4.94); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch116/Area Scan (81x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.109 W/kg

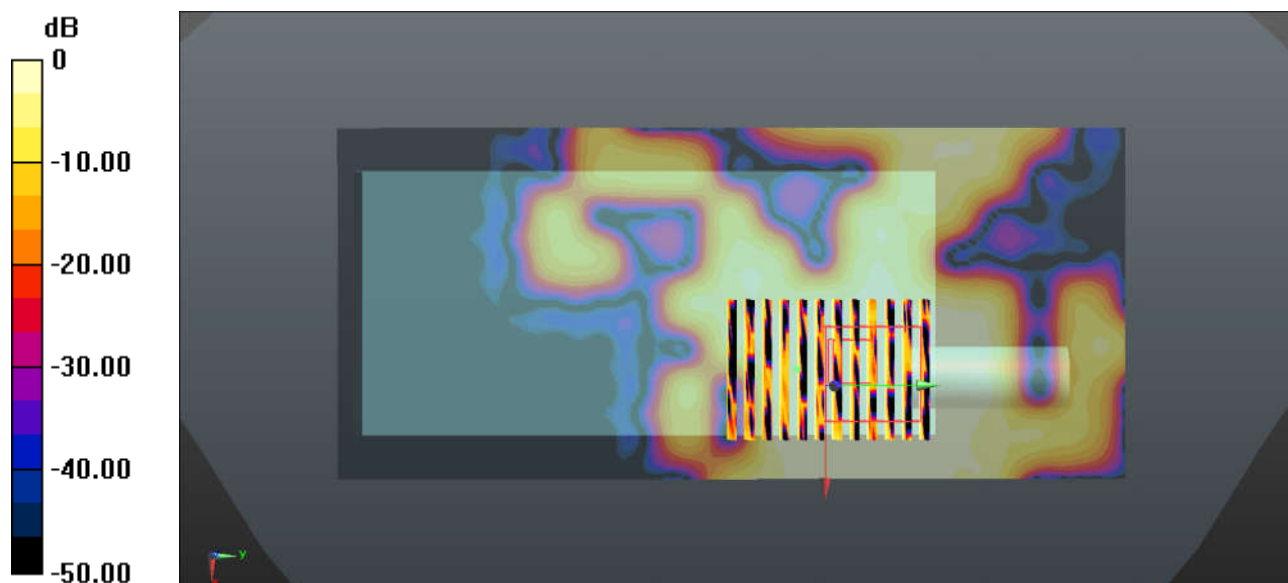
**Ch116/Zoom Scan (9x12x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 3.657 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.377 W/kg

**SAR(1 g) = 0.039 W/kg; SAR(10 g) = 0.016 W/kg**

Maximum value of SAR (measured) = 0.109 W/kg



**08\_WLAN5GHz\_802.11a 6Mbps\_face\_25mm\_Ch165**

Communication System: UID 0, WIFI (0); Frequency: 5825 MHz; Duty Cycle: 1:1.081

Medium: HSL\_5000 Medium parameters used:  $f = 5825$  MHz;  $\sigma = 5.235$  S/m;  $\epsilon_r = 34.737$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(5.23, 5.23, 5.23); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM2; Type: SAM; Serial: TP-1644
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch165/Area Scan (81x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.138 W/kg

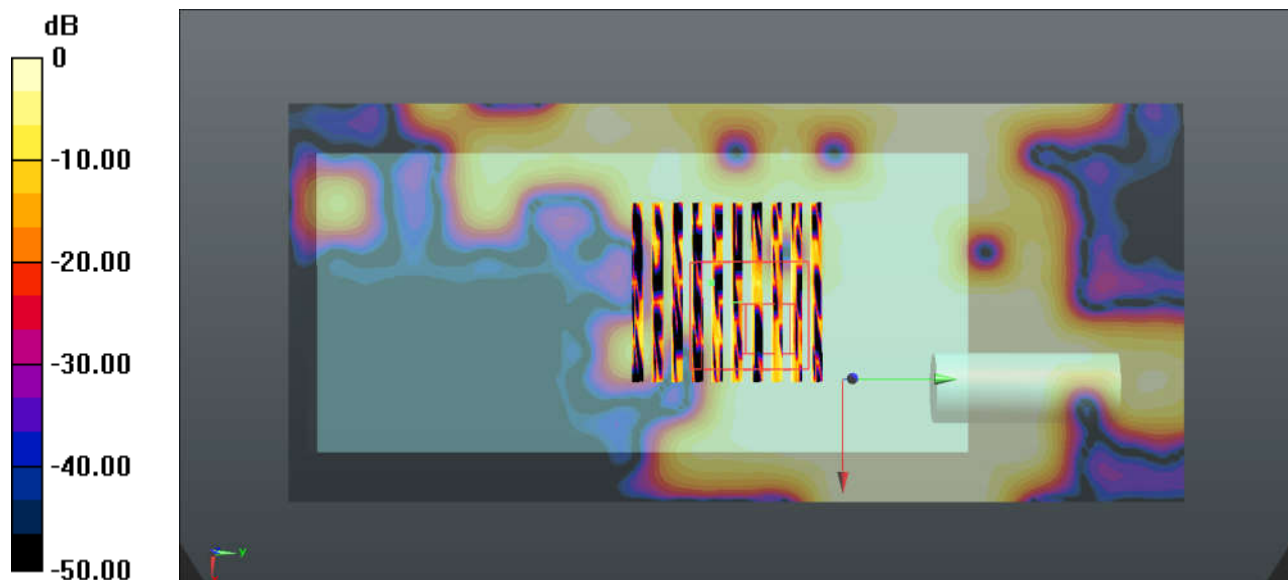
**Ch165/Zoom Scan (10x10x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 4.099 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.409 W/kg

**SAR(1 g) = 0.026 W/kg; SAR(10 g) = 0.010 W/kg**

Maximum value of SAR (measured) = 0.0734 W/kg



0 dB = 0.0734 W/kg = -11.34 dBW/kg

**09\_LTE Band 13\_10M\_QPSK\_1RB\_25Offset\_Back Face\_0mm\_Ch23230\_Belt Clip**

Communication System: UID 0, LTE (0); Frequency: 782 MHz; Duty Cycle: 1:1

Medium: MSL\_750 Medium parameters used:  $f = 782$  MHz;  $\sigma = 0.933$  S/m;  $\epsilon_r = 56.943$ ;  $\rho = 1000$

kg/m<sup>3</sup>

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(10.21, 10.21, 10.21); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch23230/Area Scan (61x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.800 W/kg

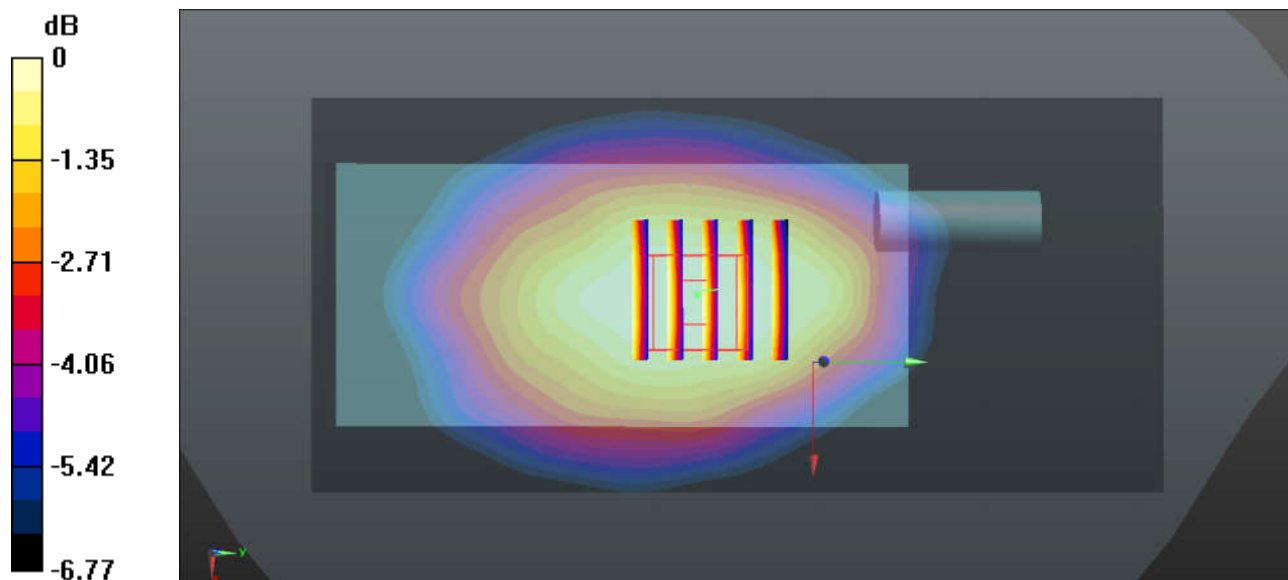
**Ch23230/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 29.80 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.787 W/kg

**SAR(1 g) = 0.693 W/kg; SAR(10 g) = 0.551 W/kg**

Maximum value of SAR (measured) = 0.765 W/kg



0 dB = 0.765 W/kg = -1.16 dBW/kg

**10\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_Back Face\_0mm\_Ch20525\_Belt Clip**

Communication System: UID 0, LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium: MSL\_835 Medium parameters used :  $f = 836.5$  MHz;  $\sigma = 0.986$  S/m;  $\epsilon_r = 56.499$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.49, 9.49, 9.49); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (61x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.590 W/kg

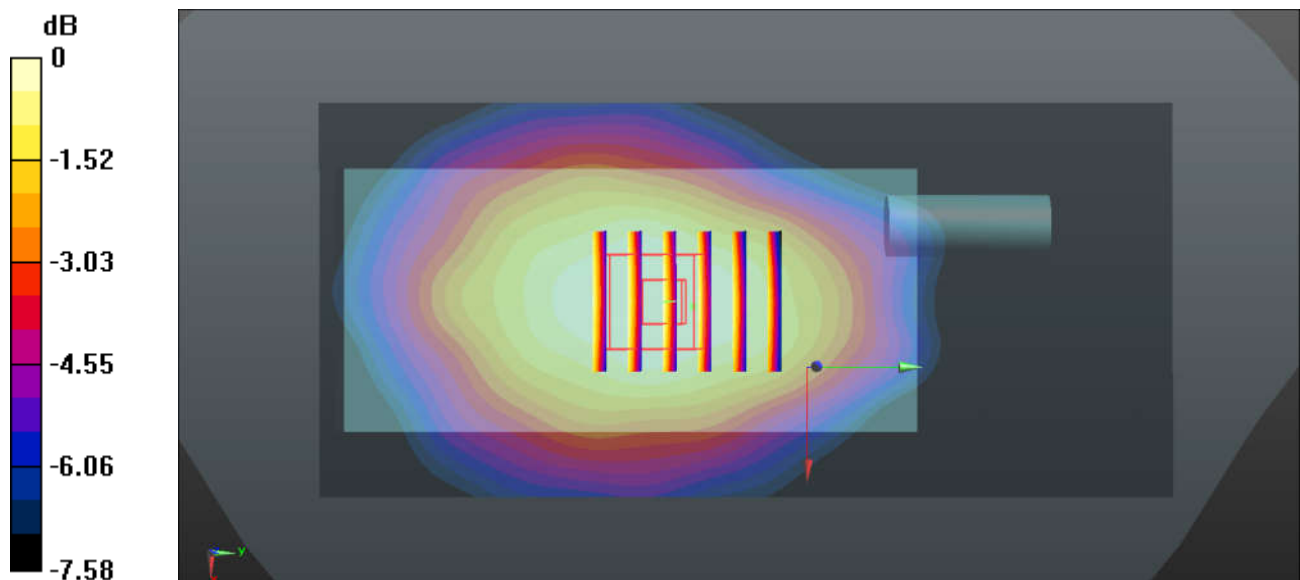
**Ch20525/Zoom Scan (5x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.79 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.596 W/kg

**SAR(1 g) = 0.505 W/kg; SAR(10 g) = 0.400 W/kg**

Maximum value of SAR (measured) = 0.576 W/kg



0 dB = 0.576 W/kg = -2.40 dBW/kg

**11\_LTE Band 4\_20M\_QPSK\_1RB\_49Offset\_Front Face\_0mm\_Ch20175\_Swivel Carry Holster**

Communication System: UID 0, FDD\_LTE (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: MSL\_1750 Medium parameters used :  $f = 1732.5$  MHz;  $\sigma = 1.47$  S/m;  $\epsilon_r = 54.775$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(8.15, 8.15, 8.15); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20175/Area Scan (61x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.327 W/kg

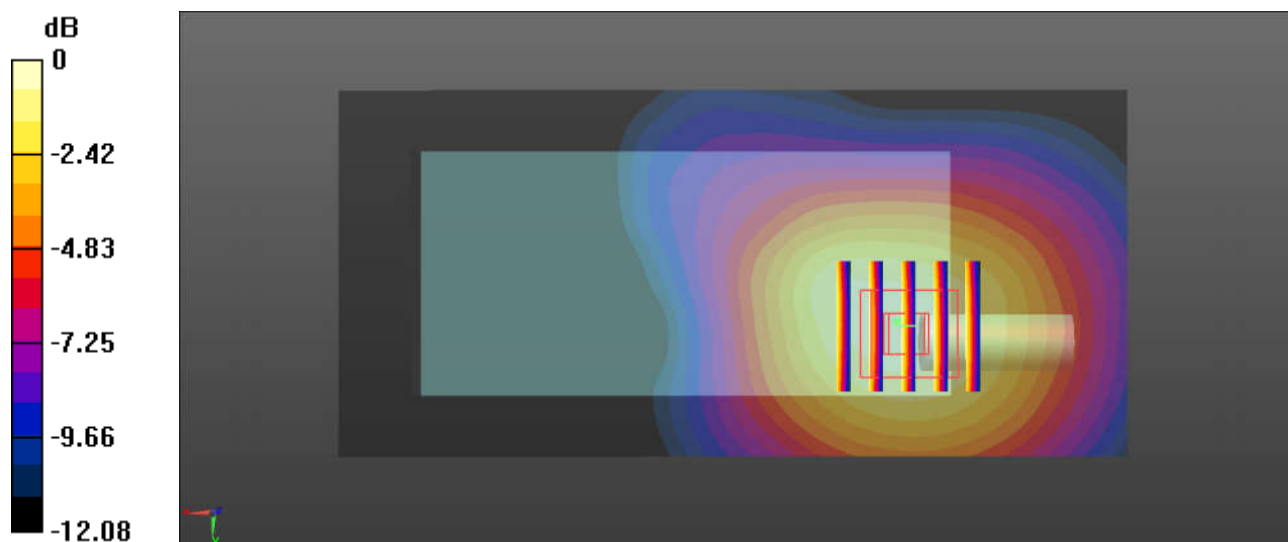
**Ch20175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 16.13 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.398 W/kg

**SAR(1 g) = 0.270 W/kg; SAR(10 g) = 0.180 W/kg**

Maximum value of SAR (measured) = 0.353 W/kg



0 dB = 0.353 W/kg = -4.52 dBW/kg

**12\_LTE Band 2\_20M\_QPSK\_1RB\_49Offset\_Back Face\_0mm\_Ch18900\_Belt Clip**

Communication System: UID 0, FDD\_LTE (0); Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.514$  S/m;  $\epsilon_r = 53.566$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(7.82, 7.82, 7.82); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch18900/Area Scan (61x131x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.353 W/kg

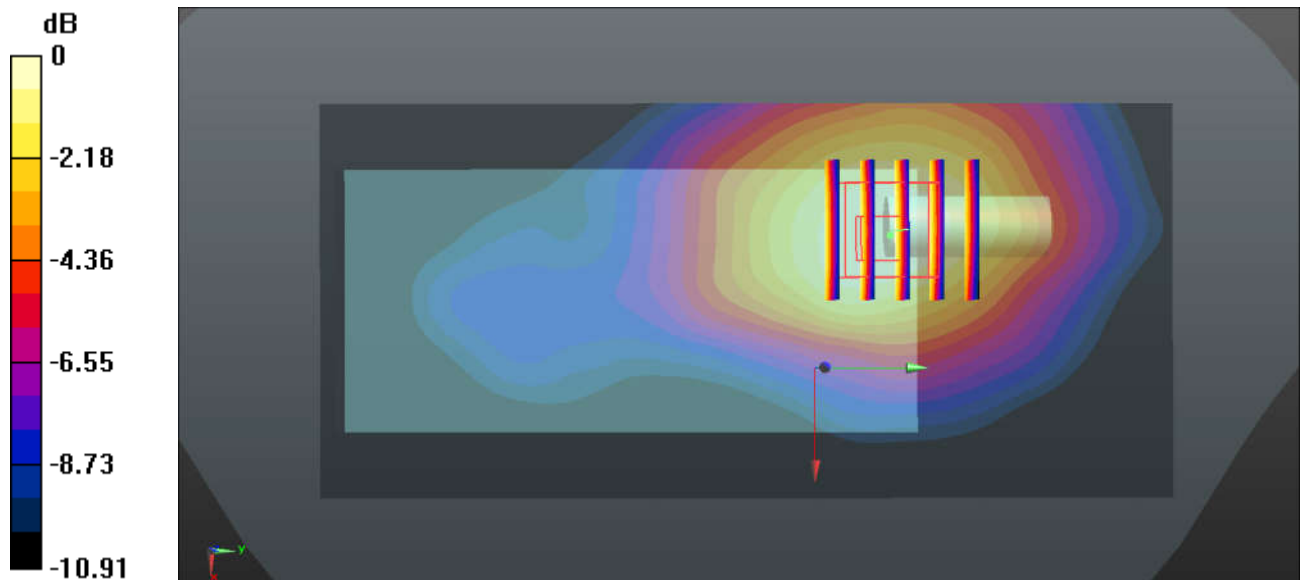
**Ch18900/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.54 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.370 W/kg

**SAR(1 g) = 0.272 W/kg; SAR(10 g) = 0.185 W/kg**

Maximum value of SAR (measured) = 0.337 W/kg



0 dB = 0.337 W/kg = -4.72 dBW/kg

**13\_WLAN2.4GHz\_802.11b 1Mbps\_Back Face\_0mm\_Ch6\_Belt Clip**

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: MSL\_2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 2.004$  S/m;  $\epsilon_r = 53.091$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.42, 7.42, 7.42); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch6/Area Scan (81x161x1):** Interpolated grid:  $dx=1.200$  mm,  $dy=1.200$  mm

Maximum value of SAR (interpolated) = 0.235 W/kg

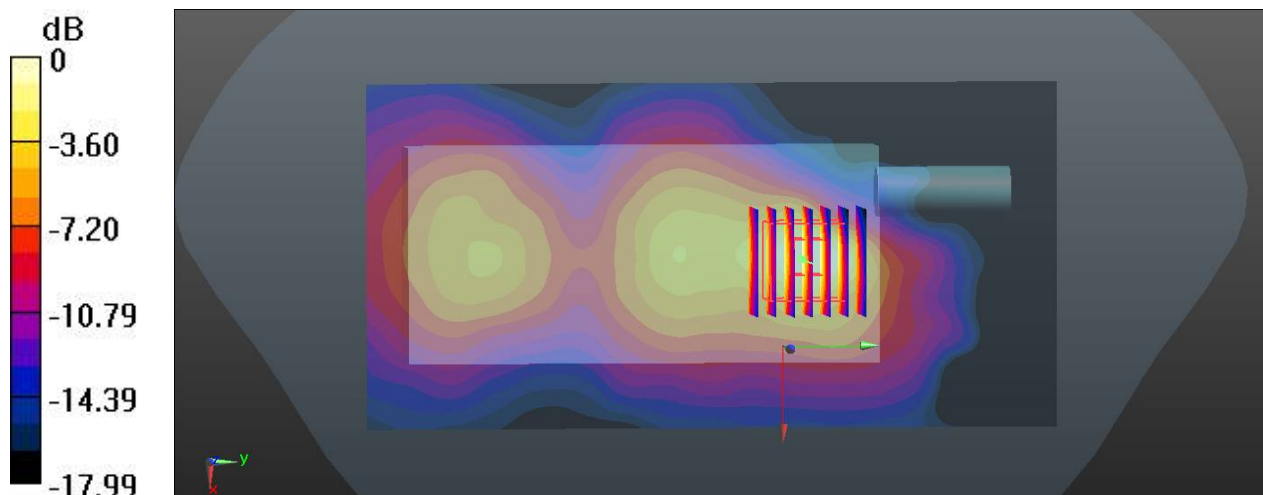
**Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 10.77 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.259 W/kg

**SAR(1 g) = 0.145 W/kg; SAR(10 g) = 0.072 W/kg**

Maximum value of SAR (measured) = 0.218 W/kg



0 dB = 0.218 W/kg = -6.62 dBW/kg

**14 Bluetooth\_1Mbps\_802.11b 1Mbps\_Back Face\_0mm\_Ch39\_Belt Clip**

Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz; Duty Cycle: 1:1.302

Medium: MSL\_2450 Medium parameters used:  $f = 2441$  MHz;  $\sigma = 2.009$  S/m;  $\epsilon_r = 53.074$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.42, 7.42, 7.42); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch39/Area Scan (81x161x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.175 W/kg

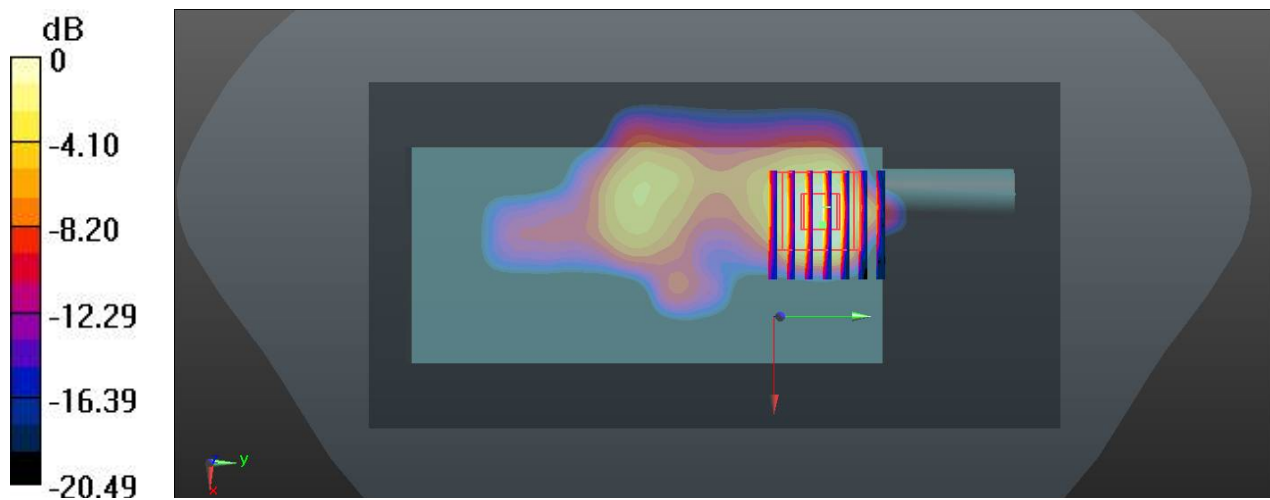
**Ch39/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.659 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 0.142 W/kg

**SAR(1 g) = 0.074 W/kg; SAR(10 g) = 0.033 W/kg**

Maximum value of SAR (measured) = 0.115 W/kg



0 dB = 0.115 W/kg = -9.39 dBW/kg

**15\_WLAN5GHz\_802.11a 6Mbps\_Back Face\_0mm\_Ch52\_Belt Clip**

Communication System: UID 0, 802.11a (0); Frequency: 5260 MHz; Duty Cycle: 1:1.081  
Medium: MSL\_5000 Medium parameters used:  $f = 5260$  MHz;  $\sigma = 5.517$  S/m;  $\epsilon_r = 47.95$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.5 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.4, 4.4, 4.4); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch52/Area Scan (91x191x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

Maximum value of SAR (interpolated) = 0.0919 W/kg

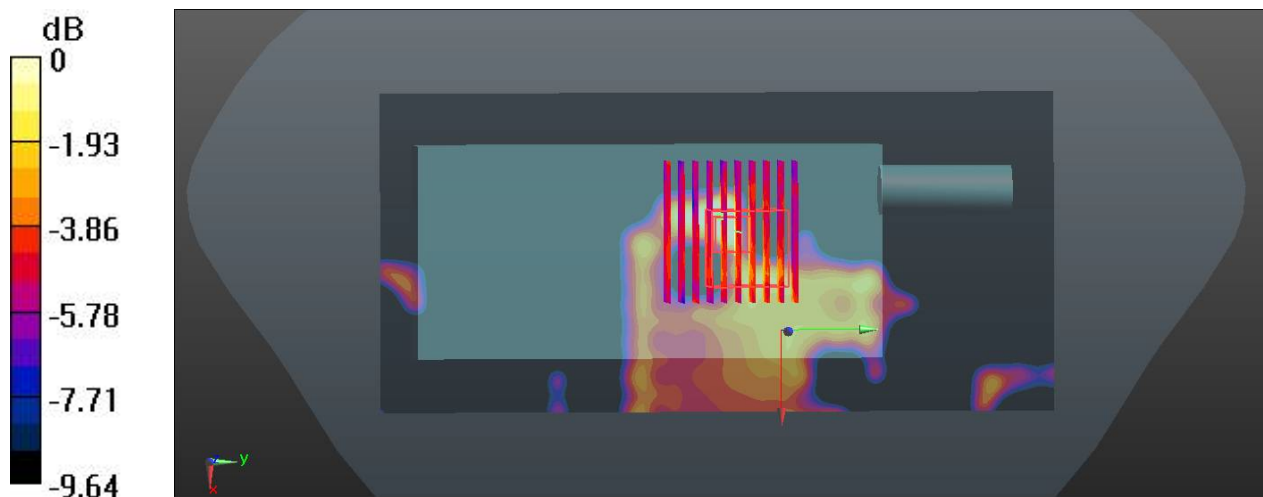
**Ch52/Zoom Scan (11x10x7)/Cube 0:** Measurement grid:  $dx=4$ mm,  $dy=4$ mm,  $dz=1.4$ mm

Reference Value = 2.679 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.136 W/kg

**SAR(1 g) = 0.017 W/kg; SAR(10 g) = 0.0066 W/kg**

Maximum value of SAR (measured) = 0.0408 W/kg



0 dB = 0.0408 W/kg = -13.89 dBW/kg

**16\_WLAN5GHz\_802.11a 6Mbps\_Front Face\_0mm\_Ch116\_Swivel Carry Holster**

Communication System: UID 0, WIFI (0); Frequency: 5580 MHz; Duty Cycle: 1:1.081

Medium: MSL\_5000 Medium parameters used:  $f = 5580$  MHz;  $\sigma = 5.928$  S/m;  $\epsilon_r = 47.406$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(3.98, 3.98, 3.98); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch116/Area Scan (81x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.156 W/kg

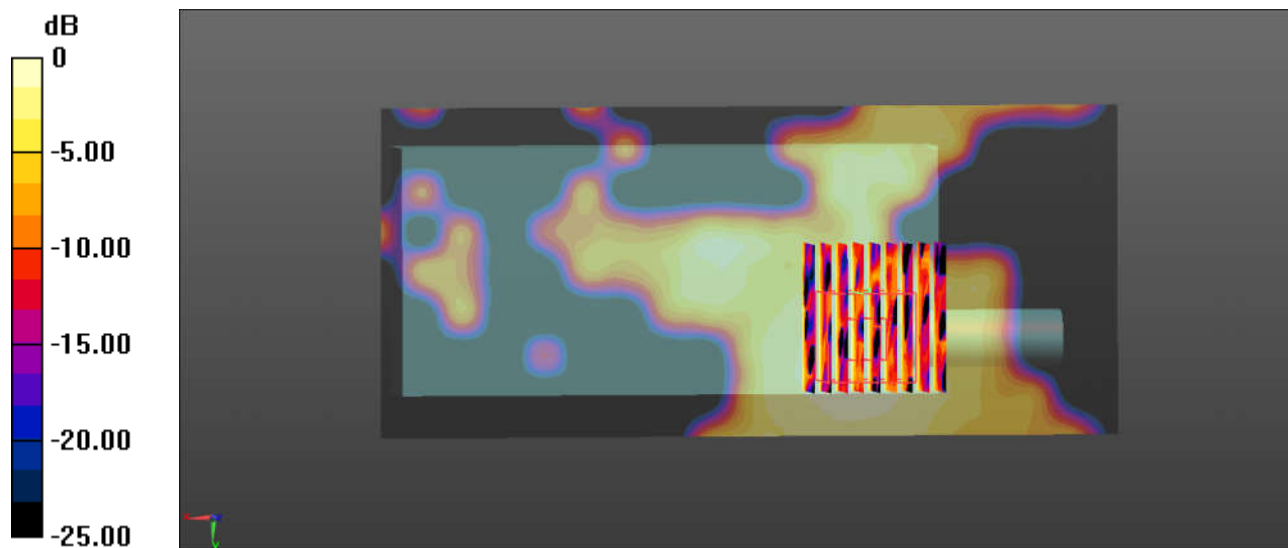
**Ch116/Zoom Scan (10x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 5.171 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.619 W/kg

**SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.025 W/kg**

Maximum value of SAR (measured) = 0.155 W/kg



**17\_WLAN5GHz\_802.11a 6Mbps\_Front Face\_0mm\_Ch165\_Swivel Carry Holster**

Communication System: UID 0, WIFI (0); Frequency: 5825 MHz; Duty Cycle: 1:1.081

Medium: MSL\_5000 Medium parameters used:  $f = 5825$  MHz;  $\sigma = 6.26$  S/m;  $\epsilon_r = 47.001$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.9 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.31, 4.31, 4.31); Calibrated: 2018.5.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2018.5.28
- Phantom: SAM1; Type: SAM; Serial: TP-1164
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch165/Area Scan (81x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.151 W/kg

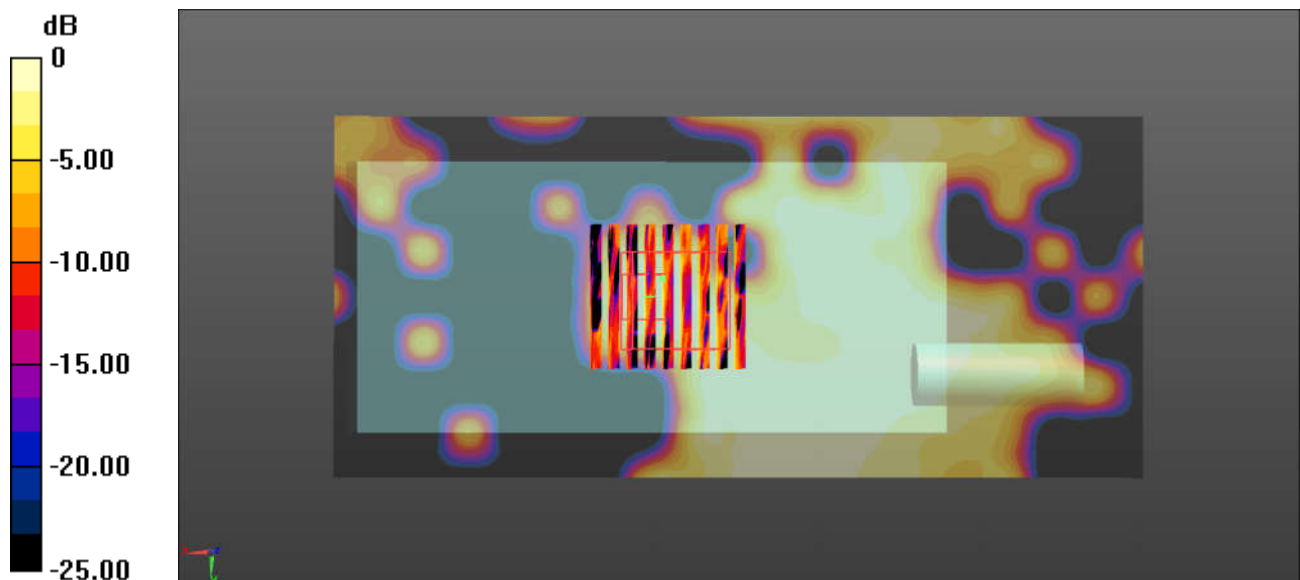
**Ch165/Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 4.345 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.509 W/kg

**SAR(1 g) = 0.036 W/kg; SAR(10 g) = 0.012 W/kg**

Maximum value of SAR (measured) = 0.111 W/kg



0 dB = 0.111 W/kg = -9.55 dBW/kg



---

## ***Appendix C. DASY Calibration Certificate***

The DASY calibration certificates are shown as follows.



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client

**Sporton**

Certificate No: **Z17-97258**

## CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1065**

Calibration Procedure(s) **FF-Z11-003-01**  
**Calibration Procedures for dipole validation kits**

Calibration date: **December 4, 2017**

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)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards       | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|------------------------------------------|-----------------------|
| Power Meter NRVD        | 102196     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Power sensor NRV-Z5     | 100596     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Reference Probe EX3DV4  | SN 3617    | 23-Jan-17(SPEAG,No.EX3-3617_Jan17)       | Jan-18                |
| DAE3                    | SN 536     | 09-Oct-17(CTTL-SPEAG,No.Z17-97198)       | Oct-18                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-17 (CTTL, No.J17X00286)           | Jan-18                |
| Network Analyzer E5071C | MY46110673 | 13-Jan-17 (CTTL, No.J17X00285)           | Jan-18                |

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

Issued: December 8, 2017

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



In Collaboration with

**s p e a g**  
**CALIBRATION LABORATORY**

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2079

Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

http://www.chinattl.cn

### Glossary:

|       |                                            |
|-------|--------------------------------------------|
| TSL   | tissue simulating liquid                   |
| ConvF | sensitivity in TSL / NORM <sub>x,y,z</sub> |
| N/A   | not applicable or not measured             |

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

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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%.



In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2079

Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

http://www.chinattl.cn

**Measurement Conditions**

DASY system configuration, as far as not given on page 1.

|                              |                          |              |
|------------------------------|--------------------------|--------------|
| DASY Version                 | DASY52                   | 52.10.0.1446 |
| Extrapolation                | Advanced Extrapolation   |              |
| Phantom                      | Triple Flat Phantom 5.1C |              |
| Distance Dipole Center - TSL | 15 mm                    | with Spacer  |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm        |              |
| Frequency                    | 750 MHz $\pm$ 1 MHz      |              |

**Head TSL parameters**

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.9           | 0.89 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 41.4 $\pm$ 6 % | 0.90 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ---            | ---                  |

**SAR result with Head TSL**

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                                |
| SAR measured                                            | 250 mW input power | 2.10 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 8.33 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | Condition          |                                |
| SAR measured                                            | 250 mW input power | 1.39 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 5.53 mW / g $\pm$ 18.7 % (k=2) |

**Body TSL parameters**

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.5           | 0.96 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 55.2 $\pm$ 6 % | 0.94 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | <1.0 °C             | ---            | ---                  |

**SAR result with Body TSL**

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL   | Condition          |                                |
| SAR measured                                            | 250 mW input power | 2.14 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 8.72 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | Condition          |                                |
| SAR measured                                            | 250 mW input power | 1.42 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 5.76 mW / g $\pm$ 18.7 % (k=2) |



In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Huidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## Appendix (Additional assessments outside the scope of CNAS L0570)

### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 50.9Ω- 3.76jΩ |
| Return Loss                          | - 28.3dB      |

### Antenna Parameters with Body TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.8Ω- 2.81jΩ |
| Return Loss                          | - 30.2dB      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 0.896 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |       |
|-----------------|-------|
| Manufactured by | SPEAG |
|-----------------|-------|



In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2079

Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

http://www.chinattl.cn

## DASY5 Validation Report for Head TSL

Date: 12.04.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1065**

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.896$  S/m;  $\epsilon_r = 41.36$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.05, 10.05, 10.05); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/I
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

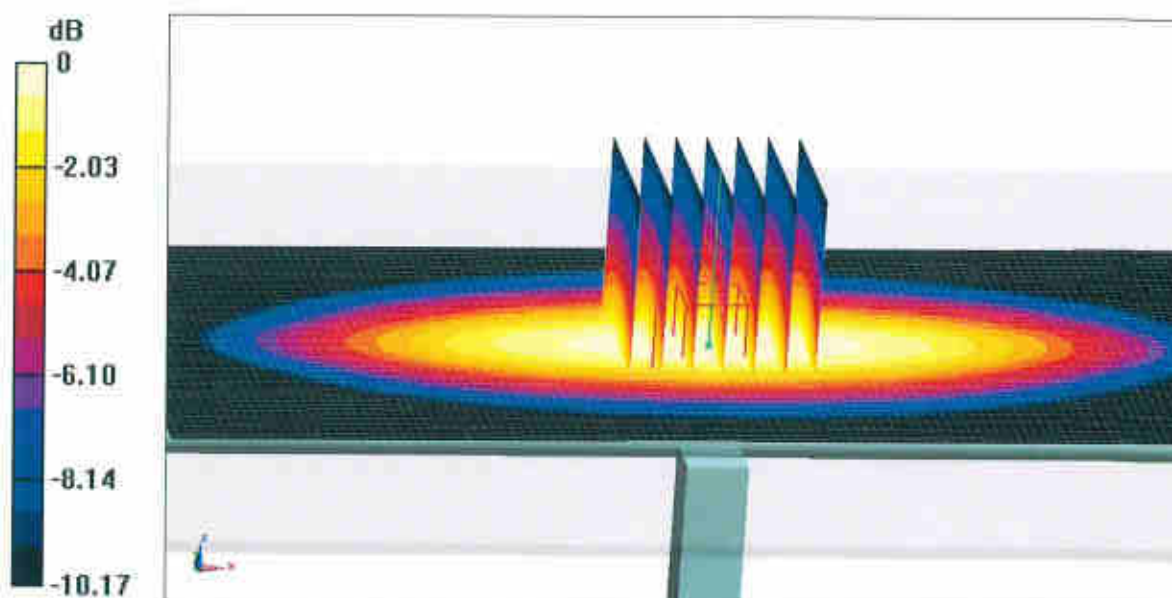
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.21 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.20 W/kg

**SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.39 W/kg**

Maximum value of SAR (measured) = 2.82 W/kg



**0 dB = 2.82 W/kg = 4.50 dBW/kg**

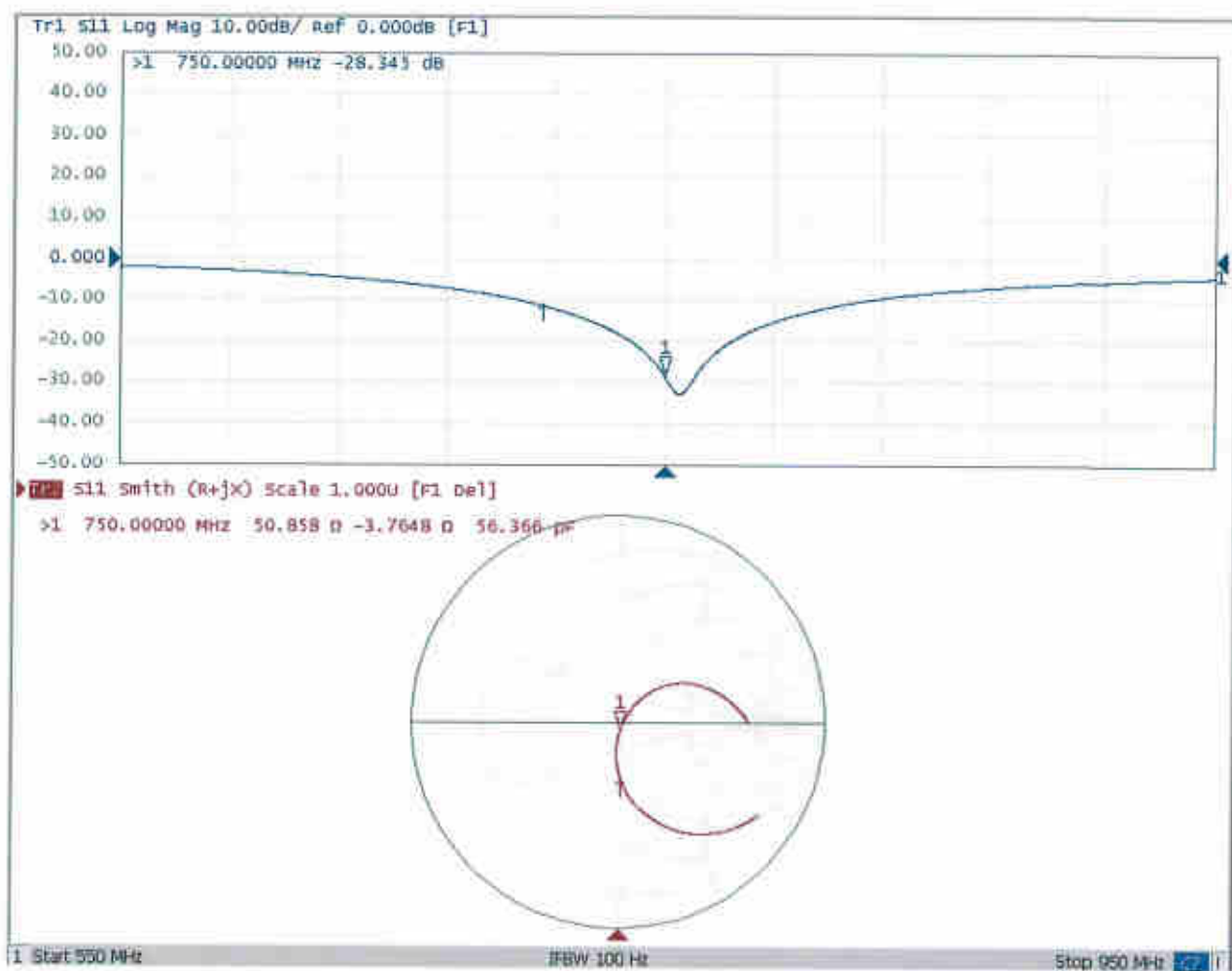


In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## Impedance Measurement Plot for Head TSL





Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## DASY5 Validation Report for Body TSL

Date: 12.04.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1065**

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.936$  S/m;  $\epsilon_r = 55.23$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.8, 9.8, 9.8); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/I
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

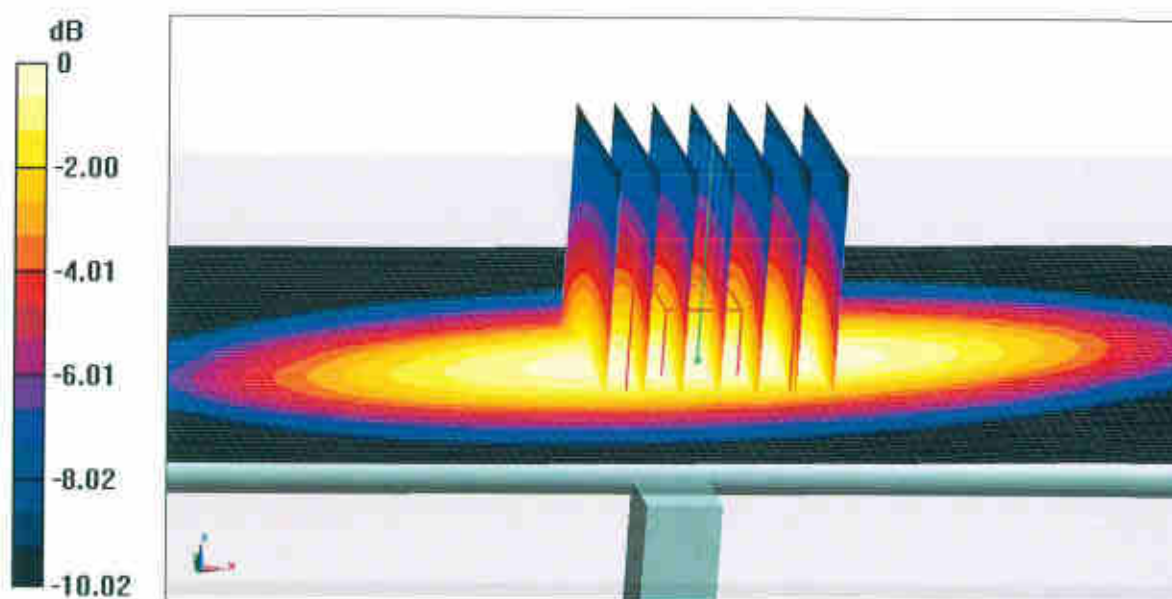
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.07 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.42 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



0 dB = 2.83 W/kg = 4.52 dBW/kg



In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

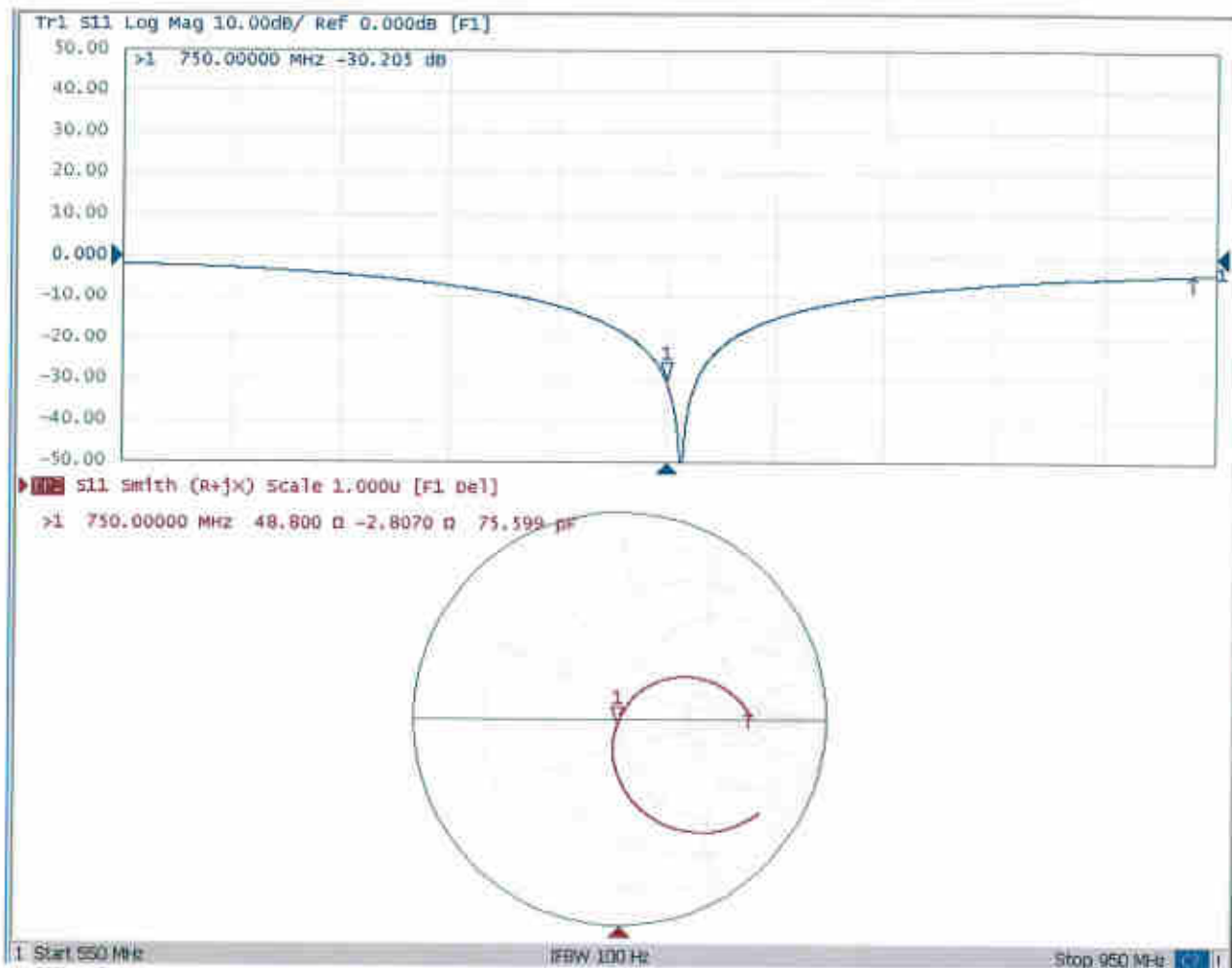
Tel: +86-10-62304633-2079

Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

http://www.chinattl.cn

## Impedance Measurement Plot for Body TSL





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client

**Sporton**

Certificate No: **Z17-97259**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d091**

Calibration Procedure(s) **FF-Z11-003-01**  
**Calibration Procedures for dipole validation kits**

Calibration date: **December 5, 2017**

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 NRVD        | 102196     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Power sensor NRV-Z5     | 100596     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Reference Probe EX3DV4  | SN 3617    | 23-Jan-17(SPEAG,No.EX3-3617_Jan17)       | Jan-18                |
| DAE3                    | SN 536     | 09-Oct-17(CTTL-SPEAG,No.Z17-97198)       | Oct-18                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-17 (CTTL, No.J17X00286)           | Jan-18                |
| Network Analyzer E5071C | MY46110673 | 13-Jan-17 (CTTL, No.J17X00285)           | Jan-18                |

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

Issued: December 9, 2017

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



In Collaboration with

**s p e a g**  
**CALIBRATION LABORATORY**

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### Glossary:

|       |                                            |
|-------|--------------------------------------------|
| TSL   | tissue simulating liquid                   |
| ConvF | sensitivity in TSL / NORM <sub>x,y,z</sub> |
| N/A   | not applicable or not measured             |

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

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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%.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

|                              |                          |              |
|------------------------------|--------------------------|--------------|
| DASY Version                 | DASY52                   | 52.10.0.1446 |
| Extrapolation                | Advanced Extrapolation   |              |
| Phantom                      | Triple Flat Phantom 5.1C |              |
| Distance Dipole Center - TSL | 15 mm                    | with Spacer  |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm        |              |
| Frequency                    | 835 MHz $\pm$ 1 MHz      |              |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.5           | 0.90 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 41.7 $\pm$ 6 % | 0.88 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ----           | ----                 |

## SAR result with Head TSL

|                                                |                    |                                |
|------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Head TSL   | Condition          |                                |
| SAR measured                                   | 250 mW input power | 2.32 mW / g                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 9.48 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL | Condition          |                                |
| SAR measured                                   | 250 mW input power | 1.53 mW / g                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 6.22 mW / g $\pm$ 18.7 % (k=2) |

## Body TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 55.2           | 0.97 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 54.7 $\pm$ 6 % | 0.96 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | <1.0 °C             | ----           | ----                 |

## SAR result with Body TSL

|                                                |                    |                                |
|------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Body TSL   | Condition          |                                |
| SAR measured                                   | 250 mW input power | 2.42 mW / g                    |
| SAR for nominal Body TSL parameters            | normalized to 1W   | 9.72 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Body TSL | Condition          |                                |
| SAR measured                                   | 250 mW input power | 1.60 mW / g                    |
| SAR for nominal Body TSL parameters            | normalized to 1W   | 6.42 mW / g $\pm$ 18.7 % (k=2) |



In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## Appendix (Additional assessments outside the scope of CNAS L0570)

### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.7Ω- 3.69jΩ |
| Return Loss                          | - 28.1dB      |

### Antenna Parameters with Body TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 46.6Ω- 4.62jΩ |
| Return Loss                          | - 24.5dB      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.258 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |       |
|-----------------|-------|
| Manufactured by | SPEAG |
|-----------------|-------|



In Collaboration with

**s p e a k**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## DASY5 Validation Report for Head TSL

Date: 12.04.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d091**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.876$  S/m;  $\epsilon_r = 41.67$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.73, 9.73, 9.73); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

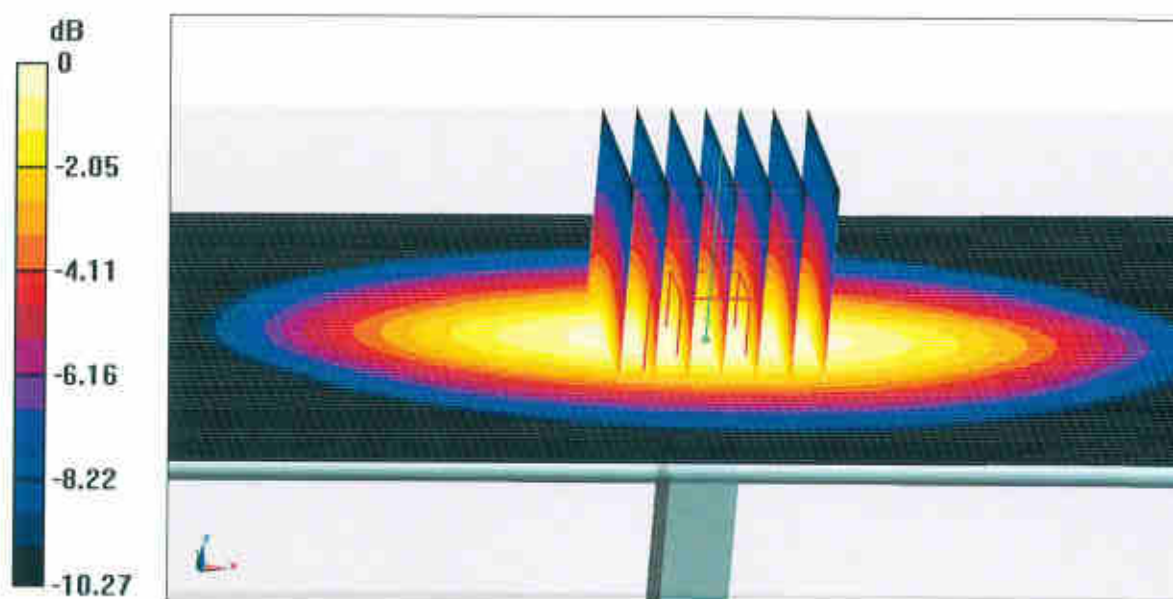
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.89V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.48 W/kg

**SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.53 W/kg**

Maximum value of SAR (measured) = 3.10 W/kg

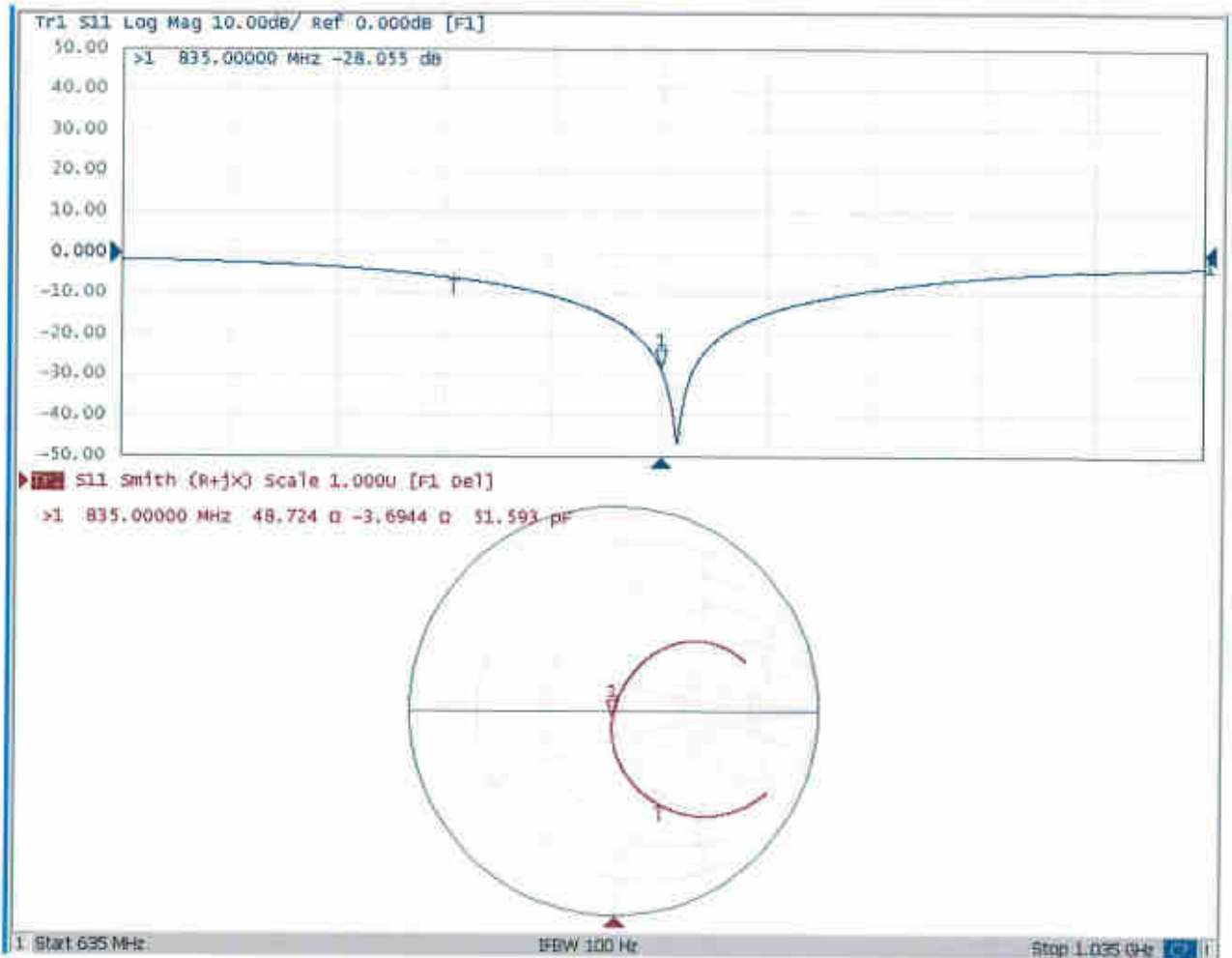


**0 dB = 3.10 W/kg = 4.91 dBW/kg**



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cntl@chinattl.com http://www.chinattl.cn

## Impedance Measurement Plot for Head TSL





In Collaboration with

**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2079

Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

http://www.chinattl.cn

## DASY5 Validation Report for Body TSL

Date: 12.05.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d091**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.962$  S/m;  $\epsilon_r = 54.65$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.64, 9.64, 9.64); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

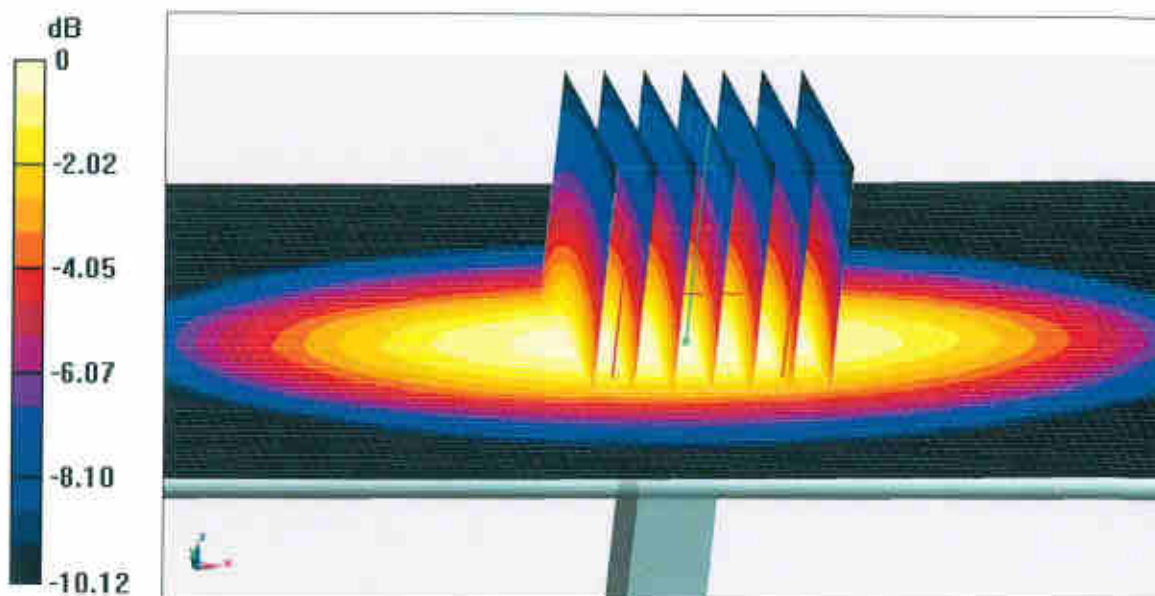
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.88 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.59 W/kg

**SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.6 W/kg**

Maximum value of SAR (measured) = 3.20 W/kg

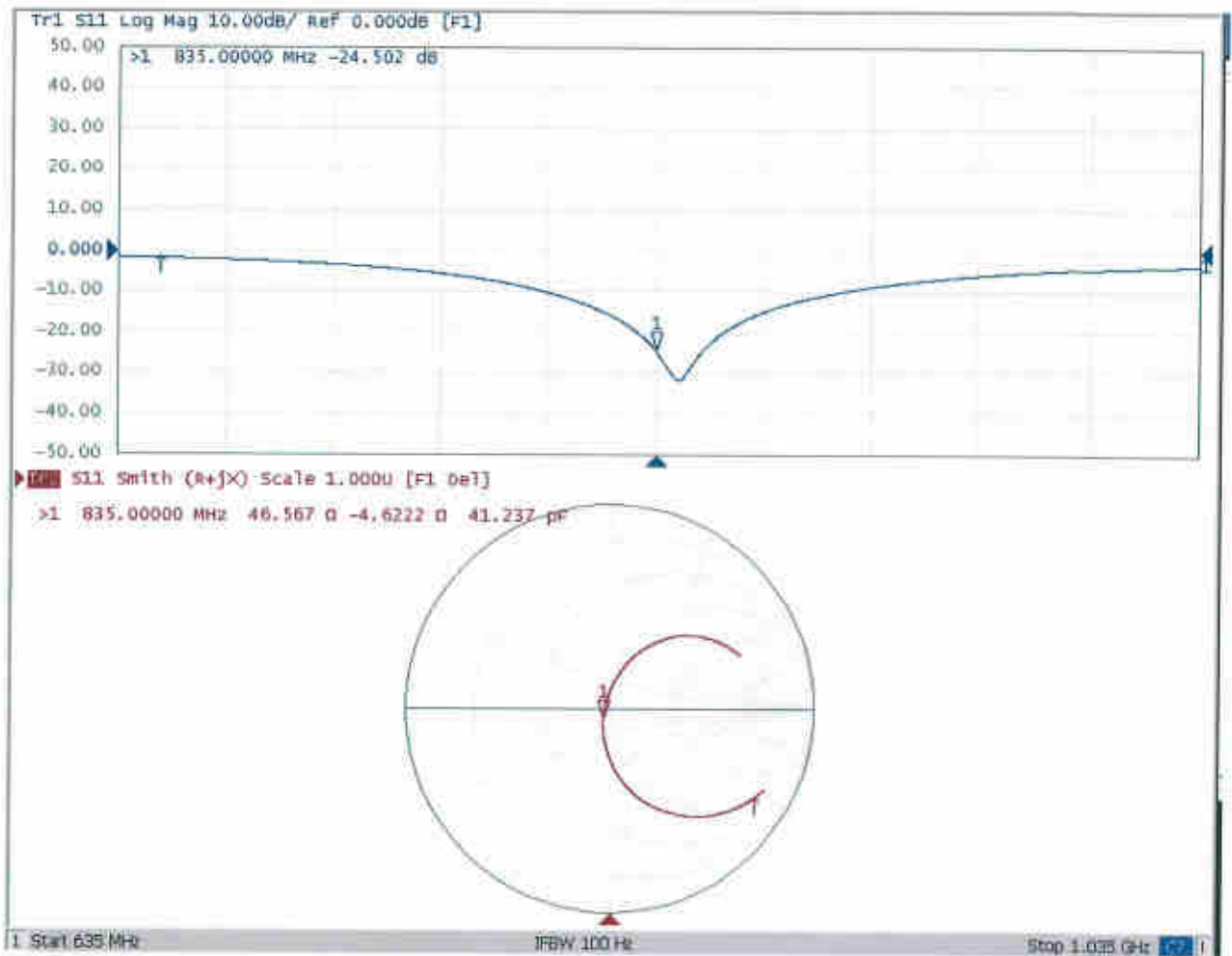


0 dB = 3.20 W/kg = 5.05 dBW/kg



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: [cttl@chinattl.com](mailto:cttl@chinattl.com) <http://www.chinattl.cn>

## Impedance Measurement Plot for Body TSL





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client

**Sporton**

Certificate No: **Z17-97260**

## CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1069**

Calibration Procedure(s) **FF-Z11-003-01**  
**Calibration Procedures for dipole validation kits**

Calibration date: **December 5, 2017**

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 NRVD        | 102196     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Power sensor NRV-Z5     | 100596     | 02-Mar-17 (CTTL, No.J17X01254)           | Mar-18                |
| Reference Probe EX3DV4  | SN 3617    | 23-Jan-17(SPEAG,No.EX3-3617_Jan17)       | Jan-18                |
| DAE3                    | SN 536     | 09-Oct-17(CTTL-SPEAG,No.Z17-97198)       | Oct-18                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-17 (CTTL, No.J17X00286)           | Jan-18                |
| Network Analyzer E5071C | MY46110673 | 13-Jan-17 (CTTL, No.J17X00285)           | Jan-18                |

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

Issued: December 9, 2017

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