



# SAR TEST REPORT

**Applicant**      Mobiwire SAS  
**FCC ID**          QPN-HOTAH  
**Product**        MobiWire Hotah  
**Brand**            MobiWire  
**Model**            MobiWire Hotah  
**Report No.**      R1809A0432-S1V2  
**Issue Date**      December 20, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **IEEE 1528- 2013, ANSI C95.1: 1992/IEEE C95.1: 1991**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

*Jiang peng Lan*

*Kai Xu*

*Performed by: Jiangpeng Lan*

*Approved by: Kai Xu*

## TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

## Table of Contents

1	Test Laboratory.....	4
1.1	Notes of the Test Report.....	4
1.2	Test facility.....	4
1.3	Testing Location.....	5
1.4	Laboratory Environment.....	5
2	Statement of Compliance.....	6
3	Description of Equipment under Test.....	7
4	Test Specification, Methods and Procedures.....	9
5	Operational Conditions during Test.....	10
5.1	Test Positions.....	10
5.1.1	Against Phantom Head.....	10
5.1.2	Body Worn Configuration.....	10
5.1.3	Phablet SAR test considerations.....	11
5.2	Measurement Variability.....	12
5.3	Test Configuration.....	13
5.3.1	GSM Test Configuration.....	13
5.3.2	UMTS Test Configuration.....	13
5.3.3	LTE Test Configuration.....	17
5.3.4	Wi-Fi Test Configuration.....	19
6	SAR Measurements System Configuration.....	20
6.1	SAR Measurement Set-up.....	20
6.2	DASY5 E-field Probe System.....	21
6.3	SAR Measurement Procedure.....	22
7	Main Test Equipment.....	24
8	Tissue Dielectric Parameter Measurements & System Verification.....	25
8.1	Tissue Verification.....	25
8.2	System Performance Check.....	27
9	Normal and Maximum Output Power.....	30
9.1	GSM Mode.....	30
9.2	WCDMA Mode.....	31
9.3	LTE Mode.....	32
9.4	WLAN Mode.....	37
9.5	Bluetooth Mode.....	38
10	Measured and Reported (Scaled) SAR Results.....	39
10.1	EUT Antenna Locations.....	39
10.2	Standalone SAR test exclusion considerations.....	41
10.3	Measured SAR Results.....	42
10.4	Simultaneous Transmission Analysis.....	52
11	Measurement Uncertainty.....	54
	ANNEX A: Test Layout.....	55
	ANNEX B: System Check Results.....	57



---

ANNEX C: Highest Graph Results.....	69
ANNEX D: Probe Calibration Certificate.....	96
ANNEX E: D835V2 Dipole Calibration Certificate.....	107
ANNEX F: D1900V2 Dipole Calibration Certificate.....	115
ANNEX G: D2450V2 Dipole Calibration Certificate.....	123
ANNEX H: D2600V2 Dipole Calibration Certificate.....	131
ANNEX I: D5GHzV2 Dipole Calibration Certificate.....	139
ANNEX J:DAE4 Calibration Certificate.....	153
ANNEX K: Extended SAR Dipole Calibrations.....	158
ANNEX L:The EUT Appearances and Test Configuration.....	163

## 1 Test Laboratory

### 1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

### 1.2 Test facility

#### **CNAS (accreditation number:L2264)**

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

#### **FCC (Designation number: CN1179, Test Firm Registration Number: 446626)**

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

#### **IC (recognition number is 8510A)**

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

#### **VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)**

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

#### **A2LA (Certificate Number: 3857.01)**

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

### 1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.  
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China  
City: Shanghai  
Post code: 201201  
Country: P. R. China  
Contact: Xu Kai  
Telephone: +86-021-50791141/2/3  
Fax: +86-021-50791141/2/3-8000  
Website: <http://www.ta-shanghai.com>  
E-mail: [xukai@ta-shanghai.com](mailto:xukai@ta-shanghai.com)

### 1.4 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 $\Omega$
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

## 2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

Table 2.1: Highest Reported SAR

Mode	Highest Reported SAR (W/kg)			
	1g SAR Head	1g SAR Body-worn (Separation 15mm)	1g SAR Hotspot (Separation 10mm)	Product Specific 10-g SAR (Separation 0mm)
GSM 850	0.070	0.141	0.491	NA
GSM 1900	0.107	0.140	0.431	NA
WCDMA Band II	0.157	0.230	0.427	NA
WCDMA Band V	0.071	0.084	0.263	NA
LTE FDD 2	0.275	0.281	0.539	NA
LTE FDD 7	0.082	0.319	0.679	NA
Wi-Fi (2.4G)	0.500	0.084	0.125	NA
Wi-Fi (5G)	0.789	0.191	NA	0.804
Date of Testing:	September 25, 2018 ~November 2, 2018 and December 5, 2018			

Table 2.2: Highest Simultaneous Transmission SAR

Exposure Configuration	1g SAR Head	1g SAR Body-worn (Separation 15mm)	1g SAR Hotspot (Separation 10mm)	Product Specific 10-g SAR (Separation 0mm)
Highest Simultaneous Transmission SAR (W/kg)	1.227	0.580	0.798	0.888
Note: 1. The detail for simultaneous transmission consideration is described in chapter 10.4				

### 3 Description of Equipment under Test

#### Client Information

<b>Applicant</b>	Mobiwire SAS
<b>Applicant address</b>	79 avenue Francois Arago, 92000 NANTERRE France
<b>Manufacturer</b>	Mobiwire SAS
<b>Manufacturer address</b>	79 avenue Francois Arago, 92000 NANTERRE France

#### General Technologies

Application Purpose:	Original Grant
EUT Stage	Identical Prototype
Model:	MobiWire Hotah
IMEI:	IMEI 1: 352361100000140 IMEI 2: 352361100000157
Hardware Version:	V01
Software Version:	V01
Antenna Type:	Internal Antenna
Device Class:	B
Wi-Fi Hotspot	Wi-Fi 2.4G
Power Class:	GSM 850:4 GSM 1900:1 UMTS Band II/V:3 LTE FDD 2/7:3
Power Level	GSM 850:level 5 GSM 1900:level 0 UMTS Band II/ V:all up bits LTE FDD 2/7:max power
<b>EUT Accessory</b>	
Battery	Manufacturer: Ningbo Veken Battery Co.,LTD Model: 178144515
Adapter 1	Manufacturer: DongGuan Aohai Power Technology Co.,Ltd Model: A88-502000
Adapter 2	Manufacturer: Dongguan Aohai Power Technology CO., LTD Model: A824-050200U
Adapter 3	Manufacturer: Dongguan Aohai Power Technology CO., LTD Model: A70-502000
Earphone	Manufacturer: Shenzhen Juwei Electronics Co.,Ltd Model: JWEP0752-M01
USB Cable	Manufacturer: Shenzhen Juwei Electronics Co.,Ltd Model: USB2.0 A/M TO TYPE C/M CABLE 1M Length: 100cm

**Wireless Technology and Frequency Range**

Wireless Technology		Modulation	Operating mode	Tx (MHz)
GSM	850	Voice(GMSK) GPRS(GMSK)	<input type="checkbox"/> Multi-slot Class:8-1UP <input type="checkbox"/> Multi-slot Class:10-2UP	824 ~ 849
	1900	EGPRS(GMSK,8PSK)	<input checked="" type="checkbox"/> Multi-slot Class:12-4UP <input type="checkbox"/> Multi-slot Class:33-4UP	1850 ~ 1910
	Does this device support DTM (Dual Transfer Mode)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
UMTS	Band II	QPSK	HSDPA UE Category:24	1850 ~ 1910
	Band V		HSUPA UE Category:7	824 ~ 849
LTE	FDD 2	QPSK, 16QAM,	Rel.11 /Category 4	1850 ~ 1910
	FDD 7			2500 ~ 2570
	Does this device support Carrier Aggregation (CA) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Does this device support SV-LTE (1xRTT-LTE)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
BT	2.4G	Version 4.2 LE		2402 ~2480
Wi-Fi	2.4G	DSSS,OFDM	802.11b/g/n HT20	2412 ~ 2462
		OFDM	802.11n HT40	2422 ~ 2452
	5G	OFDM	802.11a	5250 ~ 5350 5470 ~ 5725
Does this device support MIMO <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
NFC	13.56MHz			





## 4 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE 1528- 2013, ANSI C95.1: 1992/IEEE C95.1: 1991, the following FCC Published RF exposure KDB procedures:

248227 D01 802.11Wi-Fi SAR v02r02  
447498 D01 General RF Exposure Guidance v06  
648474 D04 Handset SAR v01r03  
865664 D01 SAR measurement 100 MHz to 6 GHz v01r04  
865664 D02 RF Exposure Reporting v01r02  
941225 D01 3G SAR Procedures v03r01  
941225 D05 SAR for LTE Devices v02r05  
941225 D06 Hotspot Mode v02r01  
941225 D05A LTE Rel.10 KDB Inquiry Sheet v01r02  
690783 D01 SAR Listings on Grants v01r03

## 5 Operational Conditions during Test

### 5.1 Test Positions

#### 5.1.1 Against Phantom Head

Measurements were made in “cheek” and “tilt” positions on both the left hand and right hand sides of the phantom.

The positions used in the measurements were according to IEEE 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".

#### 5.1.2 Body Worn Configuration

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per FCC KDB Publication 648474 D04, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is  $> 1.2$  W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

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

### 5.1.3 Phablet SAR test considerations

For smart phones, with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, that can provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets and support voice calls next to the ear, unless it is confirmed otherwise through KDB inquiries, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance.

- a) The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.
- b) The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at  $\leq 25$  mm from that surface or edge, in direct contact with a flat phantom, for product specific 10-g SAR according to the body-equivalent tissue dielectric parameters in KDB Publication 865664 D01 to address interactive hand use exposure conditions. The 1-g SAR at 5 mm for UMPC mini-tablets is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg; however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold. The normal tablet procedures in KDB Publication 616217 are required when the overall diagonal dimension of the device is > 20.0 cm. Hotspot mode SAR is not required when normal tablet procedures are applied. Extremity 10-g SAR is also not required for the front (top) surface of larger form factor full size tablets. The more conservative normal tablet SAR results can be used to support phablet mode 10-g extremity SAR.
- c) The simultaneous transmission operating configurations applicable to voice and data transmissions for both phone and mini-tablet modes must be taken into consideration separately for 1-g and 10-g SAR to determine the simultaneous transmission SAR test exclusion and measurement requirements for the relevant wireless modes and exposure conditions.

## 5.2 Measurement Variability

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

## 5.3 Test Configuration

### 5.3.1 GSM Test Configuration

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following:

Output power of reductions:

**Table 5.1: The allowed power reduction in the multi-slot configuration**

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power,(dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. GSM voice and GPRS data use GMSK, which is a constant amplitude modulation with minimal peak to average power difference within the time-slot burst. For EDGE, GMSK is used for MCS 1 – MCS 4 and 8-PSK is used for MCS 5 – MCS 9; where 8-PSK has an inherently higher peak-to-average power ratio. The GMSK and 8-PSK EDGE configurations are considered separately for SAR compliance. The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance. The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.

### 5.3.2 UMTS Test Configuration

#### 5.3.2.1 3G SAR Test Reduction Procedure

The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations modes according to output power, exposure conditions and device operating capabilities. Maximum output power is verified by applying the applicable versions of 3GPP TS 34.121.

#### 5.3.2.2 Head SAR

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

### 5.3.2.3 Body-worn accessory SAR

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the EUT with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the EUT, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC

### 5.3.2.4 Release 5 HSDPA Test Configuration

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the “Release 5 HSDPA Data Devices” section of this document, for the highest SAR body-worn accessory exposure configuration in 12.2 kbps RMC. EUT with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

HSDPA should be configured according to the UE category of a test device. The number of HSDSCH/ HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors( $\beta_c$ ,  $\beta_d$ ), and HS-DPCCH power offset parameters ( $\Delta_{ACK}$ ,  $\Delta_{NACK}$ ,  $\Delta_{CQI}$ ) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

**Table 5.2: Subtests for UMTS Release 5 HSDPA**

Sub-set	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{hs}$ (note 1, note 2)	CM(dB) (note 3)	MPR(dB)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (note 4)	15/15 (note 4)	64	12/15 (note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
 Note2: CM=1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ .  
 Note3: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factors for the reference TFC (TFC1,TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .

### 5.3.2.5 Release 6 HSUPA Test Configuration

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn

accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the “Release 6 HSPA Data Devices” section of this document, for the highest body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the  $\beta$  values indicated in Table 5.3 and other applicable procedures described in the ‘WCDMA EUT and ‘Release 5 HSDPA Data Devices’ sections of this document

**Table 5.3: Sub-Test 5 Setup for Release 6 HSUPA**

Sub-set	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{hs}^{(1)}$	$\beta_{ec}$	$\beta_{ed}$	$\beta_{ed}$ (SF)	$\beta_{ed}$ (codes)	CM <sup>(2)</sup> (dB)	MPR (dB)	AG <sup>(4)</sup> Index	E-TFCI
1	11/15 <sup>(3)</sup>	15/15 <sup>(3)</sup>	64	11/15 <sup>(3)</sup>	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}$ 47/15 $\beta_{ed2}$ 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 <sup>(4)</sup>	15/15 <sup>(4)</sup>	64	15/15 <sup>(4)</sup>	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ .

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

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

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

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Figure 5.1g.

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

**Table 5.4: HSUPA UE category**

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI (ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592



4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	11484	5.76
	4	4	10		20000	2.00
7 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	22996	?
	4	4	10		20000	?
NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE Categories 1 to 6 supports QPSK only. UE Category 7 supports QPSK and 16QAM. (TS25.306-7.3.0)						

### 5.3.2.6 HSPA, HSPA+ and DC-HSDPA Test Configuration

SAR test exclusion may apply to 3GPP Rel. 6 HSPA and Rel. 8 DC-HSDPA. When SAR measurement is required for HSPA or DC-HSDPA, a KDB inquiry is required to confirm that the wireless mode configurations in the test setup have remained stable throughout the SAR measurements. Without prior KDB confirmation to determine the SAR results are acceptable, a PAG is required for equipment approval.

SAR test exclusion for HSPA, HSPA+ and DC-HSDPA is determined according to the following:

- 1) The HSPA procedures are applied to configure 3GPP Rel. 6 HSPA devices in the required sub-test mode(s) to determine SAR test exclusion.
- 2) SAR is required for Rel. 7 HSPA+ when SAR is required for Rel. 6 HSPA; otherwise, the 3G SAR test reduction procedure is applied to (uplink) HSPA+ with 12.2 kbps RMC as the primary mode.<sup>36</sup> Power is measured for HSPA+ that supports uplink 16 QAM according to configurations in Table C.11.1.4 of 3GPP TS 34.121-1 to determine SAR test reduction.
- 3) SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.
- 4) Regardless of whether a PBA is required, the following information must be verified and included in the SAR report for devices supporting HSPA, HSPA+ or DC-HSDPA:
  - a) The output power measurement results and applicable release version(s) of 3GPP TS 34.121.
  - i) Power measurement difficulties due to test equipment setup or availability must be resolved between the grantee and its test lab.
  - b) The power measurement results are in agreement with the individual device implementation and specifications. When Enhanced MPR (E-MPR) applies, the normal MPR targets may be modified according to the Cubic Metric (CM) measured by the device, which must be taken into consideration.
  - c) The UE category, operating parameters, such as the  $\beta$  and  $\Delta$  values used to configure the device for testing, power setback procedures described in 3GPP TS 34.121 for the power measurements, and HSPA/HSPA+ channel conditions (active and stable) for the entire duration of the measurement according to the required E-TFCI and AG index values.
- 5) When SAR measurement is required, the test configurations, procedures and power measurement



results must be clearly described to confirm that the required test parameters are used, including E-TFCI and AG index stability and output power conditions.

**Table 5.5: HS-DSCH UE category**

**Table 5.1a: FDD HS-DSCH physical layer categories**

HS-DSCH category	Maximum number of HS-DSCH codes received	Minimum inter-TTI interval	Maximum number of bits of an HS-DSCH transport block received within an HS-DSCH TTI NOTE 1	Total number of soft channel bits	Supported modulations without MIMO operation or dual cell operation	Supported modulations with MIMO operation and without dual cell operation	Supported modulations with dual cell operation
Category 1	5	3	7298	19200	QPSK, 16QAM	Not applicable (MIMO not supported)	Not applicable (dual cell operation not supported)
Category 2	5	3	7298	28800			
Category 3	5	2	7298	28800			
Category 4	5	2	7298	38400			
Category 5	5	1	7298	57600			
Category 6	5	1	7298	67200			
Category 7	10	1	14411	115200			
Category 8	10	1	14411	134400			
Category 9	15	1	20251	172800			
Category 10	15	1	27952	172800			
Category 11	5	2	3630	14400	QPSK	Not applicable (dual cell operation not supported)	
Category 12	5	1	3630	28800	QPSK, 16QAM, 64QAM		
Category 13	15	1	35280	259200			
Category 14	15	1	42192	259200	QPSK, 16QAM		
Category 15	15	1	23370	345600			
Category 16	15	1	27952	345600	QPSK, 16QAM, 64QAM		-
Category 17 NOTE 2	15	1	35280	259200			
			23370	345600	-		QPSK, 16QAM
Category 18 NOTE 3	15	1	42192	259200	QPSK, 16QAM, 64QAM		-
			27952	345600	-		QPSK, 16QAM
Category 19	15	1	35280	518400	QPSK, 16QAM, 64QAM	-	
Category 20	15	1	42192	518400			
Category 21	15	1	23370	345600	-	-	QPSK, 16QAM
Category 22	15	1	27952	345600			
Category 23	15	1	35280	518400			
Category 24	15	1	42192	518400			QPSK, 16QAM, 64QAM

**5.3.3 LTE Test Configuration**

LTE modes were tested according to FCC KDB 941225 D05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Max power control was used so the UE transmits with maximum output power during SAR testing. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration.

**A) Spectrum Plots for RB Configurations**

A properly configured base station simulator was used for SAR tests and power measurements.

Therefore, spectrum plots for RB configurations were not required to be included in this report.

## **B) MPR**

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

## **C)A-MPR**

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

## **D) Largest channel bandwidth standalone SAR test requirements**

### 1) QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is  $\leq 0.8$  W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is  $> 1.45$  W/kg, SAR is required for all three RB offset configurations for that required test channel.

### 2) QPSK with 50% RB allocation

The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.

### 3) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are  $\leq 0.8$  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.

### 4) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is  $> \frac{1}{2}$  dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is  $> 1.45$  W/kg.

## **E) Other channel bandwidth standalone SAR test requirements**

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is  $> \frac{1}{2}$  dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the *reported* SAR of a configuration for the largest channel bandwidth is  $> 1.45$  W/kg.

### 5.3.4 Wi-Fi Test Configuration

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported SAR* for 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 wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- 0.4 W/kg, SAR is repeated using the same wireless mode test 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 *reported SAR* is  $\leq 0.8$  W/kg or all required test positions are tested.
  - ◇ For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - ◇ When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported SAR* is  $> 0.8$  W/kg, measure the SAR for these 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 test channels are considered.
  - ◇ The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

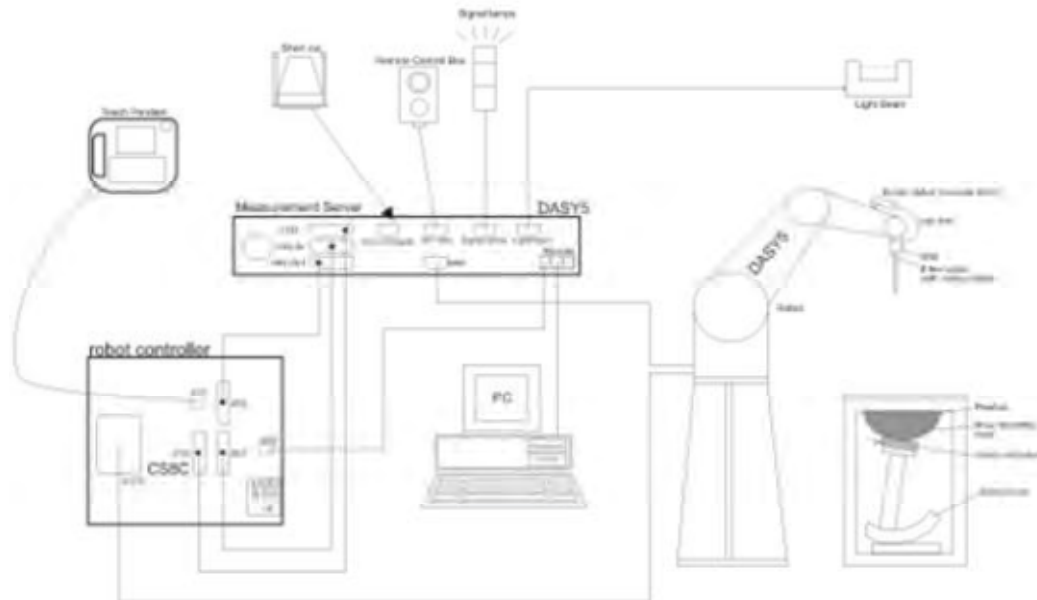
To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.

A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement.

## 6 SAR Measurements System Configuration

### 6.1 SAR Measurement Set-up

The DASY system 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 DASY 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.

## 6.2 DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4(manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity: $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure Scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.



### E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25$ dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

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

temperature probe is used in conjunction with the E-field probe.

$$SAR=C\Delta T/\Delta t$$

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

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

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

Or

$$SAR=IEI^2\sigma/\rho$$

Where:  $\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).

### 6.3 SAR Measurement Procedure

#### 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.

#### 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 dB) 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 D01 SAR measurement 100 MHz to 6 GHz.

	≤3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: ΔxArea, ΔyArea	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

### 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 D01 SAR measurement 100 MHz to 6 GHz.

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

### 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.

### Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASYS 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.

## 7 Main Test Equipment

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Cal.	Cal. Due Date
Network analyzer	Agilent	E5071B	MY42404014	2018-05-20	2019-05-19
Dielectric Probe Kit	HP	85070E	US44020115	2018-05-20	2019-05-19
Power meter	Agilent	E4417A	GB41291714	2018-05-21	2019-05-20
Power sensor	Agilent	N8481H	MY50350004	2018-05-21	2019-05-20
Power sensor	Agilent	E9327A	US40441622	2018-05-20	2019-05-19
Dual directional coupler	Agilent	778D-012	50519	2018-05-21	2019-05-20
Dual directional coupler	Agilent	777D	50146	2018-05-20	2019-05-19
Amplifier	INDEXSAR	IXA-020	0401	2018-05-20	2019-05-19
Wideband radio communication tester	R&S	CMW 500	113645	2018-05-20	2019-05-19
E-field Probe	SPEAG	EX3DV4	3677	2018-05-29	2019-05-28
DAE	SPEAG	DAE4	1317	2018-03-23	2019-03-22
Validation Kit 835MHz	SPEAG	D835V2	4d020	2017-08-28	2020-08-27
Validation Kit 1900MHz	SPEAG	D1900V2	5d060	2017-08-26	2020-08-25
Validation Kit 2450MHz	SPEAG	D2450V2	786	2017-08-29	2020-08-28
Validation Kit 2600MHz	SPEAG	D2600V2	1025	2018-05-02	2021-05-01
Validation Kit 5GHz	SPEAG	D5GHzV2	1151	2017-01-05	2020-01-04
Temperature Probe	Tianjin jinming	JM222	AA1009129	2018-05-17	2019-05-16
Hygrothermograph	Anymetr	NT-311	20150731	2018-05-17	2019-05-16
Software for Test	Speag	DASY5	52.8.8.1222	/	/
Softwarefor Tissue	Agilent	85070	E06.01.36	/	/



## 8 Tissue Dielectric Parameter Measurements & System Verification

### 8.1 Tissue Verification

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance.

#### Target values

Frequency (MHz)	Water (%)	Salt (%)	Sugar (%)	Glycol (%)	Preventol (%)	Cellulose (%)	$\epsilon_r$	$\sigma$ (s/m)	
Head	835	41.45	1.45	56	0	0.1	1.0	41.5	0.90
	1900	55.242	0.306	0	44.452	0	0	40.0	1.40
	2450	62.7	0.5	0	36.8	0	0	39.2	1.80
	2600	55.242	0.306	0	44.452	0	0	39.0	1.96
Body	835	52.5	1.4	45	0	0.1	1.0	55.2	0.97
	1900	69.91	0.13	0	29.96	0	0	53.3	1.52
	2450	73.2	0.1	0	26.7	0	0	52.7	1.95
	2600	72.6	0.1	0	27.3	0	0	52.5	2.16
Frequency (MHz)	Water (%)	Diethylenglycol monohexylether			Triton X-100		$\epsilon_r$	$\sigma$ (s/m)	
Head	5250	65.53	17.24			17.23		35.9	4.71
	5600	65.53	17.24			17.23		35.5	5.07
Body	5250	72.52	13.74			13.74		48.9	5.36
	5600	72.52	13.74			13.74		48.5	5.77

**Measurements results**

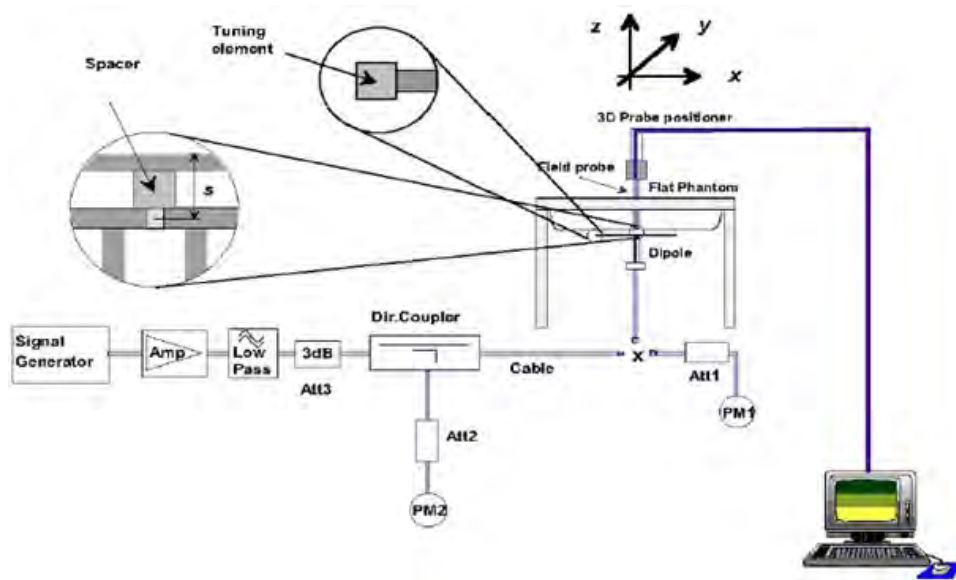
Frequency (MHz)	Test Date	Temp °C	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)		
			$\epsilon_r$	$\sigma$ (s/m)	$\epsilon_r$	$\sigma$ (s/m)	Dev $\epsilon_r$ (%)	Dev $\sigma$ (%)	
835	Head	10/26/2018	21.5	42.0	0.91	41.5	0.90	1.20	1.11
	Body	10/26/2018	21.5	53.8	0.97	55.2	0.97	-2.54	0.00
1900	Head	10/25/2018	21.5	40.7	1.39	40.0	1.40	1.75	-0.71
	Body	10/25/2018	21.5	52.8	1.51	53.3	1.52	-0.94	-0.66
2450	Head	11/2/2018	21.5	39.7	1.85	39.2	1.80	1.28	2.78
	Body	11/2/2018	21.5	51.1	1.97	52.7	1.95	-3.04	1.03
2600	Head	10/28/2018	21.5	39.3	2.02	39.0	1.96	0.77	3.06
	Body	10/28/2018	21.5	50.7	2.16	52.5	2.16	-3.43	0.00
5250	Head	11/2/2018	21.5	36.9	4.83	35.9	4.71	2.79	2.55
	Body	11/2/2018	21.5	46.7	5.42	48.9	5.36	-4.50	1.12
5600	Head	12/5/2018	21.5	34.2	5.21	35.5	5.07	-3.66	2.76
	Body	12/5/2018	21.5	47.9	5.78	48.5	5.77	-1.24	0.17

Note: The depth of tissue-equivalent liquid in a phantom must be  $\geq 15.0$  cm for SAR measurements  $\leq 3$  GHz and  $\geq 10.0$  cm for measurements  $> 3$  GHz.

## 8.2 System Performance Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured using the dielectric probe kit and the network analyzer. A system check measurement for every day was made following the determination of the dielectric parameters of the Tissue simulates, using the dipole validation kit. The dipole antenna was placed under the flat section of the twin SAM phantom.

System check is performed regularly on all frequency bands where tests are performed with the DASY system.



Picture 1 System Performance Check setup



Picture 2 Setup Photo

**Justification for Extended SAR Dipole Calibrations**

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

Dipole		Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
Dipole D835V2 SN: 4d020	Head	8/28/2017	-31.9	/	50.3	/
	Liquid	8/27/2018	-29.0	9.09%	46.6	-3.7
	Body	8/28/2017	-24.8	/	46.8	/
	Liquid	8/27/2018	-27.4	-10.48%	48.1	1.3
Dipole D1900V2 SN: 5d060	Head	8/26/2017	-23.4	/	52.0	/
	Liquid	8/25/2018	-24.7	-5.56%	54.4	2.4
	Body	8/26/2017	-21.4	/	52.7	/
	Liquid	8/25/2018	-24.6	-14.95%	55.6	2.9
Dipole D2450V2 SN: 786	Head	8/29/2017	-25.5	/	53.4	/
	Liquid	8/28/2018	-23.0	9.80%	57.2	3.8
	Body	8/29/2017	-23.6	/	51.0	/
	Liquid	8/28/2018	-23.7	-0.42%	55.2	4.2
Dipole D5GHzV2 SN: 1151 (5250MHz)	Head	1/5/2017	-24.5	/	48.4	/
	Liquid	1/4/2018	-23.8	2.86%	50.0	1.6
	Body	1/5/2017	-24.7	/	50.4	/
	Liquid	1/4/2018	-23.8	3.64%	50.0	-0.4
Dipole D5GHzV2 SN: 1151 (5600MHz)	Head	1/5/2017	-22.8	/	55.5	/
	Liquid	1/4/2018	-21.5	5.70%	55.6	0.1
	Body	1/5/2017	-23.3	/	57.2	/
	Liquid	1/4/2018	-22.5	3.43%	55.6	-1.6

**System Check results**

Frequency (MHz)		Test Date	Temp °C	250mW /100mW Measured SAR <sub>1g</sub> (W/kg)	1W Normalized SAR <sub>1g</sub> (W/kg)	1W Target SAR <sub>1g</sub> (W/kg)	Δ % (Limit ±10%)	Plot No.
835	Head	10/26/2018	21.5	2.46	9.84	9.45	4.13	1
	Body	10/26/2018	21.5	2.41	9.64	9.75	-1.13	2
1900	Head	10/25/2018	21.5	9.88	39.52	40.10	-1.45	3
	Body	10/25/2018	21.5	9.93	39.72	39.50	0.56	4
2450	Head	11/2/2018	21.5	13.70	54.80	52.60	4.18	5
	Body	11/2/2018	21.5	12.50	50.00	50.80	-1.57	6
2600	Head	10/28/2018	21.5	13.90	55.60	54.10	2.77	7
	Body	10/28/2018	21.5	13.50	54.00	54.50	-0.92	8
5250	Head	11/2/2018	21.5	7.87	78.70	78.40	0.38	9
	Body	11/2/2018	21.5	7.46	74.60	75.60	-1.32	10
5600	Head	12/5/2018	21.5	7.67	76.70	81.50	-5.89	11
	Body	12/5/2018	21.5	8.10	81.00	80.20	1.00	12

Note: Target Values used derive from the calibration certificate Data Storage and Evaluation.



## 9 Normal and Maximum Output Power

KDB 447498 D01 at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

### 9.1 GSM Mode

GSM 850		Burst-Averaged output power(dBm)				Division	Frame-Averaged output power(dBm)			
		Tune-up	Channel/Frenqucy(MHz)				Tune-up	Channel/Frenqucy(MHz)		
		MAX	128 /824.2	190 /836.6	251 /848.8	Factors	MAX	128 /824.2	190 /836.6	251 /848.8
GSM	CS	33.00	32.26	32.20	32.18	9.03	23.97	23.23	23.17	23.15
GPRS (GMSK)	1 Tx Slot	33.00	32.31	32.29	32.27	9.03	23.97	23.28	23.26	23.24
	2 Tx Slots	32.00	31.52	31.45	31.39	6.02	25.98	25.50	25.43	25.37
	3 Tx Slots	30.00	29.63	29.46	29.35	4.26	25.74	25.37	25.20	25.09
	4 Tx Slots	29.00	28.59	28.39	29.24	3.01	<b>25.99</b>	<b>25.58</b>	<b>25.38</b>	<b>26.23</b>
EGPRS (8PSK)	1 Tx Slot	28.00	27.55	27.41	27.73	9.03	18.97	18.52	18.38	18.70
	2 Tx Slots	27.00	26.33	26.40	26.54	6.02	20.98	20.31	20.38	20.52
	3 Tx Slots	25.00	24.49	24.96	24.42	4.26	20.74	20.23	20.70	20.16
	4 Tx Slots	24.00	23.34	23.39	23.53	3.01	20.99	20.33	20.38	20.52
GSM 1900		Burst-Averaged output power(dBm)				Division	Frame-Averaged output power(dBm)			
		Tune-up	Channel/Frenqucy(MHz)				Tune-up	Channel/Frenqucy(MHz)		
		MAX	512 /1850.2	661 /1880	810 /1909.8	Factors	MAX	512 /1850.2	661 /1880	810 /1909.8
GSM	CS	31.00	29.99	29.79	29.68	9.03	21.97	20.96	20.76	20.65
GPRS (GMSK)	1 Tx Slot	31.00	30.05	29.84	29.74	9.03	21.97	21.02	20.81	20.71
	2 Tx Slots	30.00	29.18	29.01	28.94	6.02	23.98	23.16	22.99	22.92
	3 Tx Slots	28.00	27.13	27.02	27.01	4.26	23.74	22.87	22.76	22.75
	4 Tx Slots	27.00	26.12	26.01	25.97	3.01	<b>23.99</b>	<b>23.11</b>	<b>23.00</b>	<b>22.96</b>
EGPRS (8PSK)	1 Tx Slot	28.00	27.12	27.03	26.97	9.03	18.97	18.09	18.00	17.94
	2 Tx Slots	27.00	26.26	26.14	25.94	6.02	20.98	20.24	20.12	19.92
	3 Tx Slots	25.00	24.55	24.38	24.05	4.26	20.74	20.29	20.12	19.79
	4 Tx Slots	24.00	23.34	23.27	23.11	3.01	20.99	20.33	20.26	20.10
Notes: The worst-case configuration and mode for SAR testing is determined to be as follows:										
1. Standalone: GSM 850 GMSK (GPRS) mode with 4 time slots for Max power, GSM 1900 GMSK (GPRS) mode with 4 time slots for Max power, based on the output power measurements above..										

## 9.2 WCDMA Mode

The following tests were completed according to the test requirements outlined in the 3GPP TS34.121 specification.

WCDMA		Band II(dBm)				Band V(dBm)			
Tx Channel		9262	9400	9538	Tune-up	4132	4183	4233	Tune-up
Frequency(MHz)		1852.4	1880	1907.6	Limit	826.4	836.6	846.6	Limit
RMC	12.2kbps	22.52	22.69	22.48	23.00	22.78	22.83	22.66	23.00
AMR	12.2kbps	22.45	22.64	22.40	23.00	22.71	22.78	22.58	23.00
HSDPA	Sub 1	21.98	22.11	21.92	22.50	22.24	22.25	22.10	22.50
	Sub 2	21.97	22.13	21.89	22.50	22.23	22.27	22.07	22.50
	Sub 3	21.44	21.63	21.41	22.00	21.70	21.77	21.59	22.00
	Sub 4	21.45	21.64	21.39	22.00	21.71	21.78	21.57	22.00
HSUPA	Sub 1	21.94	22.10	21.87	22.50	22.20	22.24	22.05	22.50
	Sub 2	20.93	21.08	20.86	21.50	21.19	21.22	21.04	21.50
	Sub 3	21.40	21.56	21.35	22.00	21.66	21.70	21.53	22.00
	Sub 4	20.86	21.05	20.83	21.50	21.12	21.19	21.01	21.50
	Sub 5	21.87	22.03	21.81	22.50	22.13	22.17	21.99	22.50
DC-HSDPA	Sub 1	21.86	22.05	21.82	22.50	22.12	22.19	22.00	22.50
	Sub 2	21.85	22.04	21.81	22.50	22.11	22.18	21.99	22.50
	Sub 3	21.43	21.53	21.32	22.00	21.69	21.67	21.50	22.00
	Sub 4	21.42	21.52	21.31	22.00	21.68	21.66	21.49	22.00
HSPA+	16QAM	21.41	21.60	21.38	22.00	21.67	21.74	21.56	22.00

Note: 1.Per KDB 941225 D01, SAR for each exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".

### 9.3 LTE Mode

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

**Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 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

LTE FDD Band 2				Conducted Power(dBm)			Tune-up Limit
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			
				18607/1850.7	18900/1880	19193/1909.3	
1.4MHz	QPSK	1	0	22.20	22.35	22.30	23.00
		1	2	22.54	22.58	22.46	23.00
		1	5	22.20	22.25	22.20	23.00
		3	0	21.54	21.59	21.50	22.00
		3	2	21.49	21.69	21.54	22.00
		3	3	21.61	21.48	21.40	22.00
	16QAM	6	0	21.54	21.58	21.48	22.00
		1	0	21.95	21.82	21.79	22.00
		1	2	21.83	21.74	21.65	22.00
		1	5	21.53	21.47	21.40	22.00
		3	0	21.38	21.33	21.28	22.00
		3	2	21.54	21.39	21.27	22.00
		3	3	21.11	21.25	21.12	22.00
		6	0	20.51	20.58	20.49	21.00
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				18615/1851.5	18900/1880	19185/1908.5	
3MHz	QPSK	1	0	22.22	22.39	22.33	23.00
		1	7	22.57	22.63	22.50	23.00
		1	14	22.23	22.30	22.24	23.00
		8	0	21.62	21.69	21.61	22.00
		8	4	21.59	21.77	21.64	22.00
		8	7	21.69	21.57	21.48	22.00
		15	0	21.57	21.62	21.51	22.00
	16QAM	1	0	21.98	21.84	21.82	22.00
		1	7	21.86	21.79	21.69	22.00
		1	14	21.55	21.51	21.43	22.00
		8	0	20.67	20.64	20.58	21.00
		8	4	20.83	20.70	20.57	21.00





Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				18625/1852.5	18900/1880	19175/1907.5	
5MHz	QPSK	8	7	20.39	20.55	20.43	21.00
		15	0	20.54	20.62	20.52	21.00
		1	0	22.19	22.37	22.29	23.00
		1	13	22.55	22.59	22.47	23.00
		1	24	22.20	22.25	22.20	23.00
		12	0	21.59	21.64	21.57	22.00
		12	6	21.57	21.73	21.59	22.00
	16QAM	12	13	21.67	21.55	21.44	22.00
		25	0	21.55	21.61	21.49	22.00
		1	0	21.95	21.80	21.79	22.00
		1	13	21.83	21.77	21.66	22.00
		1	24	21.52	21.49	21.39	22.00
		12	0	20.65	20.60	20.55	21.00
		12	6	20.80	20.65	20.53	21.00
10MHz	QPSK	12	13	20.36	20.50	20.39	21.00
		25	0	20.52	20.58	20.47	21.00
		1	0	22.21	22.38	22.32	23.00
		1	25	22.58	22.64	22.51	23.00
		1	49	22.22	22.29	22.23	23.00
		25	0	21.62	21.69	21.61	22.00
		25	13	21.60	21.78	21.63	22.00
	16QAM	25	25	21.69	21.59	21.49	22.00
		50	0	21.63	21.63	21.53	22.00
		1	0	21.97	21.83	21.81	22.00
		1	25	21.86	21.81	21.69	22.00
		1	49	21.55	21.51	21.42	22.00
		25	0	20.68	20.65	20.59	21.00
		25	13	20.82	20.69	20.56	21.00
15MHz	QPSK	25	25	20.39	20.55	20.43	21.00
		50	0	20.55	20.63	20.51	21.00
		1	0	22.20	22.34	22.30	23.00
		1	38	22.56	22.63	22.48	23.00
		1	74	22.19	22.24	22.19	23.00
		36	0	21.60	21.65	21.58	22.00
		36	18	21.57	21.73	21.59	22.00
	16QAM	36	39	21.66	21.56	21.45	22.00
		75	0	21.61	21.59	21.48	22.00



Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				18700/1860	18900/1880	19100/1900	
20MHz	16QAM	1	0	21.92	21.81	21.79	22.00
		1	38	21.84	21.78	21.67	22.00
		1	74	21.52	21.47	21.39	22.00
		36	0	20.65	20.63	20.56	21.00
		36	18	20.79	20.64	20.52	21.00
		36	39	20.37	20.51	20.40	21.00
		75	0	20.52	20.58	20.47	21.00
	QPSK	1	0	22.17	22.30	22.27	23.00
		1	50	22.55	22.59	22.46	23.00
		1	99	22.17	22.23	22.16	23.00
		50	0	21.57	21.60	21.54	22.00
		50	25	21.55	21.69	21.56	22.00
		50	50	21.63	21.51	21.41	22.00
		100	0	21.58	21.54	21.44	22.00
16QAM	1	0	21.90	21.77	21.74	22.00	
	1	50	21.80	21.76	21.63	22.00	
	1	99	21.50	21.44	21.37	22.00	
	50	0	20.62	20.59	20.53	21.00	
	50	25	20.76	20.62	20.49	21.00	
	50	50	20.34	20.46	20.36	21.00	
	100	0	20.50	20.54	20.44	21.00	

LTE FDD Band 7				Conducted Power(dBm)			Tune-up Limit
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			
				20775/2502.5	21100/2535	21425/2567.5	
5MHz	QPSK	1	0	22.19	22.28	22.25	23.00
		1	13	22.60	22.78	22.82	23.00
		1	24	22.33	22.38	22.47	23.00
		12	0	21.43	21.65	21.59	22.00
		12	6	21.51	21.75	21.80	22.00
		12	13	21.62	21.68	21.69	22.00
		25	0	21.42	21.61	21.66	22.00
	16QAM	1	0	21.79	21.73	21.77	22.00
		1	13	22.14	21.94	21.99	22.00
		1	24	21.92	21.89	21.93	22.00
		12	0	20.87	20.65	20.61	21.00
		12	6	20.79	20.56	20.63	21.00
		12	13	20.68	20.64	20.65	21.00
		25	0	20.60	20.53	20.59	21.00



Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				20800/2505	21100/2535	21400/2565	
10MHz	QPSK	1	0	22.21	22.29	22.28	23.00
		1	25	22.63	22.83	22.86	23.00
		1	49	22.35	22.42	22.50	23.00
		25	0	21.46	21.70	21.63	22.00
		25	13	21.54	21.80	21.84	22.00
		25	25	21.64	21.72	21.74	22.00
		50	0	21.50	21.63	21.70	22.00
	16QAM	1	0	21.81	21.76	21.79	22.00
		1	25	22.17	21.98	22.02	22.00
		1	49	21.95	21.91	21.96	22.00
		25	0	20.90	20.70	20.65	21.00
		25	13	20.81	20.60	20.66	21.00
		25	25	20.71	20.69	20.69	21.00
		50	0	20.63	20.58	20.63	21.00
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				20825/2507.5	21100/2535	21375/2562.5	
15MHz	QPSK	1	0	22.20	22.25	22.26	23.00
		1	38	22.61	22.82	22.83	23.00
		1	74	22.32	22.37	22.46	23.00
		36	0	21.44	21.66	21.60	22.00
		36	18	21.51	21.75	21.80	22.00
		36	39	21.61	21.69	21.70	22.00
		75	0	21.48	21.59	21.65	22.00
	16QAM	1	0	21.76	21.74	21.77	22.00
		1	38	22.15	21.95	22.00	22.00
		1	74	21.92	21.87	21.93	22.00
		36	0	20.87	20.68	20.62	21.00
		36	18	20.78	20.55	20.62	21.00
		36	39	20.69	20.65	20.66	21.00
		75	0	20.60	20.53	20.59	21.00
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				20850/2510	21100/2535	21350/2560	
20MHz	QPSK	1	0	22.17	22.21	22.23	23.00
		1	50	22.60	22.78	22.81	23.00
		1	99	22.30	22.36	22.43	23.00
		50	0	21.41	21.61	21.56	22.00
		50	25	21.49	21.71	21.77	22.00
		50	50	21.58	21.64	21.66	22.00
		100	0	21.45	21.54	21.61	22.00
	16QAM	1	0	21.74	21.70	21.72	22.00
		1	50	22.11	21.93	21.96	22.00



		1	99	21.90	21.84	21.91	22.00
		50	0	20.84	20.64	20.59	21.00
		50	25	20.75	20.53	20.59	21.00
		50	50	20.66	20.60	20.62	21.00
		100	0	20.58	20.49	20.56	21.00

### 9.4 WLAN Mode

Wi-Fi 2.4G Mode	Channel /Frequency(MHz)	Maximum Output Power (dBm)		
		Tune-up	Meas.	TP Set Level
802.11b (1M)	1/2412	17.00	16.15	19
	6/2437	17.00	16.28	19
	11/2462	17.00	16.24	19
802.11g (6M)	1/2412	15.00	12.14	17
	6/2437	15.00	14.39	17
	11/2462	15.00	12.05	17
802.11n-HT20 (MCS0)	1/2412	15.00	12.30	17
	6/2437	15.00	14.65	17
	11/2462	15.00	12.01	17
802.11n-HT40 (MCS0)	3/2422	14.00	10.86	16.5
	6/2437	14.00	13.45	16.5
	9/2452	14.00	10.95	16.5

Note: Initial test configuration is 802.11b mode, since the highest maximum output power.

Wi-Fi 5G (U-NII-2A) Mode	Channel /Frequency(MHz)	Maximum Output Power (dBm)		
		Tune-up	Meas.	TP Set Level
802.11a (6M)	52/5260	15.00	14.33	17.00
	56/5280	15.00	14.29	17.00
	60/5300	15.00	14.27	17.00
	64/5320	15.00	14.10	17.00

Wi-Fi 5G (U-NII-2C) Mode	Channel /Frequency(MHz)	Maximum Output Power (dBm)		
		Tune-up	Meas.	TP Set Level
802.11a (6M)	100/5500	15.00	14.03	17.00
	116/5580	15.00	13.99	17.00
	132/5660	15.00	13.17	17.00
	140/5700	15.00	13.10	17.00

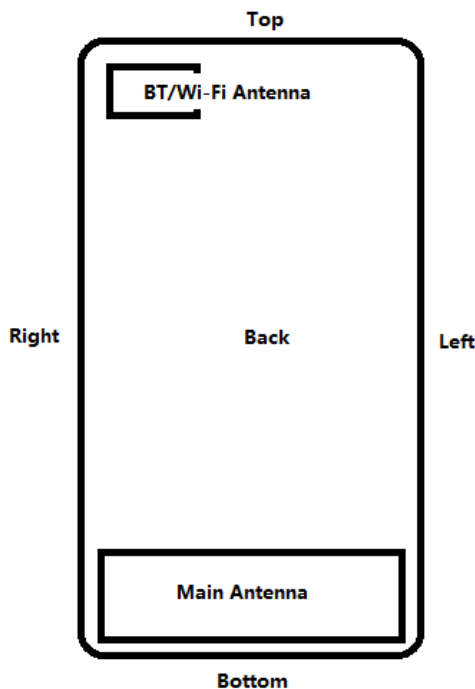


## 9.5 Bluetooth Mode

BT	Conducted Power(dBm)			Tune-up Limit (dBm)
	Channel/Frequency(MHz)			
	Ch 0/2402 MHz	Ch 39/2441 MHz	Ch 78/2480 MHz	
GFSK	5.64	5.89	4.93	6.00
$\pi/4$ DQPSK	4.76	5.19	3.96	6.00
8DPSK	4.92	5.33	4.14	6.00
BLE	Ch 0/2402 MHz	Ch 19/2440 MHz	Ch 39/2480 MHz	Tune-up Limit (dBm)
GFSK	5.89	6.29	5.00	7.00

# 10 Measured and Reported (Scaled) SAR Results

## 10.1 EUT Antenna Locations



Overall (Length x Width): 160 mm x 84 mm

Overall Diagonal: 168/Display Diagonal: 128mm

Distance of the Antenna to the EUT surface/edge

Antenna	Back Side	Front side	Left Edge	Right Edge	Top Edge	Bottom Edge
Main-Antenna	<25mm	<25mm	<25mm	<25mm	>25mm	<25mm
BT/Wi-Fi Antenna	<25mm	<25mm	>25mm	<25mm	<25mm	>25mm

Hotspot mode, Positions for SAR tests

Mode	Back Side	Front side	Left Edge	Right Edge	Top Edge	Bottom Edge
Main-Antenna	yes	yes	Yes	Yes	N/A	Yes
BT/Wi-Fi Antenna	yes	yes	N/A	Yes	Yes	N/A

Note: 1. Per KDB 941225 D06, when the overall device length and width are  $\geq 9\text{cm} \times 5\text{cm}$ , the test distance is 10mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

2. For smart phones with an overall diagonal dimension is 168mm. Per KDB 648474 D04, for smart phones with a display diagonal dimension  $> 15.0\text{ cm}$  or an overall diagonal dimension  $> 16.0\text{ cm}$ , 10-g extremity SAR must be tested as a phablet to determine SAR compliance. For Phablet, Since hotspot mode 1-g reported SAR  $< 1.2\text{ W/kg}$ , 10-g extremity SAR is no required.

3. Per FCC KDB 447498 D01,

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:

- a)  $\leq 0.8\text{ W/kg}$  or  $2.0\text{ W/kg}$ , for 1-g or 10-g respectively, when the transmission band is  $\leq 100\text{MHz}$
- b)  $\leq 0.6\text{ W/kg}$  or  $1.5\text{ W/kg}$ , for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.



- c)  $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz.
- 4. When the original highest measured SAR is  $\geq 0.80$  W/kg, the measurement was repeated once.
- 5. Per KDB 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was  $\leq 1.2$  W/kg, no additional SAR evaluations using a headset cable were required.



## 10.2 Standalone SAR test exclusion considerations

Per KDB 447498 D01, 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

- $f(\text{GHz})$  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

Per KDB 447498 D01, when the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

Bluetooth	Distance (mm)	MAX Power (dBm)	Frequency (MHz)	Ratio	Evaluation
Head	5	7.00	2480	1.58	No
Body-worn	15	7.00	2480	0.53	No
Hotspot	10	7.00	2480	0.79	No
Product Specific 10-g SAR	5	7.00	2480	1.58	No



## 10.3 Measured SAR Results

Table 1: GSM 850

Test Position	Cover Type	Time slot	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
							Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
<b>Head SAR</b>											
Left Cheek	Standard	GSM	1:8.3	190/836.6	33.00	32.20	0.051	0.103	1.20	0.061	/
Left Tilt	Standard	GSM	1:8.3	190/836.6	33.00	32.20	0.031	0.030	1.20	0.037	/
Right Cheek	Standard	GSM	1:8.3	190/836.6	33.00	32.20	0.058	0.031	1.20	0.070	13
Right Tilt	Standard	GSM	1:8.3	190/836.6	33.00	32.20	0.024	-0.045	1.20	0.029	/
<b>Body-worn (Distance 15mm)</b>											
Back Side	Standard	GSM	1:8.3	190/836.6	33.00	32.20	0.117	-0.020	1.20	0.141	14
Front Side	Standard	GSM	1:8.3	190/836.6	33.00	32.20	0.102	-0.051	1.20	0.123	/
<b>Hotspot (Distance 10mm)</b>											
Back Side	Standard	4Txslots	1:2.07	190/836.6	29.00	28.39	0.427	-0.066	1.15	0.491	15
Front Side	Standard	4Txslots	1:2.07	190/836.6	29.00	28.39	0.251	0.080	1.15	0.289	/
Left Edge	Standard	4Txslots	1:2.07	190/836.6	29.00	28.39	0.058	-0.037	1.15	0.067	/
Right Edge	Standard	4Txslots	1:2.07	190/836.6	29.00	28.39	0.108	-0.010	1.15	0.124	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	4Txslots	1:2.07	190/836.6	29.00	28.39	0.047	0.020	1.15	0.054	/
<p>Note: 1.The value with blue color is the maximum SAR Value of each test band.</p> <p>2.When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.</p>											



Table 2: GSM 1900

Test Position	Cover Type	Time slot	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
							Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
<b>Head SAR</b>											
Left Cheek	Standard	GSM	1:8.3	661/1880	31.00	29.79	0.079	0.050	1.32	0.104	/
Left Tilt	Standard	GSM	1:8.3	661/1880	31.00	29.79	0.068	0.030	1.32	0.089	/
Right Cheek	Standard	GSM	1:8.3	661/1880	31.00	29.79	0.081	0.070	1.32	0.107	16
Right Tilt	Standard	GSM	1:8.3	661/1880	31.00	29.79	0.071	0.027	1.32	0.093	/
<b>Body-worn (Distance 15mm)</b>											
Back Side	Standard	GSM	1:8.3	661/1880	31.00	29.79	0.088	-0.080	1.32	0.116	/
Front Side	Standard	GSM	1:8.3	661/1880	31.00	29.79	0.106	-0.170	1.32	0.140	17
<b>Hotspot (Distance 10mm)</b>											
Back Side	Standard	4Txslots	1:2.07	661/1880	27.00	26.01	0.343	0.080	1.26	0.431	18
Front Side	Standard	4Txslots	1:2.07	661/1880	27.00	26.01	0.337	0.120	1.26	0.423	/
Left Edge	Standard	4Txslots	1:2.07	661/1880	27.00	26.01	0.062	0.100	1.26	0.078	/
Right Edge	Standard	4Txslots	1:2.07	661/1880	27.00	26.01	0.086	0.081	1.26	0.108	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	4Txslots	1:2.07	661/1880	27.00	26.01	0.153	0.120	1.26	0.192	/
Note: 1.The value with blue color is the maximum SAR Value of each test band. 2.When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.											



Table 3: UMTS Band II (Main-antenna)

Test Position	Cover Type	Channel Type	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
							Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
<b>Head SAR</b>											
Left Cheek	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.098	0.020	1.07	0.105	/
Left Tilt	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.041	0.044	1.07	0.044	/
Right Cheek	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.146	0.120	1.07	0.157	19
Right Tilt	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.076	0.109	1.07	0.081	/
<b>Body-worn (Distance 15mm)</b>											
Back Side	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.214	-0.060	1.07	0.230	20
Front Side	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.071	0.156	1.07	0.076	/
<b>Hotspot (Distance 10mm)</b>											
Back Side	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.398	0.010	1.07	0.427	21
Front Side	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.257	-0.150	1.07	0.276	/
Left Edge	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.058	-0.052	1.07	0.063	/
Right Edge	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.038	0.090	1.07	0.040	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	RMC 12.2K	1:1	9400/1880	23.00	22.69	0.126	0.160	1.07	0.135	/

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq \frac{1}{4}$  dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for the secondary mode.



Table 4: UMTS Band V

Test Position	Cover Type	Channel Type	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
							Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
<b>Head SAR</b>											
Left Cheek	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.044	0.026	1.04	0.046	/
Left Tilt	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.012	0.025	1.04	0.012	/
Right Cheek	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.068	0.036	1.04	0.071	22/
Right Tilt	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.019	0.084	1.04	0.020	/
<b>Body-worn (Distance 15mm)</b>											
Back Side	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.081	0.042	1.04	0.084	23
Front Side	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.065	-0.170	1.04	0.068	/
<b>Hotspot (Distance 10mm)</b>											
Back Side	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.253	0.054	1.04	0.263	24
Front Side	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.140	0.062	1.04	0.146	/
Left Edge	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.046	-0.022	1.04	0.048	/
Right Edge	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.095	0.010	1.04	0.099	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	RMC 12.2K	1:1	4183/836.6	23.00	22.83	0.032	0.180	1.04	0.033	/
<p>Note: 1. The value with blue color is the maximum SAR Value of each test band.</p> <p>2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is <math>\leq \frac{1}{4}</math> dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is <math>\leq 1.2</math> W/kg, SAR measurement is not required for the secondary mode.</p>											



Table 5: LTE Band 2 (20MHz, Main-antenna)

Test Position	Cover Type	Mode	Duty Cycle	RB allocation	RB offset	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
									Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
<b>Head SAR (QPSK)</b>													
Left Cheek	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.236	0.101	1.10	0.259	/
Left Tilt	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.054	0.052	1.10	0.060	/
Right Cheek	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.250	-0.084	1.10	0.275	25
Right Tilt	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.105	0.028	1.10	0.115	/
Left Cheek	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.240	-0.052	1.07	0.258	/
Left Tilt	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.078	0.120	1.07	0.084	/
Right Cheek	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.088	0.062	1.07	0.095	/
Right Tilt	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.088	0.010	1.07	0.095	/
Right Cheek	SIM2	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.244	0.105	1.10	0.268	/
<b>Body-worn (QPSK, Distance 15mm)</b>													
Back Side	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.256	0.029	1.10	0.281	26
Front Side	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.146	-0.059	1.10	0.160	/
Back Side	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.201	-0.032	1.07	0.216	/
Front Side	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.121	-0.047	1.07	0.130	/
<b>Hotspot (QPSK, Distance 10mm)</b>													
Back Side	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.490	-0.084	1.10	0.539	27
Front Side	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.266	0.105	1.10	0.292	/
Left Edge	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.107	0.022	1.10	0.118	/
Right Edge	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.056	0.030	1.10	0.062	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	QPSK	1:1	1	50	18900/1880	23.00	22.59	0.133	0.123	1.10	0.146	/
Back Side	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.254	0.021	1.07	0.273	/
Front Side	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.228	-0.051	1.07	0.245	/
Left Edge	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.055	0.138	1.07	0.059	/
Right Edge	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.018	0.080	1.07	0.019	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	QPSK	1:1	50%	25	18900/1880	22.00	21.69	0.118	-0.110	1.07	0.127	/
Note: 1. The value with blue color is the maximum SAR Value of each test band.													
2. For QPSK with 100% RB allocation, SAR is required when and the highest reported SAR for 1 RB and 50% RB allocation in are $\geq 0.8$ W/kg.													



Table 6: LTE Band 7 (20MHz, Main-antenna)

Test Position	Cover Type	Mode	Duty Cycle	RB allocation	RB offset	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
									Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
<b>Head SAR (QPSK)</b>													
Left Cheek	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.070	0.004	1.04	0.073	/
Left Tilt	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.039	0.023	1.04	0.041	/
Right Cheek	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.073	0.032	1.04	0.076	/
Right Tilt	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.042	0.092	1.04	0.043	/
Left Cheek	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.078	0.152	1.05	0.082	28
Left Tilt	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.020	0.087	1.05	0.021	/
Right Cheek	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.034	0.072	1.05	0.036	/
Right Tilt	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.034	0.082	1.05	0.036	/
<b>Body-worn (QPSK, Distance 15mm)</b>													
Back Side	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.305	0.150	1.04	0.319	29
Front Side	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.186	0.058	1.04	0.194	/
Back Side	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.246	-0.024	1.05	0.259	/
Front Side	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.215	0.032	1.05	0.227	/
Back Side	SIM2	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.301	-0.018	1.04	0.314	/
<b>Hotspot (QPSK, Distance 10mm)</b>													
Back Side	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.650	0.024	1.04	0.679	30
Front Side	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.361	0.043	1.04	0.377	/
Left Edge	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.069	0.030	1.04	0.072	/
Right Edge	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.069	0.067	1.04	0.072	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.641	0.140	1.04	0.670	N/A
Back Side	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.564	0.160	1.05	0.595	/
Front Side	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.307	0.048	1.05	0.324	/
Left Edge	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.054	-0.190	1.05	0.057	/
Right Edge	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.044	0.067	1.05	0.046	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Standard	QPSK	1:1	50%	25	21350/2560	22.00	21.77	0.454	0.060	1.05	0.479	/
Back Side	SIM2	QPSK	1:1	1	50	21350/2560	23.00	22.81	0.627	-0.063	1.04	0.655	/

Note: 1. The value with blue color is the maximum SAR Value of each test band.  
2. For QPSK with 100% RB allocation, SAR is required when and the highest reported SAR for 1 RB and 50% RB allocation in are  $\geq 0.8$  W/kg.



Table 7: Wi-Fi (2.4G)

Test Position	Cover Type	Mode	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)					Plot No.
							Area Scan SAR 1g	Zoom Scan SAR 1g	Power Drift (dB)	Scaling Factor	Report SAR 1g	
<b>Head SAR</b>												
Left Cheek	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.369	0.422	0.170	1.19	0.500	31
Left Tilt	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.301	0.140	0.060	1.19	0.166	/
Right Cheek	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.132	0.123	0.039	1.19	0.146	/
Right Tilt	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.117	0.111	0.037	1.19	0.132	/
<b>Body-worn (Distance 15mm)</b>												
Back Side	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.069	0.071	0.120	1.19	0.084	32
Front Side	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.172	0.052	-0.074	1.19	0.061	/
<b>Hotspot (Distance 10mm)</b>												
Back Side	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.105	0.065	0.089	1.19	0.077	/
Front Side	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.110	0.105	-0.065	1.19	0.125	33
Left Edge	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.036	0.002	0.024	1.19	0.002	/
Right Edge	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.053	0.034	-0.188	1.19	0.040	/
Top Edge	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.049	0.041	-0.085	1.19	0.049	/
Bottom Edge	Standard	802.11b	99.5%	6/2437	17.00	16.28	0.016	0.009	-0.136	1.19	0.011	/

Note: 1. The value with blue color is the maximum SAR Value of each test band.

MAX Adjusted SAR							
Mode	Test Position	Channel/Frequency(MHz)	MAX Reported SAR <sub>1g</sub> (W/kg)	802.11b Tune-up limit (dBm)	Tune-up limit (dBm)	Scaling Factor	Adjusted SAR <sub>1g</sub> (W/kg)
802.11g	Left Cheek	6/2437	0.500	17	15	0.63	0.315
802.11n HT20	Left Cheek	6/2437	0.500	17	15	0.63	0.315
802.11n HT40	Left Cheek	6/2437	0.500	17	14	0.50	0.251

Note: SAR is not required for OFDM 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.





Table 8: Wi-Fi (5G,U-NII-2A)

Test Position	Cover Type	Mode	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)					Plot No.
							Area Scan SAR 1g	Zoom Scan SAR 1g	Power Drift (dB)	Scaling Factor	Report SAR 1g	
<b>Head SAR</b>												
Left Cheek	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.349	0.414	-0.030	1.20	0.496	34
Left Tilt	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.210	0.160	-0.120	1.20	0.192	/
Right Cheek	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.252	0.239	0.041	1.20	0.286	/
Right Tilt	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.428	0.173	0.044	1.20	0.207	/
<b>Body-worn (Distance 15mm)</b>												
Back Side	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.158	0.160	0.039	1.20	0.191	35
Front Side	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.077	0.068	0.071	1.20	0.081	/
Test Position	Cover Type	Mode	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 4 W/kg (mW/g)					Plot No.
							Area Scan SAR 10g	Zoom Scan SAR 10g	Power Drift (dB)	Scaling Factor	Report SAR 10g	
<b>Product Specific 10-g SAR (Distance 0mm)</b>												
Back Side	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.587	0.672	0.063	1.20	0.804	36
Front Side	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.185	0.224	0.107	1.20	0.268	/
Left Edge	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.023	0.026	0.048	1.20	0.031	/
Right Edge	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.115	0.110	0.077	1.20	0.132	/
Top Edge	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.183	0.181	0.117	1.20	0.217	/
Bottom Edge	Standard	802.11 a	97.5%	52/5260	15.00	14.33	0.032	0.031	0.187	1.20	0.038	/
Note: 1. The value with blue color is the maximum SAR Value of each test band.												
2. Since the band does not support hotspot function, Product Specific 10-g SAR is required.												



**Table 9: Wi-Fi (5G,U-NII-2C)**

Test Position	Cover Type	Mode	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)					Plot No.
							Area Scan SAR 1g	Zoom Scan SAR 1g	Power Drift (dB)	Scaling Factor	Report SAR 1g	
<b>Head SAR</b>												
Left Cheek	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.648	0.591	0.061	1.28	0.758	/
	Standard	802.11 a	97.5%	116/5580	15.00	13.99	0.553	0.543	0.054	1.29	0.703	/
	Standard	802.11 a	97.5%	132/5660	15.00	13.17	0.509	0.479	0.048	1.56	0.749	/
	Standard	802.11 a	97.5%	140/5700	15.00	13.10	0.491	0.470	0.069	1.59	0.747	/
Left Tilt	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.520	0.615	0.154	1.28	0.789	37
	Standard	802.11 a	97.5%	116/5580	15.00	13.99	0.452	0.504	0.112	1.29	0.652	/
	Standard	802.11 a	97.5%	132/5660	15.00	13.17	0.439	0.467	0.140	1.56	0.730	/
	Standard	802.11 a	97.5%	140/5700	15.00	13.10	0.391	0.451	0.170	1.59	0.717	/
Right Cheek	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.397	0.429	0.110	1.28	0.550	/
	Standard	802.11 a	97.5%	116/5580	15.00	13.99	0.339	0.341	0.100	1.29	0.441	/
	Standard	802.11 a	97.5%	132/5660	15.00	13.17	0.229	0.232	0.120	1.56	0.363	/
	Standard	802.11 a	97.5%	140/5700	15.00	13.10	0.197	0.204	0.110	1.59	0.324	/
Right Tilt	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.513	0.577	0.129	1.28	0.740	/
	Standard	802.11 a	97.5%	116/5580	15.00	13.99	0.456	0.477	0.140	1.29	0.618	/
	Standard	802.11 a	97.5%	132/5660	15.00	13.17	0.327	0.357	0.115	1.56	0.558	/
	Standard	802.11 a	97.5%	140/5700	15.00	13.10	0.298	0.332	0.170	1.59	0.528	/
<b>Body-worn (Distance 15mm)</b>												
Back Side	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.142	0.131	0.053	1.28	0.168	38
Front Side	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.093	0.082	0.033	1.28	0.105	/
Test Position	Cover Type	Mode	Duty Cycle	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 4 W/kg (mW/g)					Plot No.
							Area Scan SAR 10g	Zoom Scan SAR 10g	Power Drift (dB)	Scaling Factor	Report SAR 10g	
<b>Product Specific 10-g SAR (Distance 0mm)</b>												
Back Side	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.584	0.607	0.054	1.28	0.779	39
Front Side	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.238	0.217	0.029	1.28	0.278	/
Left Edge	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.040	0.033	0.026	1.28	0.042	/
Right Edge	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.210	0.191	0.027	1.28	0.245	/
Top Edge	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.293	0.297	0.086	1.28	0.381	/
Bottom Edge	Standard	802.11 a	97.5%	100/5500	15.00	14.03	0.050	0.043	0.022	1.28	0.055	/
Note: 1. The value with blue color is the maximum SAR Value of each test band. 3. Since the band does not support hotspot function, Product Specific 10-g SAR is required.												

**Table 10: BT**

Band	Configuration	Frequency (MHz)	Maximum Power (dBm)	Separation Distance (mm)	Estimated SAR (W/kg)
Bluetooth	Head	2480	7	5	0.210
	Body-worn	2480	7	15	0.070
	Hotspot	2480	7	10	0.105
	Product Specific 10-g SAR	2480	7	5	0.084

For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 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.

### 10.4 Simultaneous Transmission Analysis

Simultaneous Transmission Configurations	Head	Body-worn	Hotspot	Product Specific 10-g SAR (Separation 0mm)
GSM(Voice) + Bluetooth	Yes	Yes	N/A	Yes
GPRS/EDGE(Data) + Bluetooth	N/A	Yes	Yes	Yes
WCDMA + Bluetooth	Yes	Yes	Yes	Yes
LTE + Bluetooth	N/A	Yes	Yes	Yes
GSM(Voice) + Wi-Fi-2.4GHz	Yes	Yes	N/A	Yes
GPRS/EDGE(Data) + Wi-Fi-2.4GHz	N/A	Yes	Yes	Yes
WCDMA + Wi-Fi-2.4GHz	Yes	Yes	Yes	Yes
LTE + Wi-Fi-2.4GHz	Yes	Yes	Yes	Yes
GSM(Voice) + Wi-Fi-5GHz	Yes	Yes	N/A	Yes
GPRS/EDGE(Data) + Wi-Fi-5GHz	N/A	Yes	Yes	Yes
WCDMA + Wi-Fi-5GHz	Yes	Yes	Yes	Yes
LTE + Wi-Fi-5GHz	Yes	Yes	Yes	Yes
Wi-Fi-2.4GHz + Bluetooth	Yes	Yes	Yes	Yes
Wi-Fi-5GHz + Bluetooth	Yes	Yes	Yes	Yes
Wi-Fi-2.4GHz + Wi-Fi-5GHz	N/A	N/A	N/A	N/A

**General Note:**

1. The Scaled SAR summation is calculated based on the same configuration and test position.
2. Per KDB 447498 D01, simultaneous transmission SAR is compliant if,
  - i) Scalar SAR summation < 1.6W/kg, simultaneously transmission SAR measurement is not necessary.
  - ii)  $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ , where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
  - iii) If  $SPLSR \leq 0.04$ , simultaneously transmission SAR measurement is not necessary.



**The maximum SAR<sub>1g</sub> Value for Main-Antenna**

SAR <sub>1g</sub> (W/kg)		GSM	GSM	WCDMA	WCDMA	LTE	LTE	MAX.
Test Position		850	1900	Band II	Band V	FDD 2	FDD 7	SAR <sub>1g/10g</sub>
Left Cheek		0.061	0.104	0.105	0.046	0.259	0.082	0.259
Left Tilt		0.037	0.089	0.044	0.012	0.084	0.041	0.089
Right Cheek		0.070	0.107	0.157	0.071	0.275	0.076	0.275
Right Tilt		0.029	0.093	0.081	0.020	0.115	0.043	0.115
Body worn	Back Side	0.141	0.116	0.230	0.084	0.281	0.319	0.319
	Front Side	0.123	0.140	0.076	0.068	0.160	0.227	0.227
Hotspot	Back Side	0.491	0.431	0.427	0.263	0.539	0.679	0.679
	Front Side	0.289	0.423	0.276	0.146	0.292	0.377	0.423
	Left Edge	0.067	0.078	0.063	0.048	0.118	0.072	0.118
	Right Edge	0.124	0.108	0.040	0.099	0.062	0.072	0.124
	Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Bottom Edge	0.054	0.192	0.135	0.033	0.146	0.670	0.670

**About BT and Wi-Fi and Main- Antenna**

SAR <sub>1g/10g</sub> (W/kg)		Main-antenna	BT	Wi-Fi	Wi-Fi 5G		MAX.
Test Position				2.4G	U-NII-2A	U-NII-2C	ΣSAR <sub>1g/10g</sub>
Left, Cheek		0.259	0.210	0.500	0.496	<b>0.758</b>	<b>1.227</b>
Left, Tilt		0.089	0.210	0.166	0.192	<b>0.789</b>	1.088
Right, Cheek		0.275	0.210	0.146	0.286	<b>0.550</b>	1.035
Right, Tilt		0.115	0.210	0.132	0.207	<b>0.740</b>	1.065
Body worn 1g	Back Side	0.319	0.070	0.084	<b>0.191</b>	0.168	0.580
	Front Side	0.227	0.070	0.061	0.081	<b>0.105</b>	0.402
Hotspot 1g	Back Side	0.679	0.042	<b>0.077</b>	N/A	N/A	0.798
	Front Side	0.423	0.042	<b>0.125</b>	N/A	N/A	0.590
	Left Edge	0.118	0.042	<b>0.002</b>	N/A	N/A	0.162
	Right Edge	0.124	0.042	<b>0.040</b>	N/A	N/A	0.206
	Top Edge	N/A	0.042	<b>0.049</b>	N/A	N/A	0.091
	Bottom Edge	0.670	0.042	<b>0.011</b>	N/A	N/A	0.723
Product Specific 10-g SAR	Back Side	N/A	0.084	N/A	<b>0.804</b>	0.779	<b>0.888</b>
	Front Side	N/A	0.084	N/A	0.268	<b>0.278</b>	0.362
	Left Edge	N/A	0.084	N/A	0.031	<b>0.042</b>	0.126
	Right Edge	N/A	0.084	N/A	0.132	<b>0.245</b>	0.329
	Top Edge	N/A	0.084	N/A	0.217	<b>0.381</b>	0.465
	Bottom Edge	N/A	0.084	N/A	0.038	<b>0.055</b>	0.139

Note: 1.The value with blue color is the maximum ΣSAR<sub>1g/10g</sub> Value.  
 2.MAX. ΣSAR<sub>1g/10g</sub> =Unlicensed SAR<sub>MAX</sub> +Licensed SAR<sub>MAX</sub>

MAX. ΣSAR<sub>1g</sub> = 1.227W/kg<1.6W/kg and MAX. ΣSAR<sub>10g</sub> = 0.888 W/kg<4W/kg, so the Simultaneous transimition SAR with volum scan are not required for BT and Wi-Fi and Main-Antenna.



## 11 Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528- 2013 is not required in SAR reports submitted for equipment approval. This also applies to the 10-g SAR required for phablets in KDB Publication 648474.

## ANNEX A: Test Layout

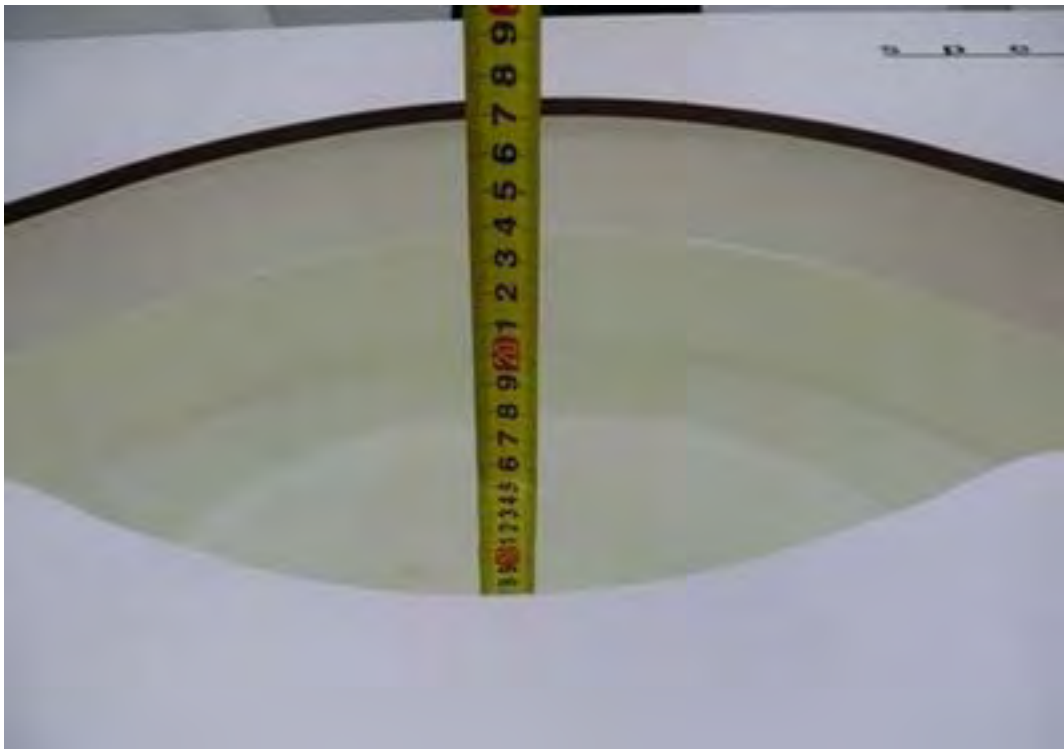


### Tissue Simulating Liquids

For the measurement of the field distribution inside the flat phantom with DASy, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For Head and 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 Picture 3 and Picture 4.



Picture 3: liquid depth in the head Phantom



Picture 4: Liquid depth in the flat Phantom



## ANNEX B: System Check Results

### Plot1 System Performance Check at 835 MHz Head TSL

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020

Date: 10/26/2018

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.91 \text{ mho/m}$ ;  $\epsilon_r = 42.0$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.10, 9.10, 9.10); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=15mm, Pin=250mW/Area Scan (41x121x1):** Measurement grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 2.59 mW/g

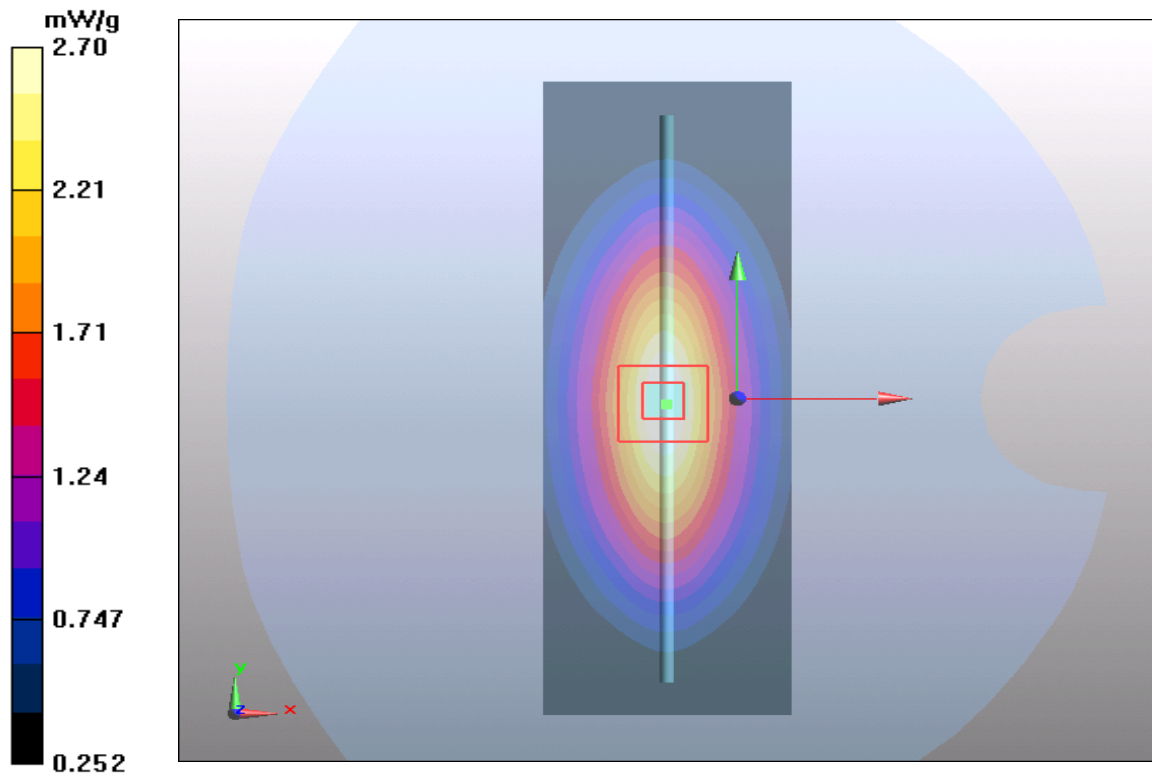
**d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 54.3 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 3.67 W/kg

**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.65 mW/g**

Maximum value of SAR (measured) = 2.70 mW/g



**Plot2 System Performance Check at 835 MHz Body TSL**

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Date: 10/26/2018

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.97 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.32, 9.32, 9.32); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=15mm, Pin=250mW/Area Scan (41x121x1):** Measurement grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 2.58 mW/g

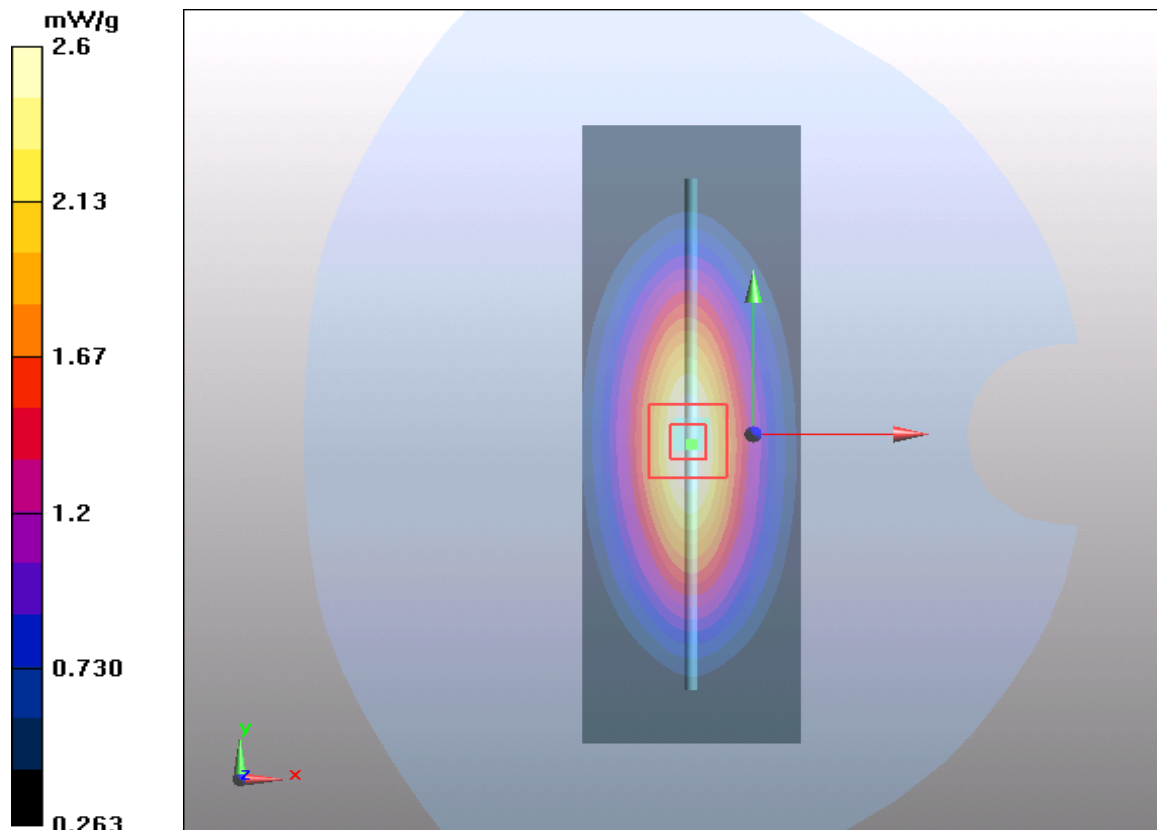
**d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 51.9 V/m; Power Drift = -0.058 dB

Peak SAR (extrapolated) = 3.5 W/kg

**SAR(1 g) = 2.41 mW/g; SAR(10 g) = 1.6 mW/g**

Maximum value of SAR (measured) = 2.6 mW/g



**Plot3 System Performance Check at 1900 MHz Head TSL**

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Date: 10/25/2018

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.39$  mho/m;  $\epsilon_r = 40.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.96, 7.96, 7.96); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 11.3 mW/g

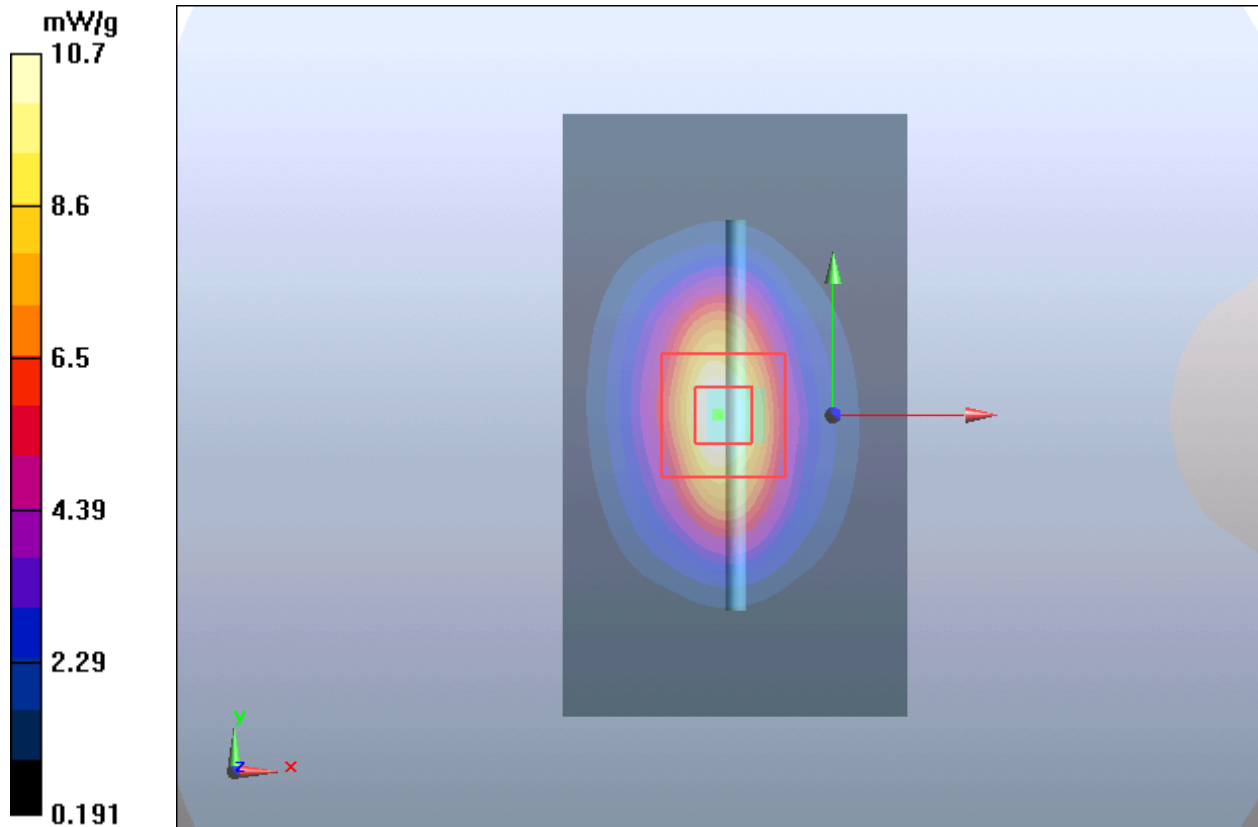
**d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 85.5 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 17.8 W/kg

**SAR(1 g) = 9.88 mW/g; SAR(10 g) = 4.9 mW/g**

Maximum value of SAR (measured) = 10.7 mW/g



**Plot4 System Performance Check at 1900 MHz Body TSL**

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Date: 10/25/2018

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.51$  mho/m;  $\epsilon_r = 52.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 12.2 mW/g

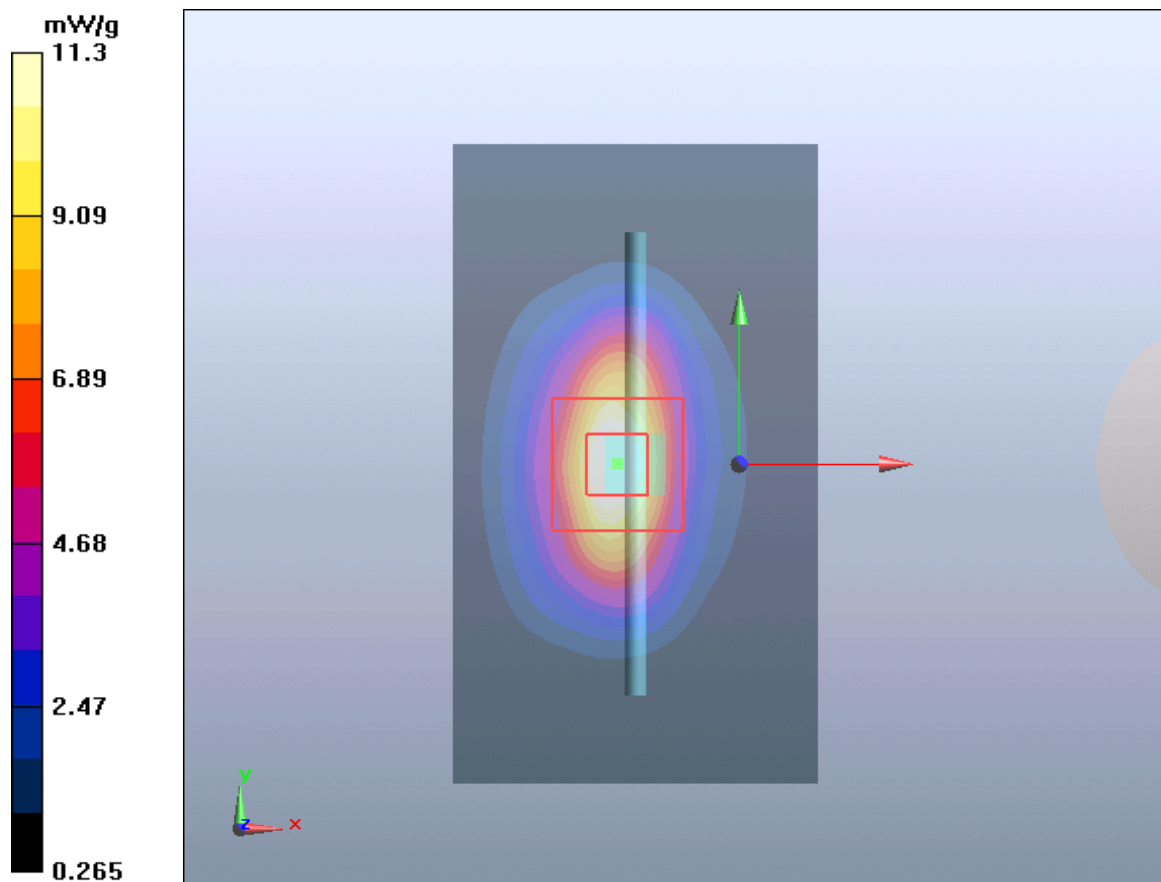
**d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 82.3 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 17.8 W/kg

**SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.25 mW/g**

Maximum value of SAR (measured) = 11.3 mW/g



**Plot5 System Performance Check at 2450 MHz Head TSL**

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

Date: 11/2/2018

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 39.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.57, 7.57, 7.57); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 18.2 mW/g

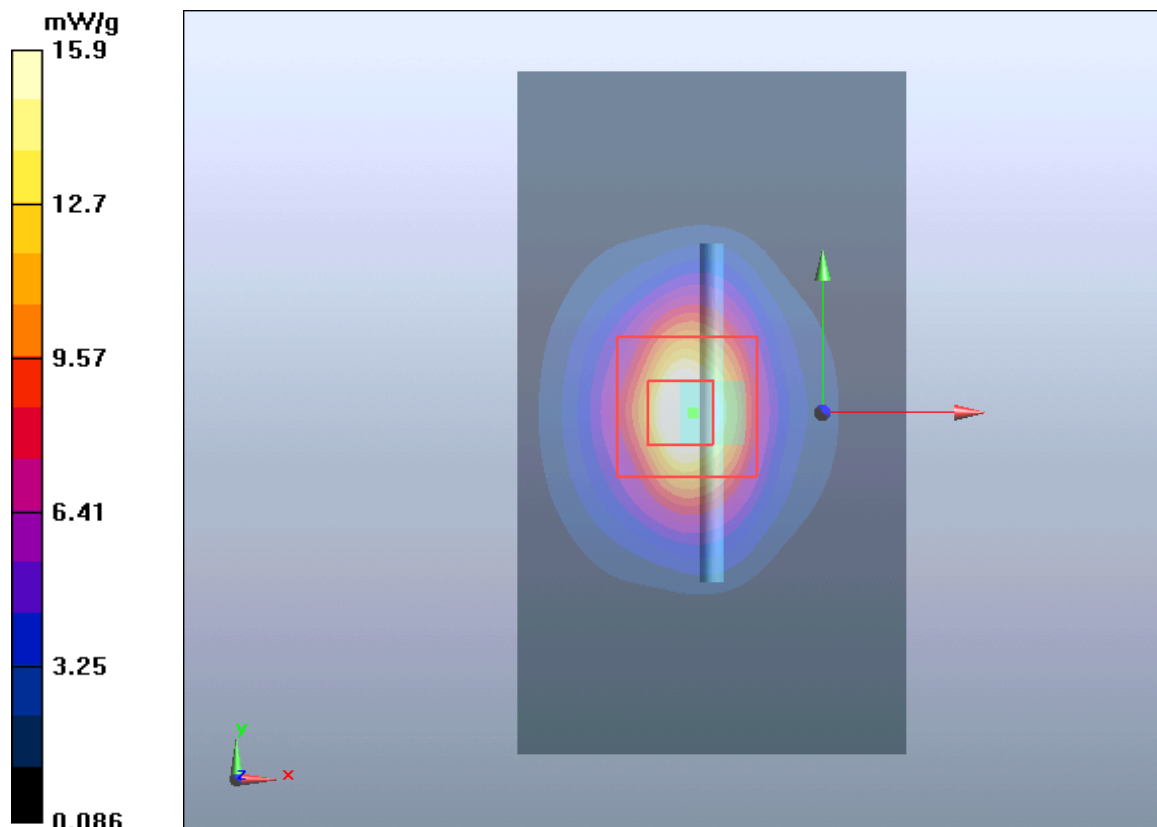
**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.8 V/m; Power Drift = 0.075 dB

Peak SAR (extrapolated) = 30 W/kg

**SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.22 mW/g**

Maximum value of SAR (measured) = 15.9 mW/g



**Plot6 System Performance Check at 2450 MHz Body TSL**

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

Date: 11/2/2018

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

Medium parameters used:  $f = 2450 \text{ MHz}$ ;  $\sigma = 1.97 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.53, 7.53, 7.53); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 16 mW/g

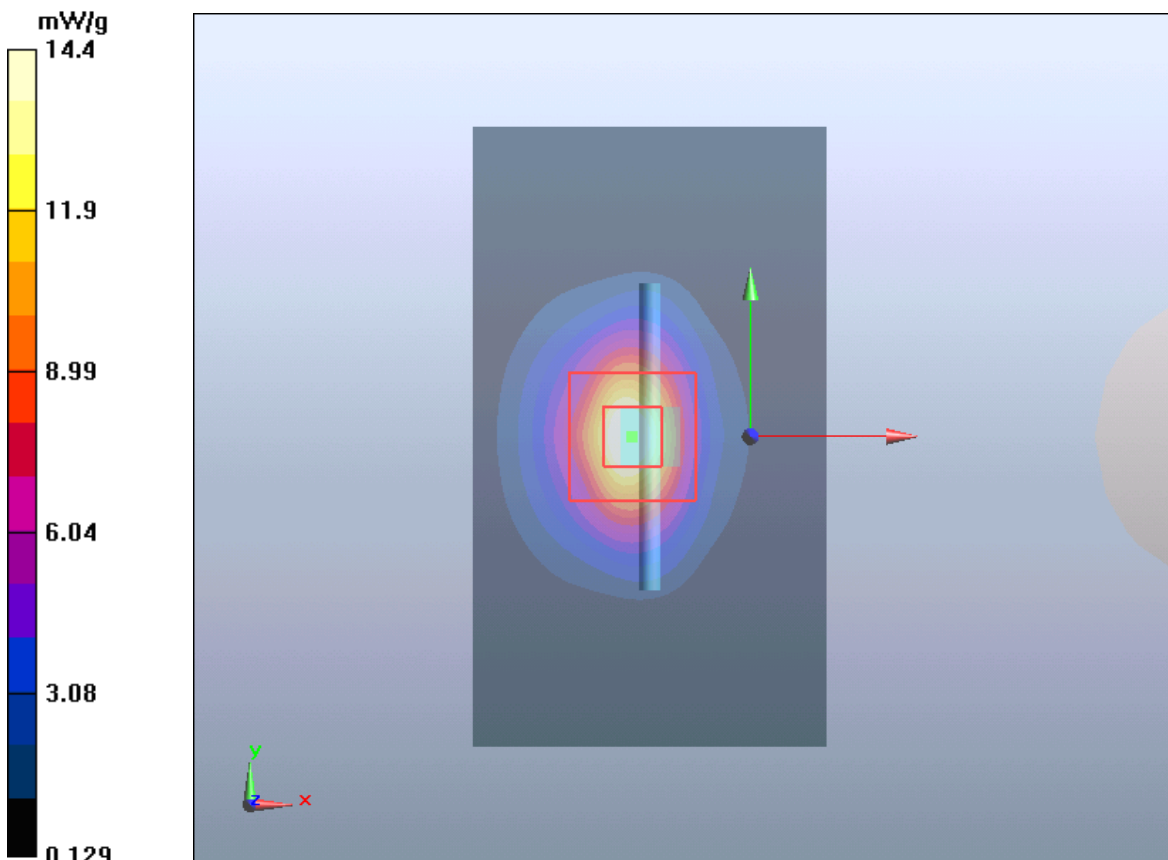
**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 81.2 V/m; Power Drift = 0.003 dB

Peak SAR (extrapolated) = 25.4 W/kg

**SAR(1 g) = 12.5 mW/g; SAR(10 g) = 6.20 mW/g**

Maximum value of SAR (measured) = 14.4 mW/g



**Plot 7 System Performance Check at 2600 MHz Head TSL**

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025**

Date: 10/28/2018

Communication System: CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.02$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.28, 7.28, 7.28); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid:dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 17.439 mW/g

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm,

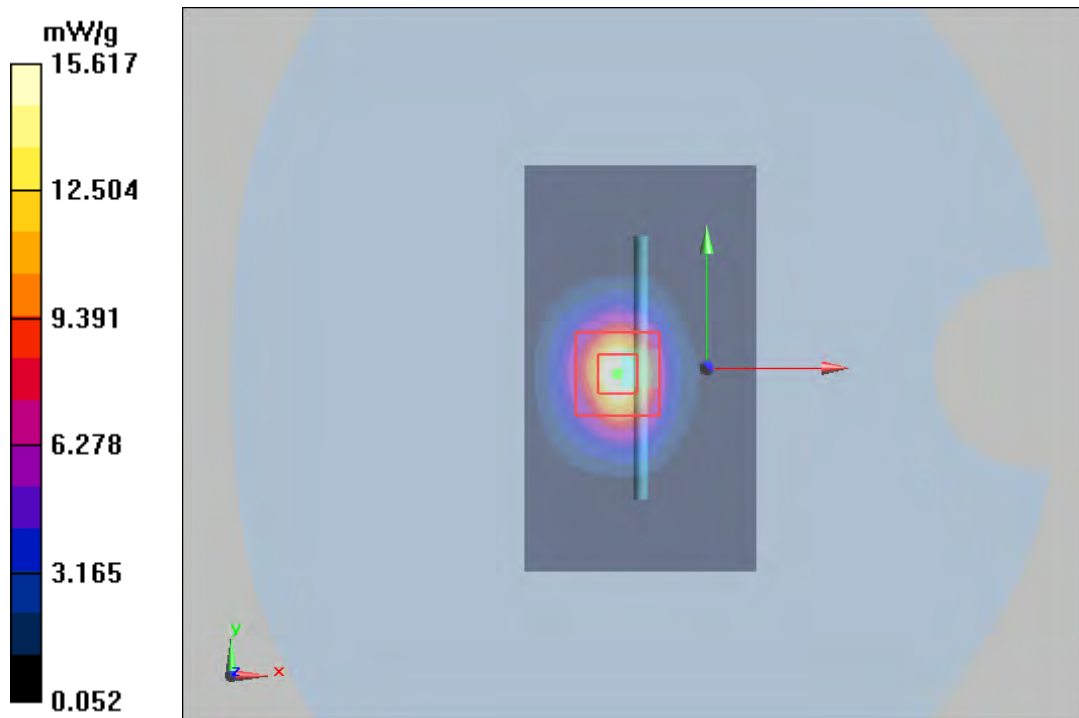
dz=5mm

Reference Value = 87.998 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 31.858 W/kg

**SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.07 mW/g**

Maximum value of SAR (measured) = 15.617 mW/g



**Plot 8 System Performance Check at 2600 MHz Body TSL****DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025**

Date: 10/28/2018

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.16$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.16, 7.16, 7.16); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=250mW /Area Scan (41x71x1):** Measurement grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 17.7 mW/g

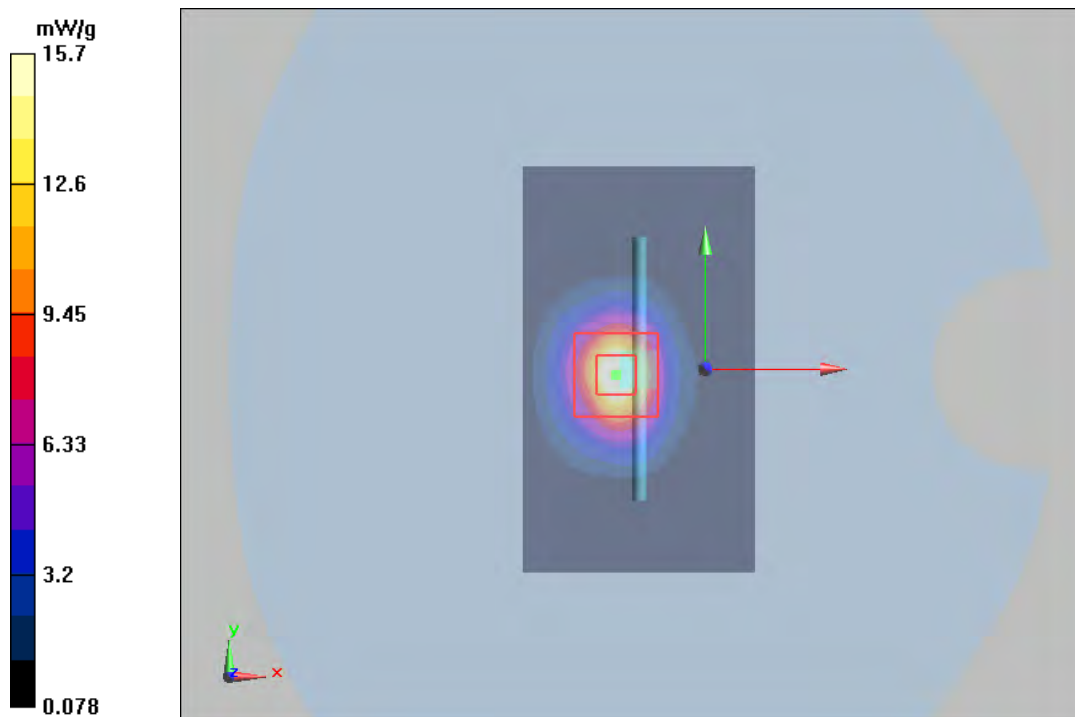
**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 74 V/m; Power Drift = -0.0027 dB

Peak SAR (extrapolated) = 28.5 W/kg

**SAR(1 g) = 13.5 mW/g; SAR(10 g) = 5.99 mW/g**

Maximum value of SAR (measured) = 15.7 mW/g





**Plot 9 System Performance Check at 5250 MHz Head TSL**

**DUT: Dipole 5250 MHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1151**

Date: 11/2/2018

Communication System: CW; Frequency: 5250 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5250 \text{ MHz}$ ;  $\sigma = 4.83 \text{ mho/m}$ ;  $\epsilon_r = 36.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(5.60, 5.60, 5.60); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=100mW/Area Scan (61x101x1):** Measurement grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 9.14 mW/g

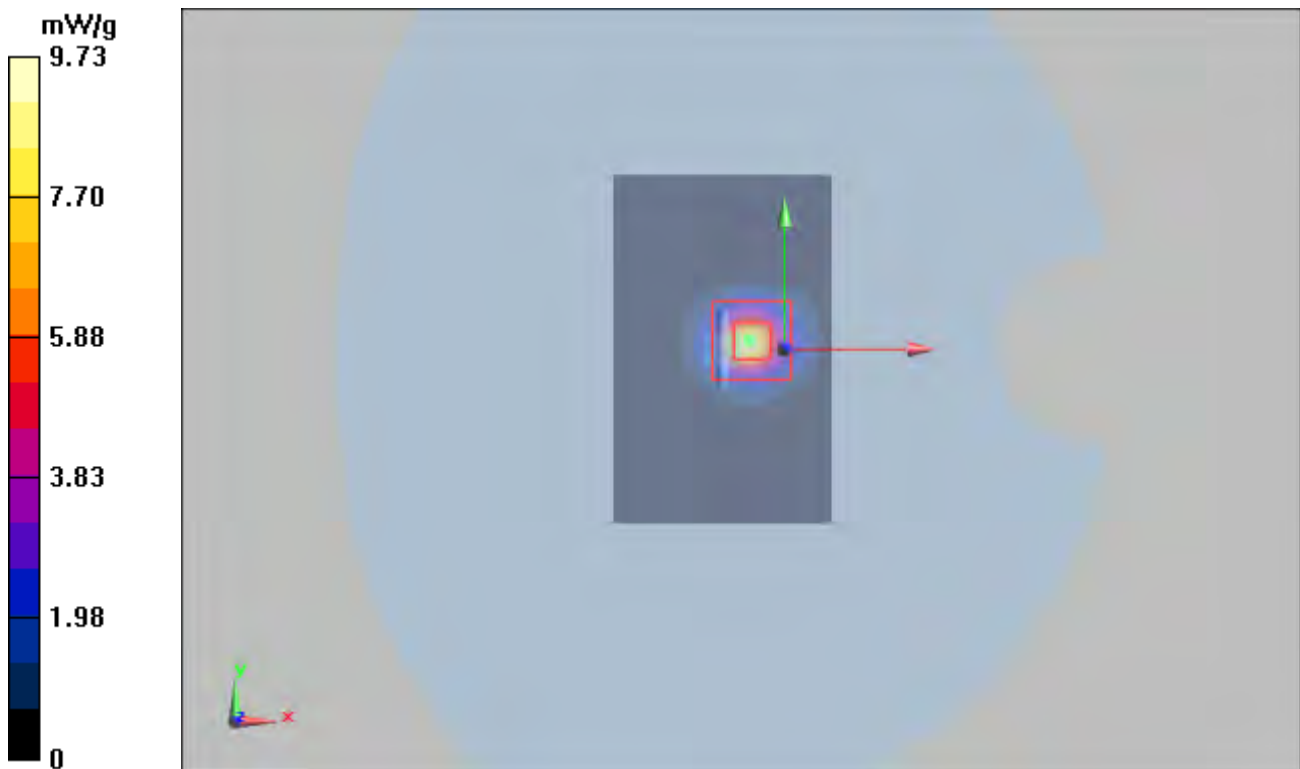
**d=10mm, Pin=100mW/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 33.6 V/m; Power Drift = -0.095 dB

Peak SAR (extrapolated) = 52.2 W/kg

**SAR(1 g) = 7.87 mW/g; SAR(10 g) = 2.25 mW/g**

Maximum value of SAR (measured) = 9.73 mW/g



**Plot 10 System Performance Check at 5250 MHz Body TSL**

**DUT: Dipole 5250 MHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1151**

Date: 11/2/2018

Communication System: CW; Frequency: 5250 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.42$  mho/m;  $\epsilon_r = 46.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(5.04, 5.04, 5.04); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=100mW/Area Scan (61x101x1):** Measurement grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 7.69 mW/g

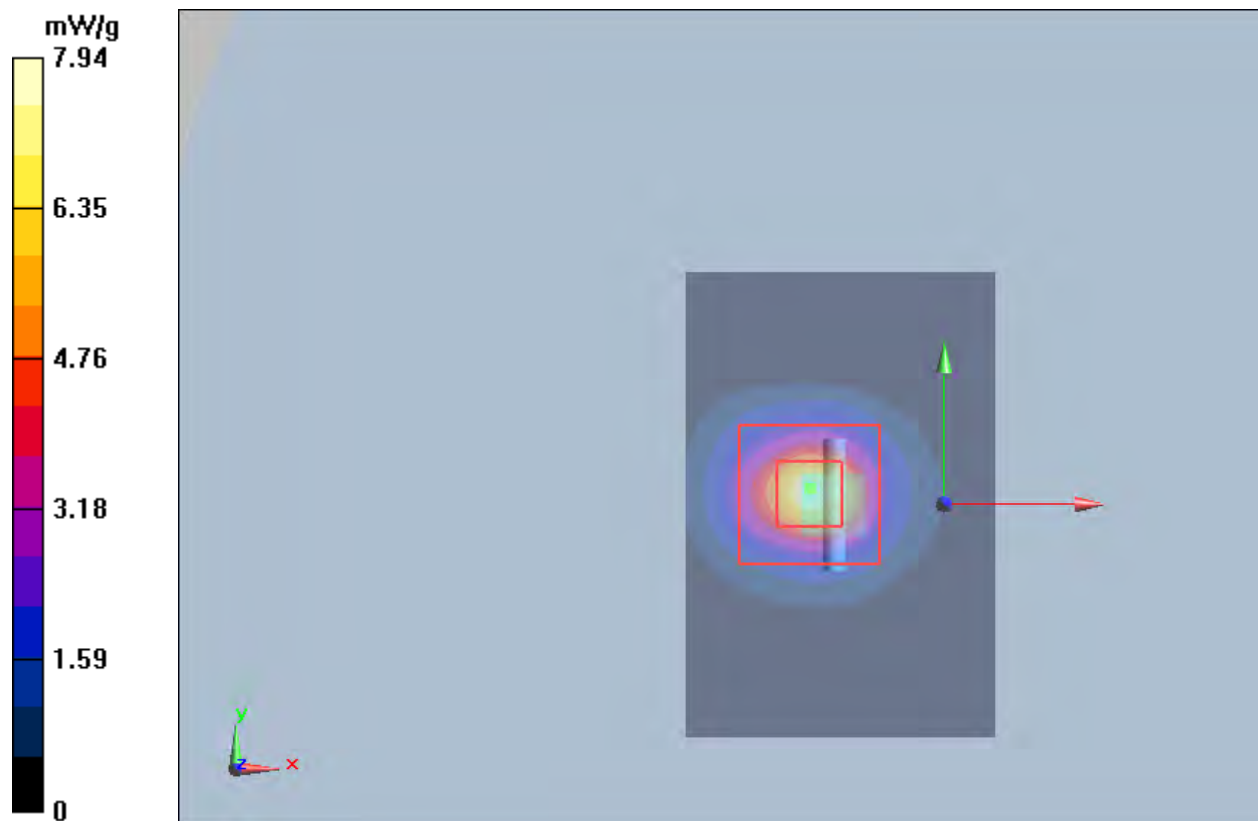
**d=10mm, Pin=100mW/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 36.3 V/m; Power Drift = 0.0277 dB

Peak SAR (extrapolated) = 47.7 W/kg

**SAR(1 g) = 7.46 mW/g; SAR(10 g) = 2.26 mW/g**

Maximum value of SAR (measured) = 7.94 mW/g



**Plot 11 System Performance Check at 5600 MHz Head TSL****DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1151**

Date: 12/5/2018

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.21$  mho/m;  $\epsilon_r = 34.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(4.87, 4.87, 4.87); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=100mW/Area Scan (61x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 8.25 mW/g

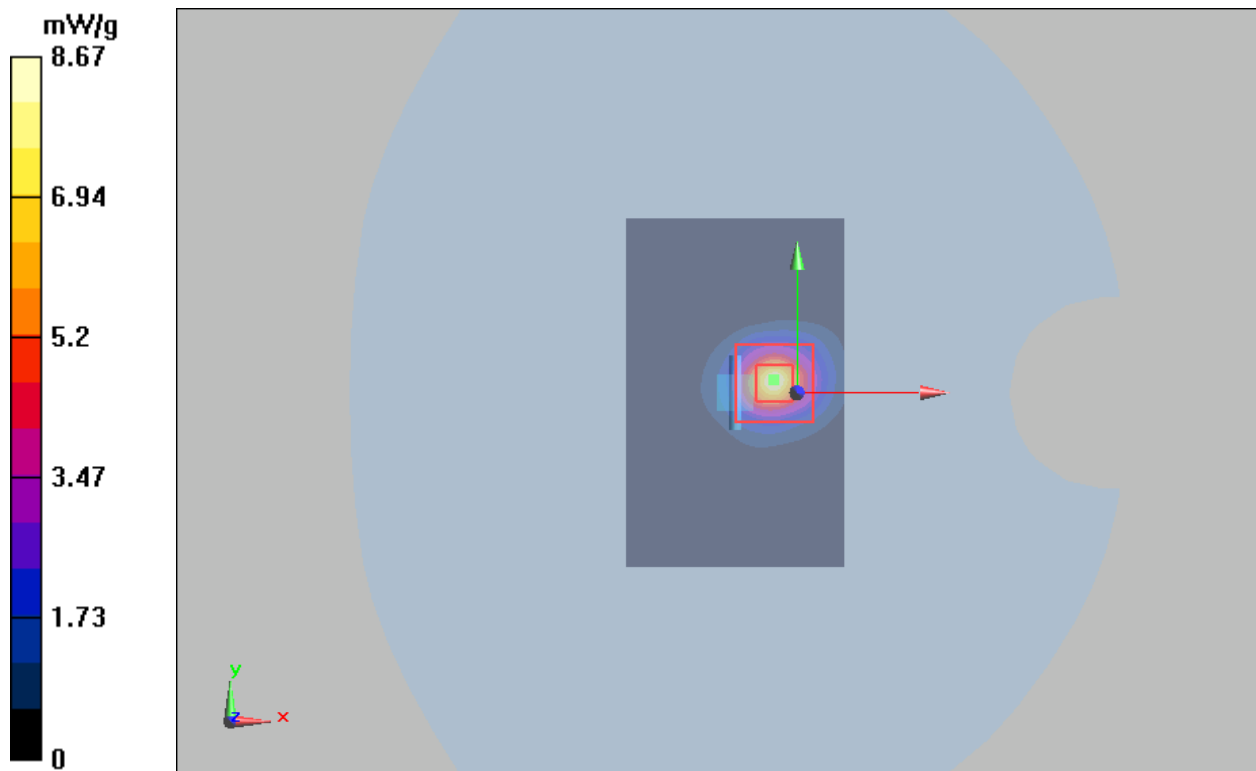
**d=10mm, Pin=100mW/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 23.1 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 22.9 W/kg

**SAR(1 g) = 7.67 mW/g; SAR(10 g) = 2.27 mW/g**

Maximum value of SAR (measured) = 8.67 mW/g



**Plot 12 System Performance Check at 5600 MHz Body TSL**

**DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1151**

Date: 12/5/2018

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5600 \text{ MHz}$ ;  $\sigma = 5.78 \text{ mho/m}$ ;  $\epsilon_r = 47.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(4.27, 4.27, 4.27); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**d=10mm, Pin=100mW/Area Scan (61x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 7.84 mW/g

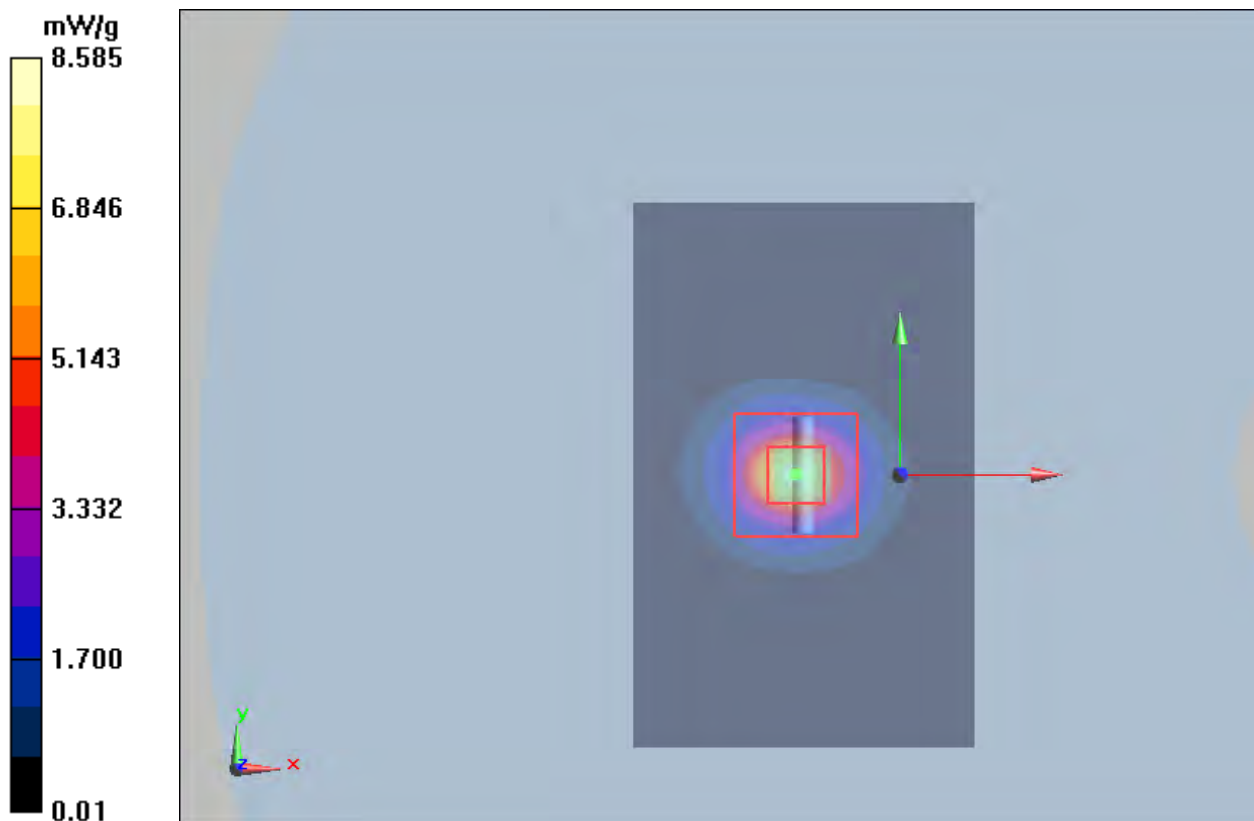
**d=10mm, Pin=100mW/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 38 V/m; Power Drift = -0.018 dB

Peak SAR (extrapolated) = 22.6 W/kg

**SAR(1 g) = 8.10 mW/g; SAR(10 g) = 2.11 mW/g**

Maximum value of SAR (measured) = 8.585 mW/g



## ANNEX C: Highest Graph Results

### Plot 13 GSM 850 Right Cheek Middle

Date: 10/26/2018

Communication System: UID 0, GSM 850 (0); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.916$  S/m;  $\epsilon_r = 41.951$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.10, 9.10, 9.10); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Right Cheek Middle/Area Scan (81x131x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.0800 W/kg

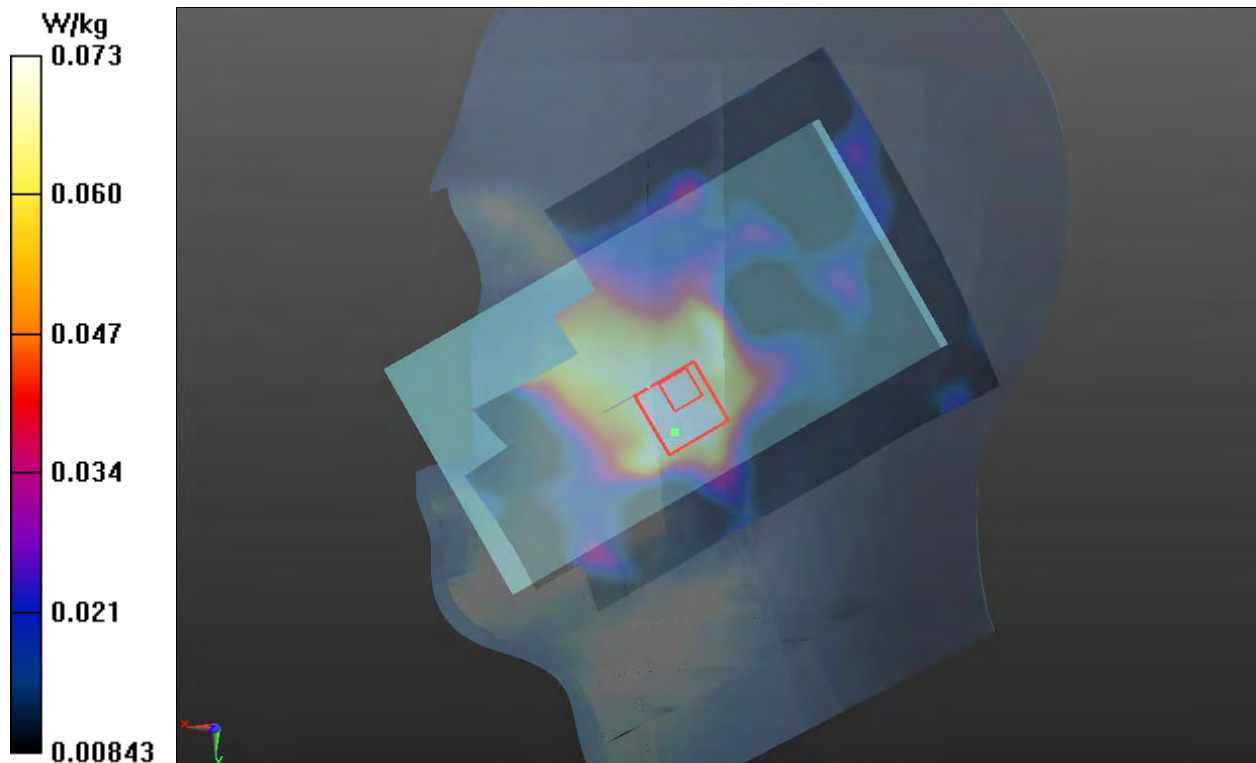
**Right Cheek Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.294 V/m; Power Drift = 0.031 dB

Peak SAR (extrapolated) = 0.0940 W/kg

**SAR(1 g) = 0.058 W/kg; SAR(10 g) = 0.046 W/kg**

Maximum value of SAR (measured) = 0.073 W/kg



**Plot 14 GSM 850 Back Side Middle (Distance 15mm)**

Date: 10/26/2018

Communication System: UID 0, GSM 850 (0); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042

Medium parameters used:  $f = 837 \text{ MHz}$ ;  $\sigma = 0.974 \text{ S/m}$ ;  $\epsilon_r = 53.795$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.32, 9.32, 9.32); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid:  $dx=15 \text{ mm}$ ,  $dy=15 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.121 \text{ W/kg}$

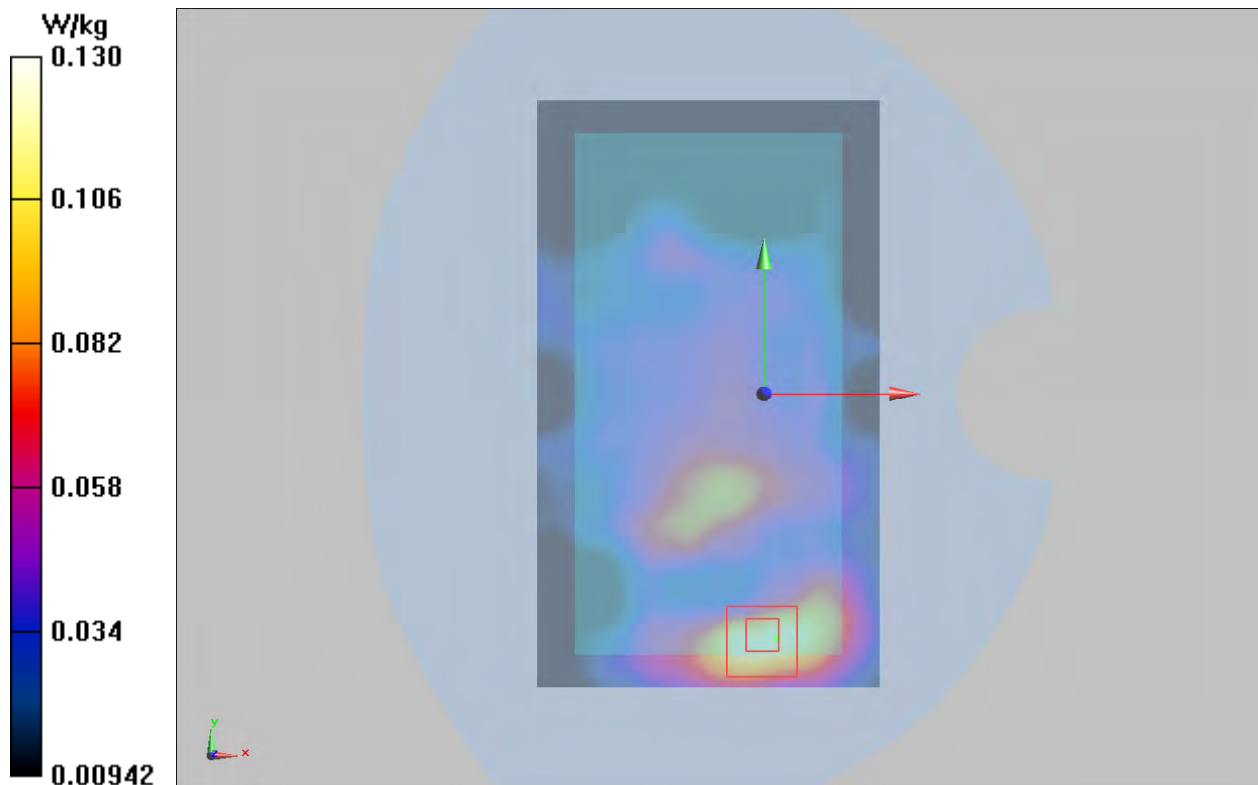
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $7.129 \text{ V/m}$ ; Power Drift =  $-0.02 \text{ dB}$

Peak SAR (extrapolated) =  $0.170 \text{ W/kg}$

**SAR(1 g) =  $0.117 \text{ W/kg}$ ; SAR(10 g) =  $0.073 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.130 \text{ W/kg}$



**Plot 15 GSM 850 GPRS (4Txslots) Back Side Middle (Distance 10mm)**

Date: 10/26/2018

Communication System: UID 0, GPRS 4TX (0); Frequency: 836.6 MHz; Duty Cycle: 1:2.07491

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 53.795$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.32, 9.32, 9.32); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.478 W/kg

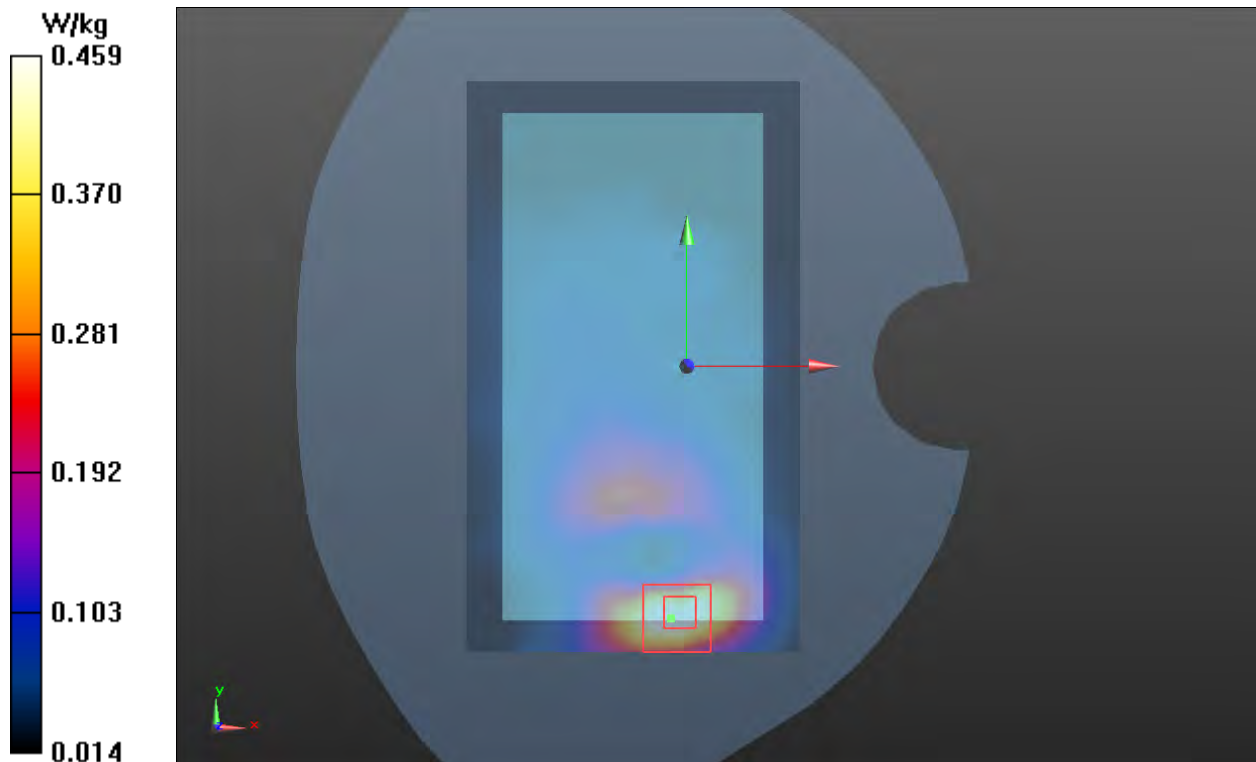
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.398 V/m; Power Drift = -0.066 dB

Peak SAR (extrapolated) = 0.726 W/kg

**SAR(1 g) = 0.427 W/kg; SAR(10 g) = 0.240 W/kg**

Maximum value of SAR (measured) = 0.459 W/kg



### Plot 16 GSM 1900 Right Cheek Middle

Date: 10/25/2018

Communication System: UID 0, GSM 1900 (0); Frequency: 1880 MHz; Duty Cycle: 1:8.30042

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.371$  S/m;  $\epsilon_r = 40.715$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.96, 7.96, 7.96); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Right Cheek Middle/Area Scan (81x131x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.0941 W/kg

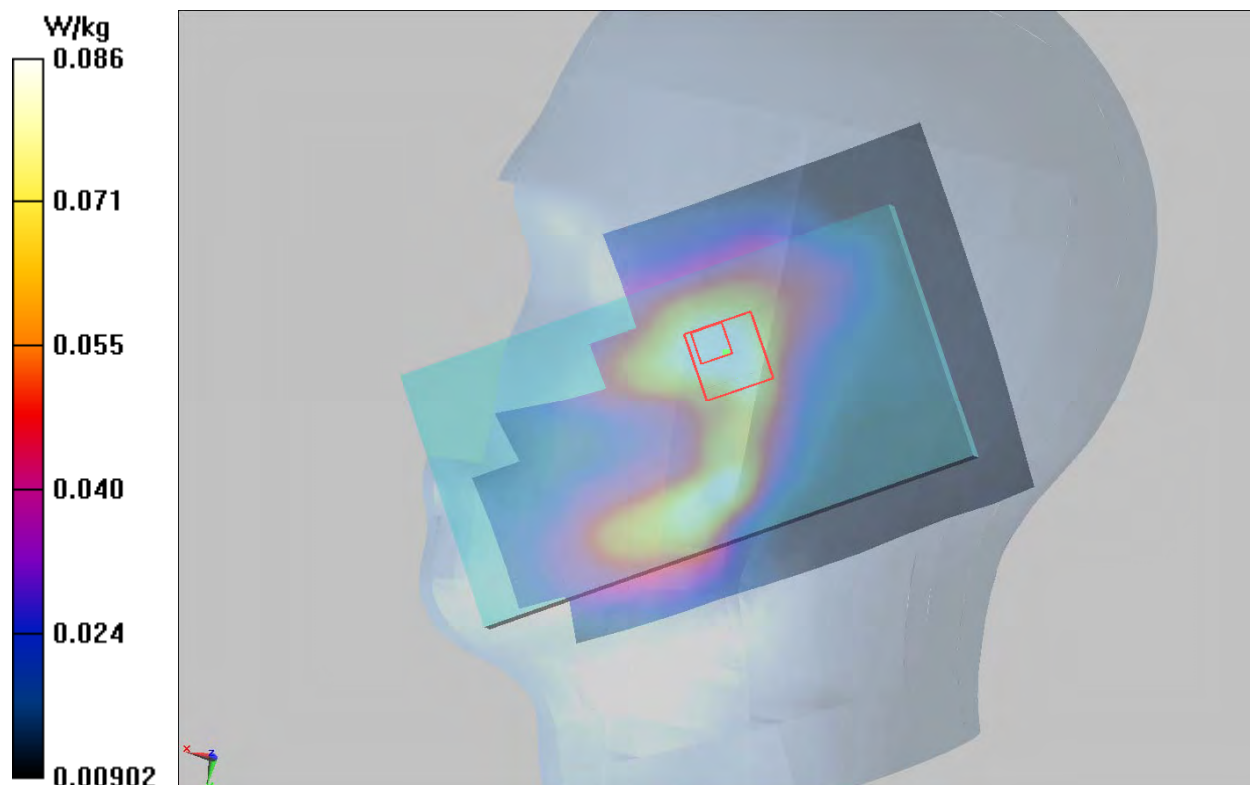
**Right Cheek Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.489 V/m; Power Drift = 0.070 dB

Peak SAR (extrapolated) = 0.110 W/kg

**SAR(1 g) = 0.081 W/kg; SAR(10 g) = 0.057 W/kg**

Maximum value of SAR (measured) = 0.086 W/kg





**Plot 17 GSM 1900 Front Side Middle (Distance 15mm)**

Date: 10/25/2018

Communication System: UID 0, GSM 1900 (0); Frequency: 1880 MHz; Duty Cycle: 1:8.30042

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.477$  S/m;  $\epsilon_r = 51.607$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Front Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.119 W/kg

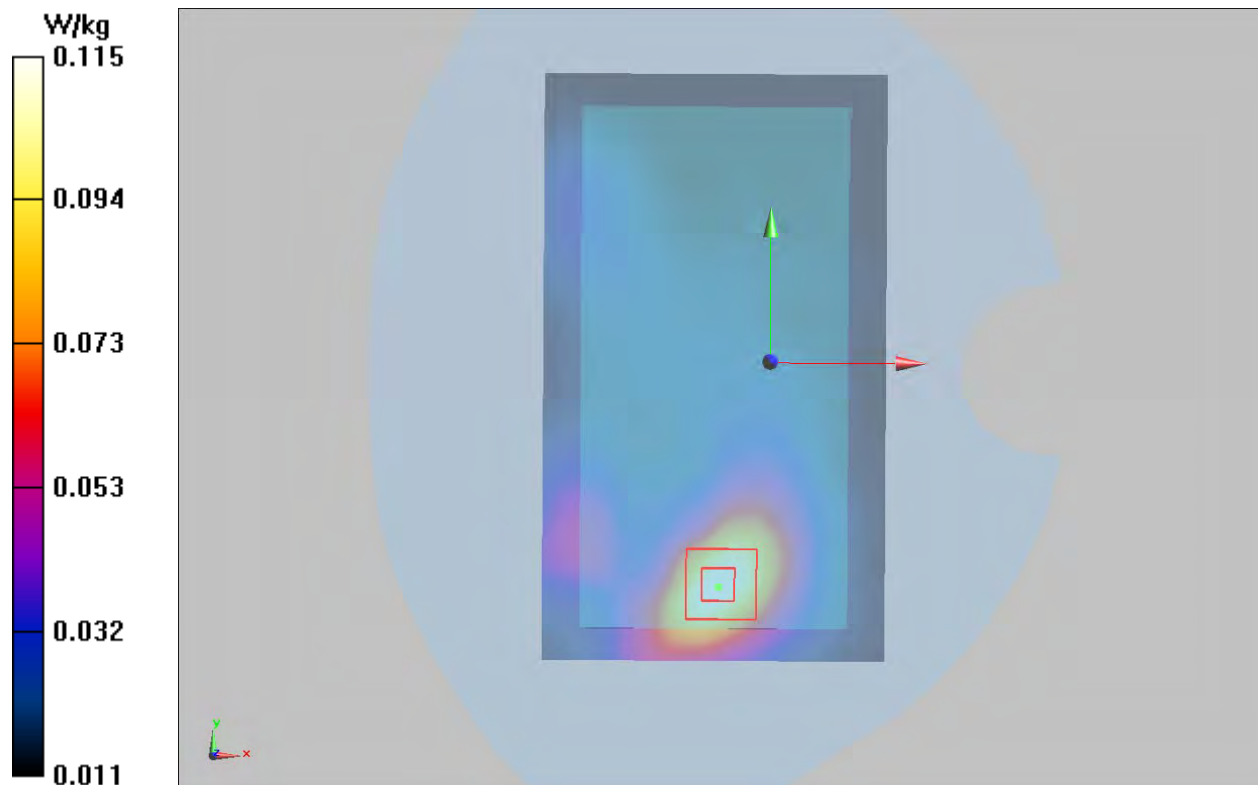
**Front Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.112 V/m; Power Drift = -0.170 dB

Peak SAR (extrapolated) = 0.157 W/kg

**SAR(1 g) = 0.106 W/kg; SAR(10 g) = 0.068 W/kg**

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



**Plot 18 GSM 1900 GPRS (4Txslots) Back Side Middle (Distance 10mm)**

Date: 10/25/2018

Communication System: UID 0, GPRS 4TX (0); Frequency: 1880 MHz; Duty Cycle: 1:2.07491

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.477$  S/m;  $\epsilon_r = 51.607$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.387 W/kg

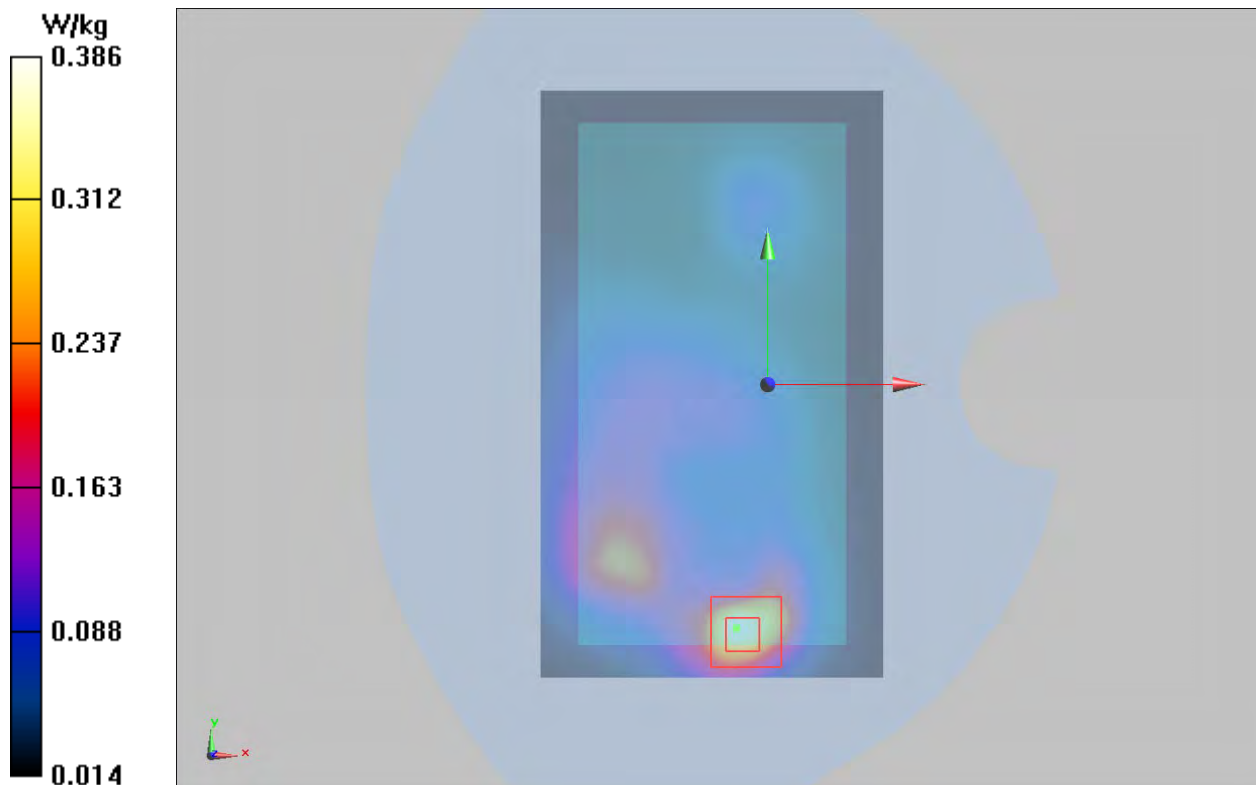
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.677 V/m; Power Drift = 0.080 dB

Peak SAR (extrapolated) = 0.567 W/kg

**SAR(1 g) = 0.343 W/kg; SAR(10 g) = 0.180 W/kg**

Maximum value of SAR (measured) = 0.386 W/kg



**Plot 19 UMTS Band II Right Cheek Middle**

Date: 10/25/2018

Communication System: UID 0, WCDMA II (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.371$  S/m;  $\epsilon_r = 40.715$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.96, 7.96, 7.96); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Right Cheek Middle/Area Scan (81x131x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.161 W/kg

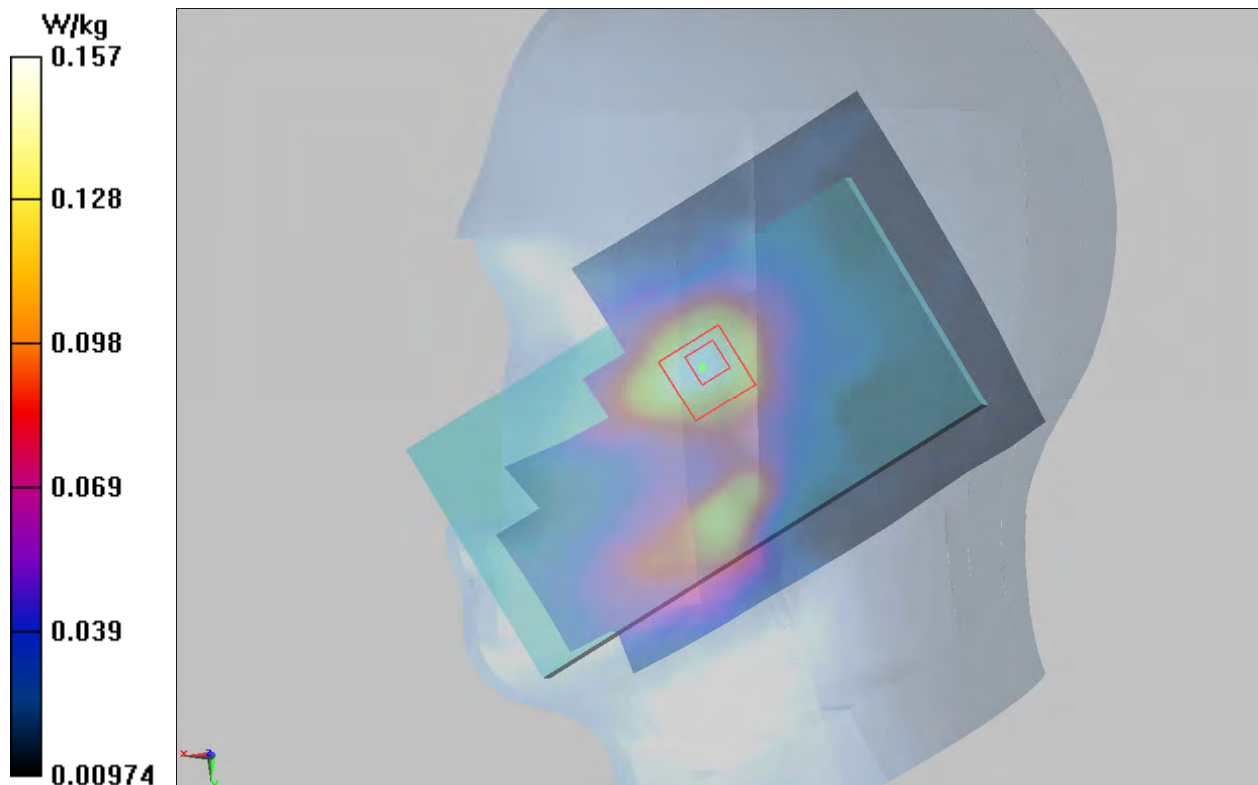
**Right Cheek Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.344 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.202 W/kg

**SAR(1 g) = 0.146 W/kg; SAR(10 g) = 0.099 W/kg**

Maximum value of SAR (measured) = 0.157 W/kg



**Plot 20 UMTS Band II Back Side Middle (Distance 15mm)**

Date: 10/25/2018

Communication System: UID 0, WCDMA II (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.477$  S/m;  $\epsilon_r = 51.607$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.238 W/kg

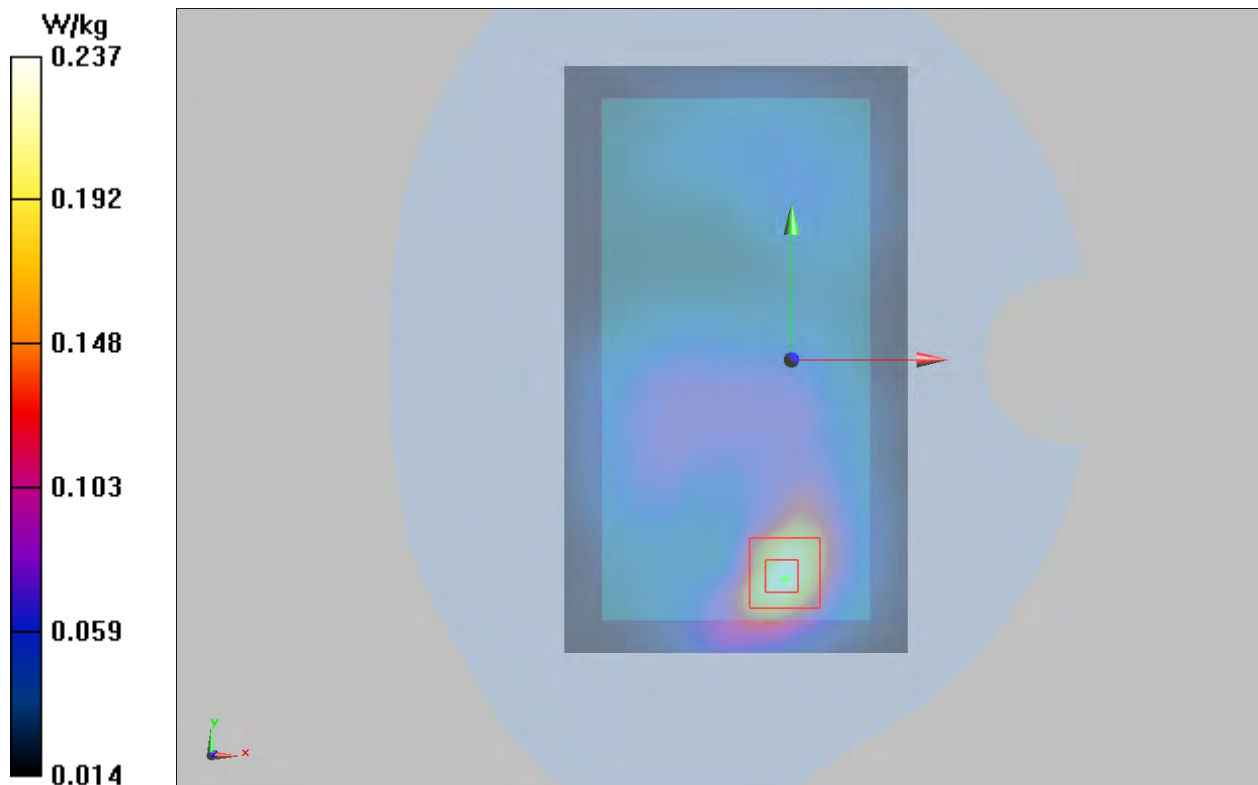
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.867 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.344 W/kg

**SAR(1 g) = 0.214 W/kg; SAR(10 g) = 0.122 W/kg**

Maximum value of SAR (measured) = 0.237 W/kg



**Plot 21 UMTS Band II Back Side Middle (Distance 10mm)**

Date: 10/25/2018

Communication System: UID 0, WCDMA II (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.477$  S/m;  $\epsilon_r = 51.607$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.446 W/kg

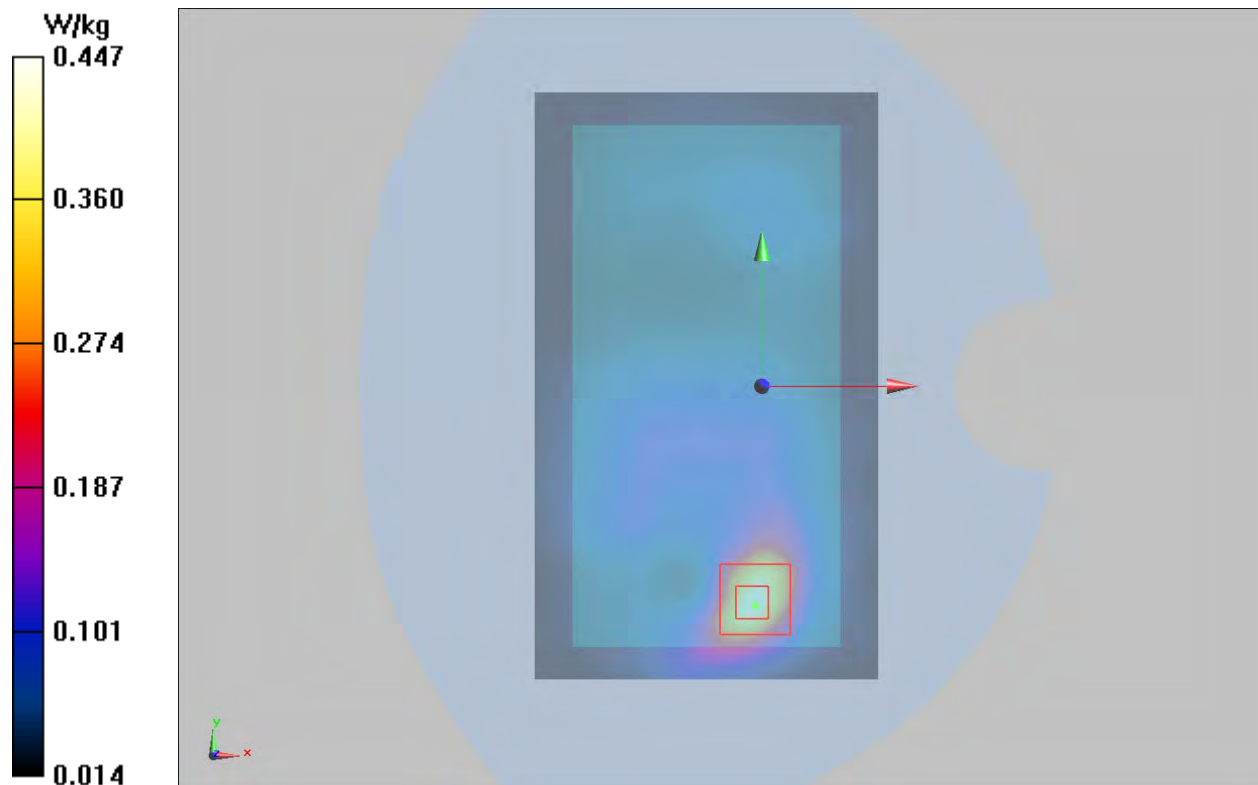
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.724 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.670 W/kg

**SAR(1 g) = 0.398 W/kg; SAR(10 g) = 0.211 W/kg**

Maximum value of SAR (measured) = 0.447 W/kg



**Plot 22 UMTS Band V Right Cheek Middle**

Date: 10/26/2018

Communication System: UID 0, WCDMA V (0); Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.916$  S/m;  $\epsilon_r = 41.951$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.10, 9.10, 9.10); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Right Cheek Middle/Area Scan (81x131x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.0806 W/kg

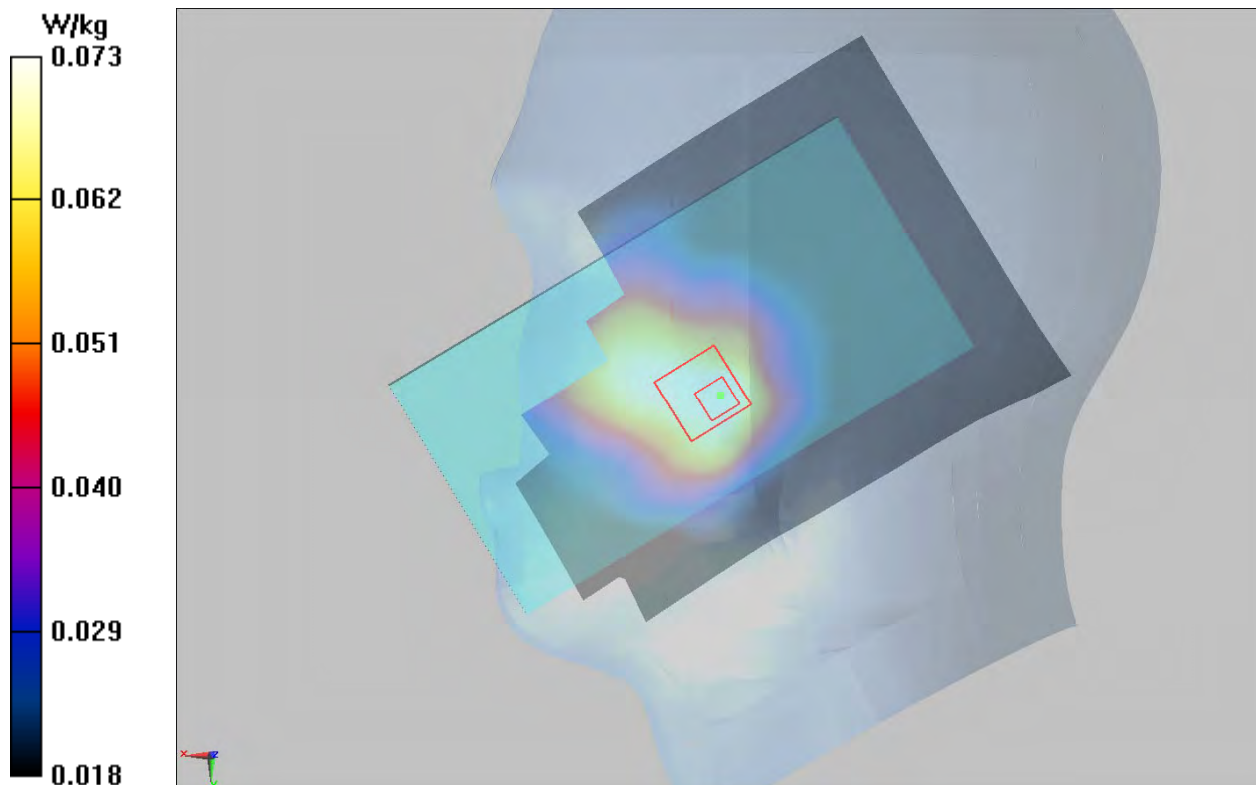
**Right Cheek Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.983 V/m; Power Drift = 0.036 dB

Peak SAR (extrapolated) = 0.0800 W/kg

**SAR(1 g) = 0.068 W/kg; SAR(10 g) = 0.056 W/kg**

Maximum value of SAR (measured) = 0.073 W/kg



**Plot 23 UMTS Band V Back Side Middle(Distance 15mm)**

Date: 10/26/2018

Communication System: UID 0, WCDMA V (0); Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 53.795$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.32, 9.32, 9.32); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

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

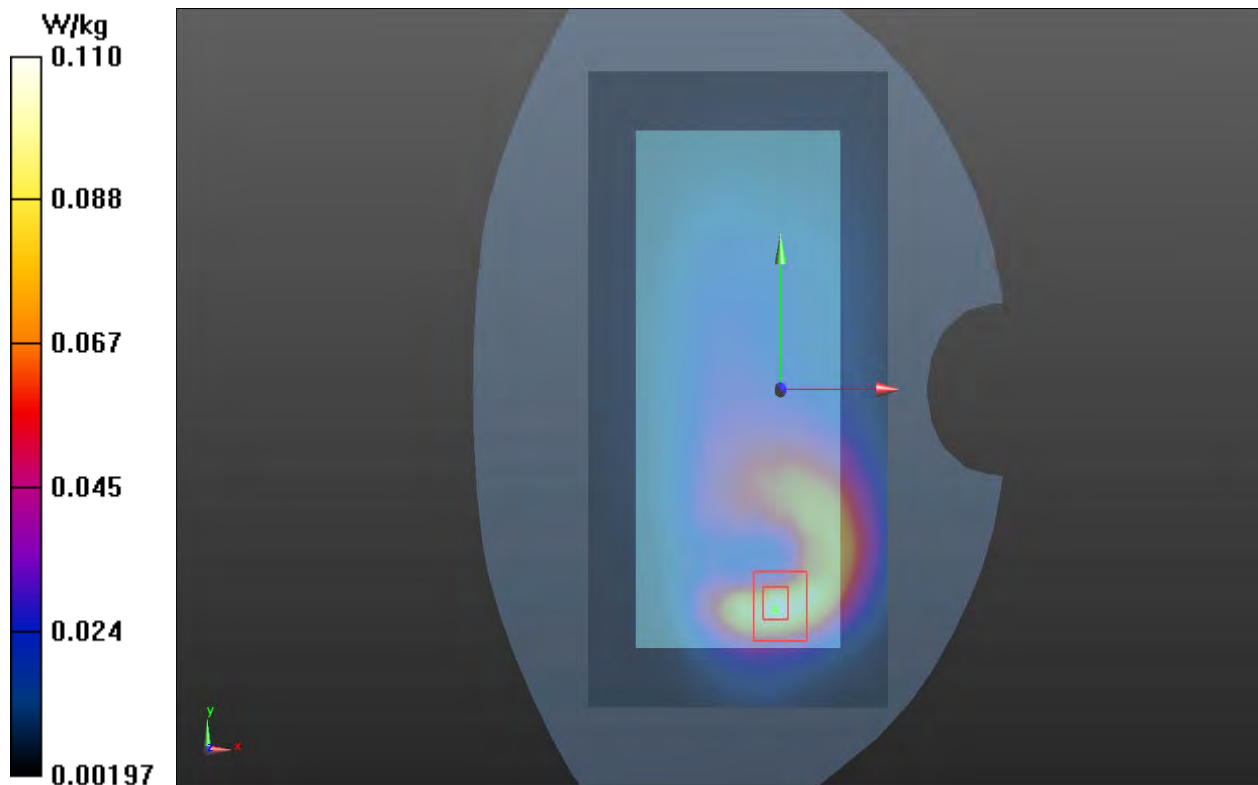
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.407 V/m; Power Drift = 0.042 dB

Peak SAR (extrapolated) = 0.111 W/kg

**SAR(1 g) = 0.081 W/kg; SAR(10 g) = 0.062 W/kg**

Maximum value of SAR (measured) = 0.110 W/kg



**Plot 24 UMTS Band V Back Side Middle (Distance 10mm)**

Date: 10/26/2018

Communication System: UID 0, WCDMA V (0); Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 53.795$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(9.32, 9.32, 9.32); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.282 W/kg

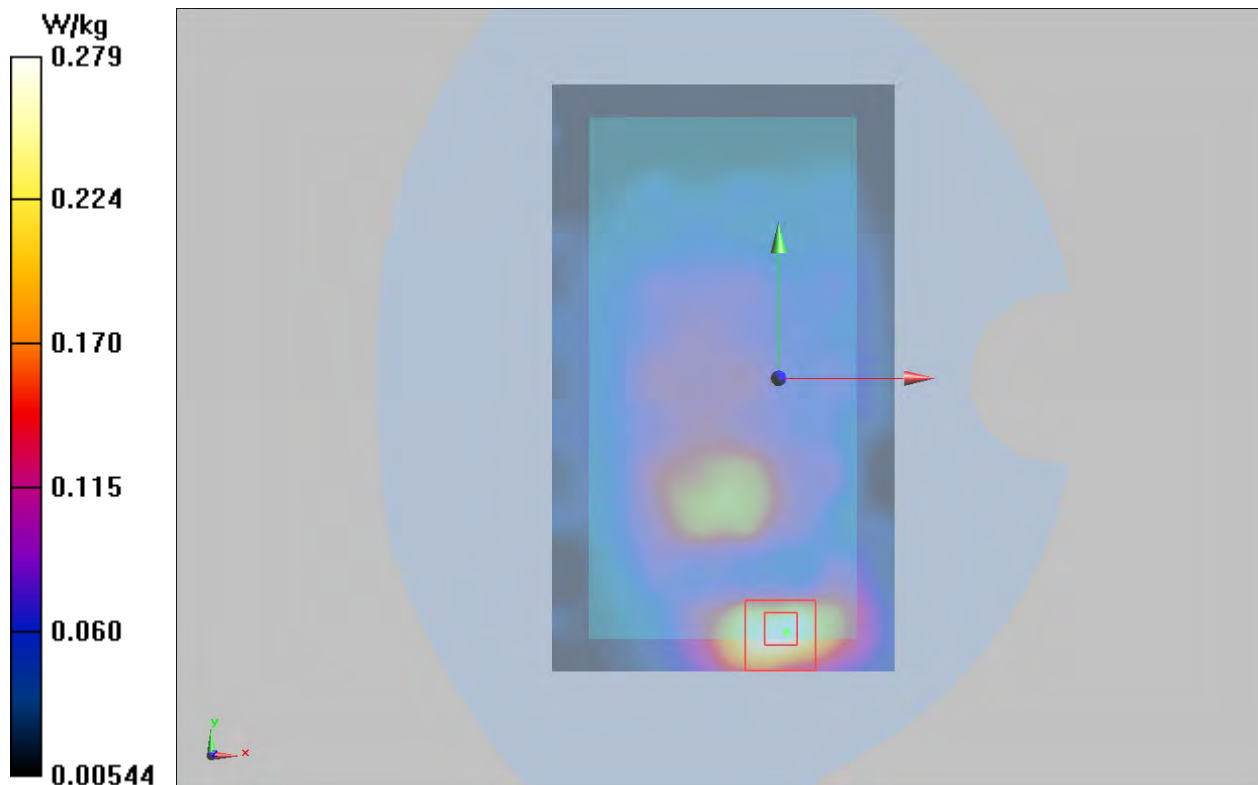
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.65 V/m; Power Drift = 0.054 dB

Peak SAR (extrapolated) = 0.430 W/kg

**SAR(1 g) = 0.253 W/kg; SAR(10 g) = 0.141 W/kg**

Maximum value of SAR (measured) = 0.279 W/kg





**Plot 25 LTE Band 2 1RB Right Cheek Middle**

Date: 10/25/2018

Communication System: UID 0, LTE (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.371$  S/m;  $\epsilon_r = 40.715$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.96, 7.96, 7.96); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Right Cheek Middle/Area Scan (81x131x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.287 W/kg

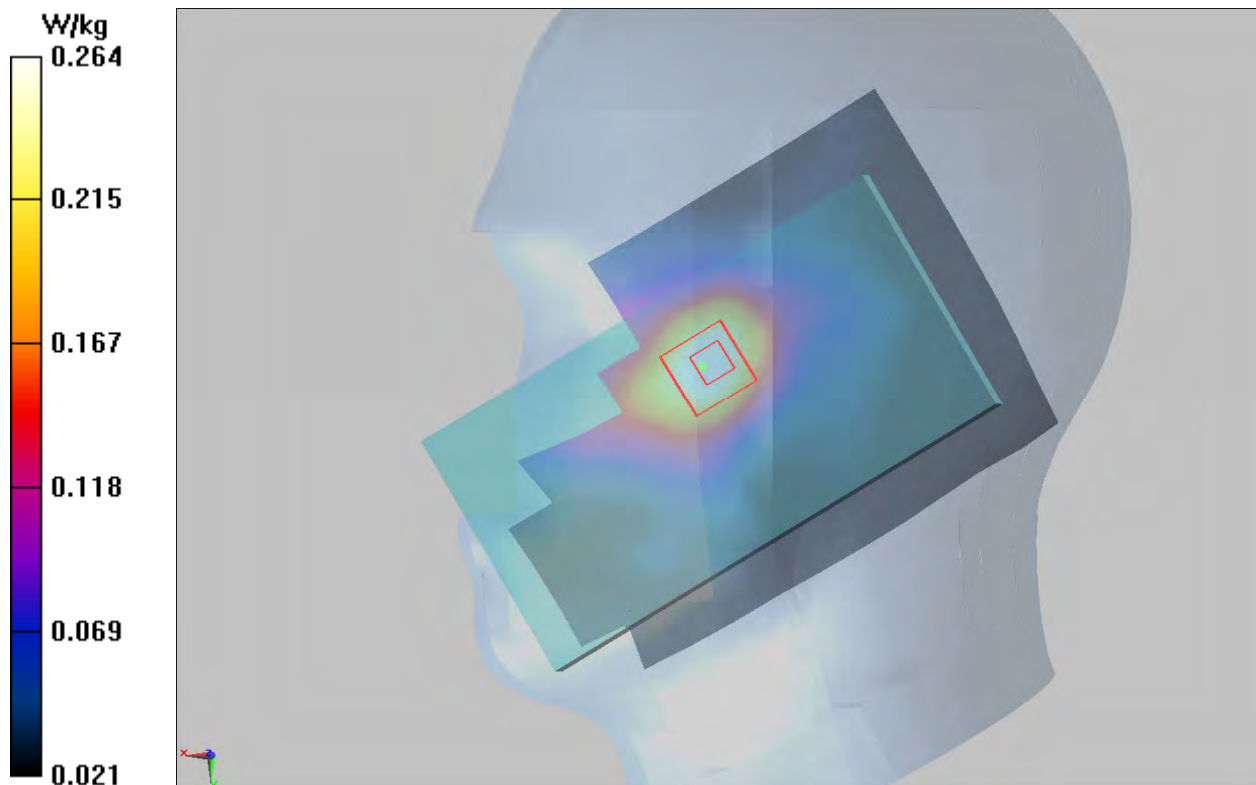
**Right Cheek Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.893 V/m; Power Drift = -0.084 dB

Peak SAR (extrapolated) = 0.341 W/kg

**SAR(1 g) = 0.250 W/kg; SAR(10 g) = 0.167 W/kg**

Maximum value of SAR (measured) = 0.264 W/kg



**Plot 26 LTE Band 2 1RB Back Side Middle (Distance 15mm)**

Date: 10/25/2018

Communication System: UID 0, LTE (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.477 \text{ S/m}$ ;  $\epsilon_r = 51.607$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid:  $dx=15 \text{ mm}$ ,  $dy=15 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.252 \text{ W/kg}$

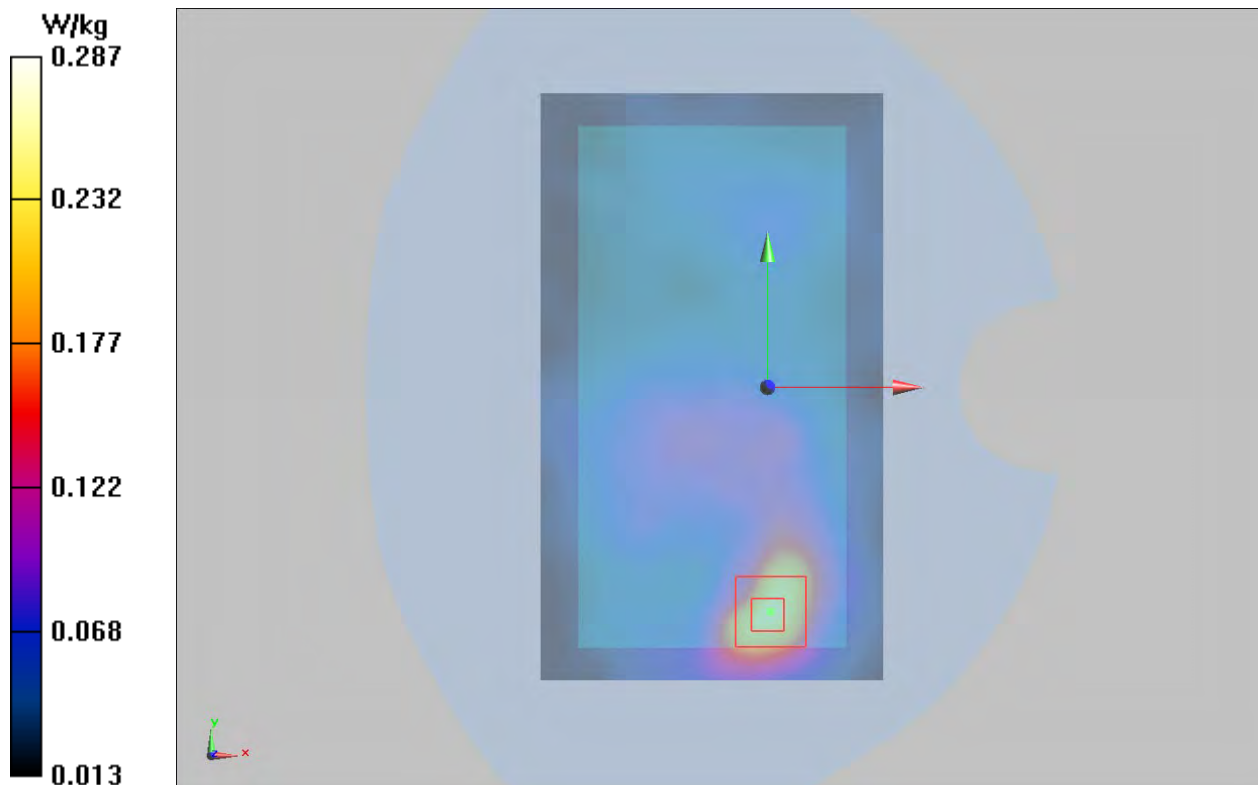
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $7.067 \text{ V/m}$ ; Power Drift =  $0.029 \text{ dB}$

Peak SAR (extrapolated) =  $0.417 \text{ W/kg}$

**SAR(1 g) =  $0.256 \text{ W/kg}$ ; SAR(10 g) =  $0.144 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.287 \text{ W/kg}$



**Plot 27 LTE Band 2 1RB Back Side Middle (Distance 10mm)**

Date: 10/25/2018

Communication System: UID 0, LTE (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.477$  S/m;  $\epsilon_r = 51.607$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.70, 7.70, 7.70); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (71x121x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.526 W/kg

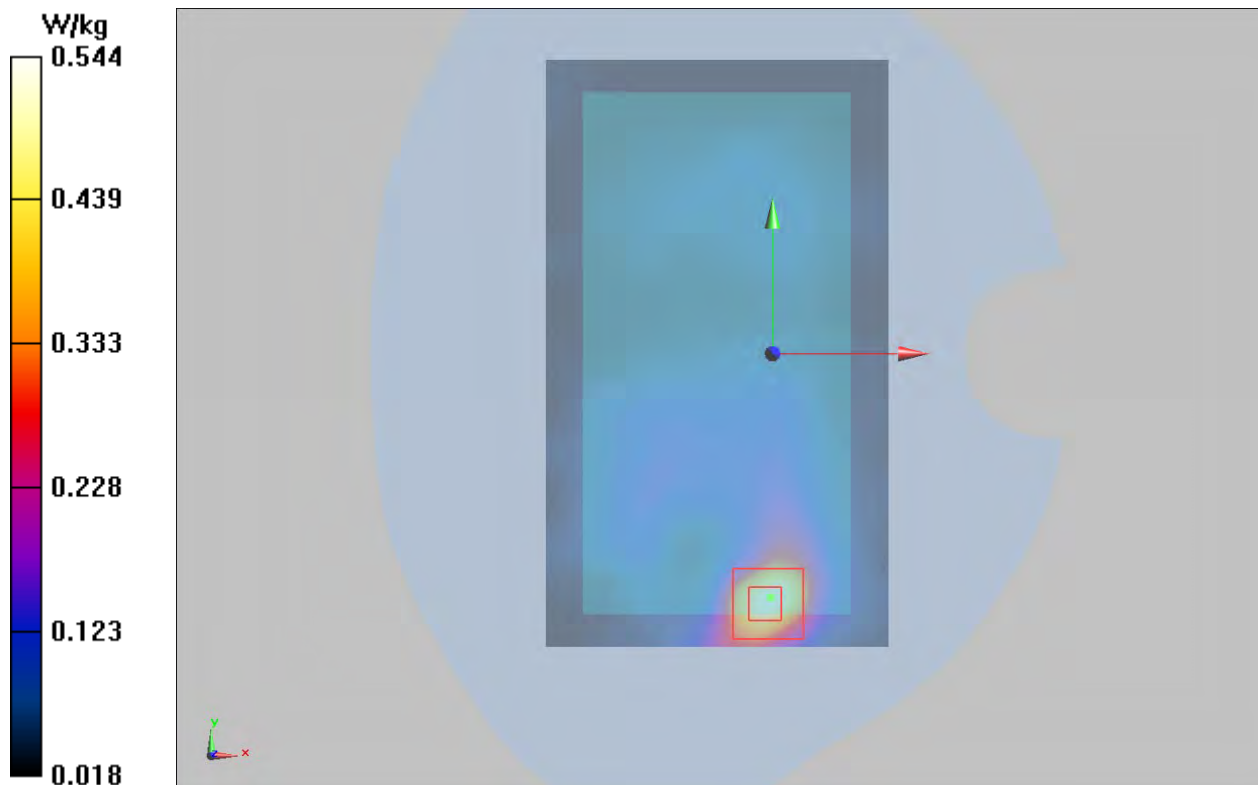
**Back Side Middle/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.822 V/m; Power Drift = -0.084 dB

Peak SAR (extrapolated) = 0.833 W/kg

**SAR(1 g) = 0.490 W/kg; SAR(10 g) = 0.257 W/kg**

Maximum value of SAR (measured) = 0.544 W/kg



**Plot 28 LTE Band 7 50%RB Left Cheek High**

Date: 10/28/2018

Communication System: UID 0, LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2560$  MHz;  $\sigma = 1.969$  S/m;  $\epsilon_r = 39.309$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.28, 7.28, 7.28); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Left Cheek High/Area Scan (101x201x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0837 W/kg

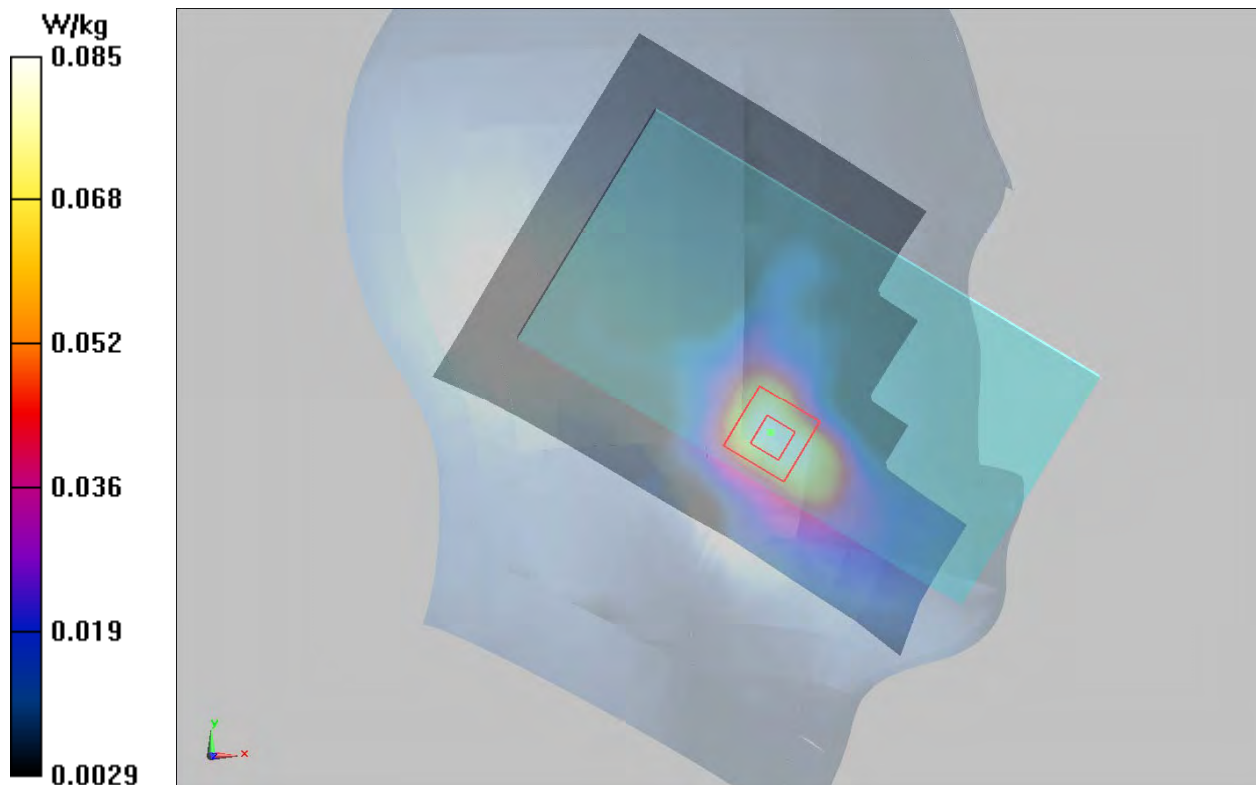
**Left Cheek High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.689 V/m; Power Drift = 0.152 dB

Peak SAR (extrapolated) = 0.157 W/kg

**SAR(1 g) = 0.078 W/kg; SAR(10 g) = 0.041 W/kg**

Maximum value of SAR (measured) = 0.085 W/kg



**Plot 29 LTE Band 7 1RB Back Side High (Distance 15mm)**

Date: 10/28/2018

Communication System: UID 0, LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2560$  MHz;  $\sigma = 2.105$  S/m;  $\epsilon_r = 50.784$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.16, 7.16, 7.16); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side High/Area Scan (101x201x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.348 W/kg

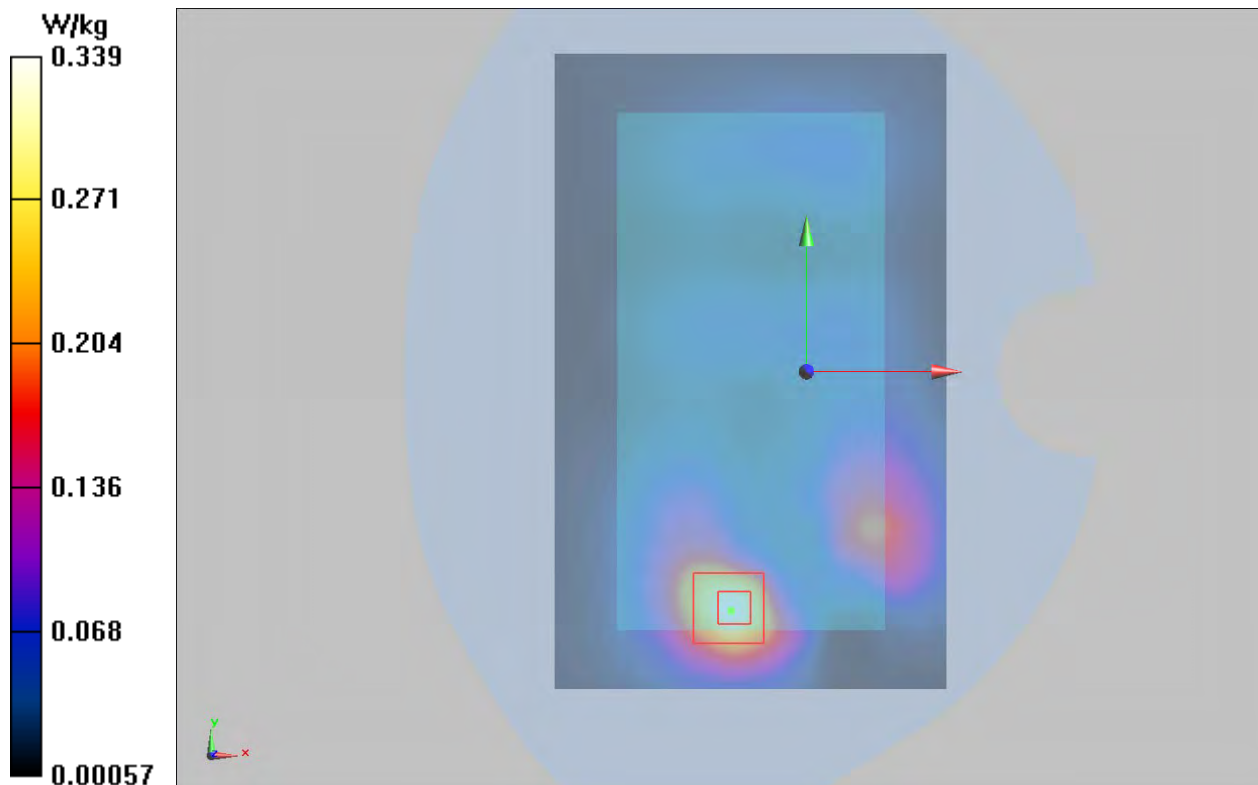
**Back Side High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.122 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.578 W/kg

**SAR(1 g) = 0.305 W/kg; SAR(10 g) = 0.155 W/kg**

Maximum value of SAR (measured) = 0.339 W/kg



**Plot 30 LTE Band 7 1RB Back Side High (Distance 10mm)**

Date: 10/28/2018

Communication System: UID 0, LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2560$  MHz;  $\sigma = 2.105$  S/m;  $\epsilon_r = 50.784$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.16, 7.16, 7.16); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side High/Area Scan (101x201x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.725 W/kg

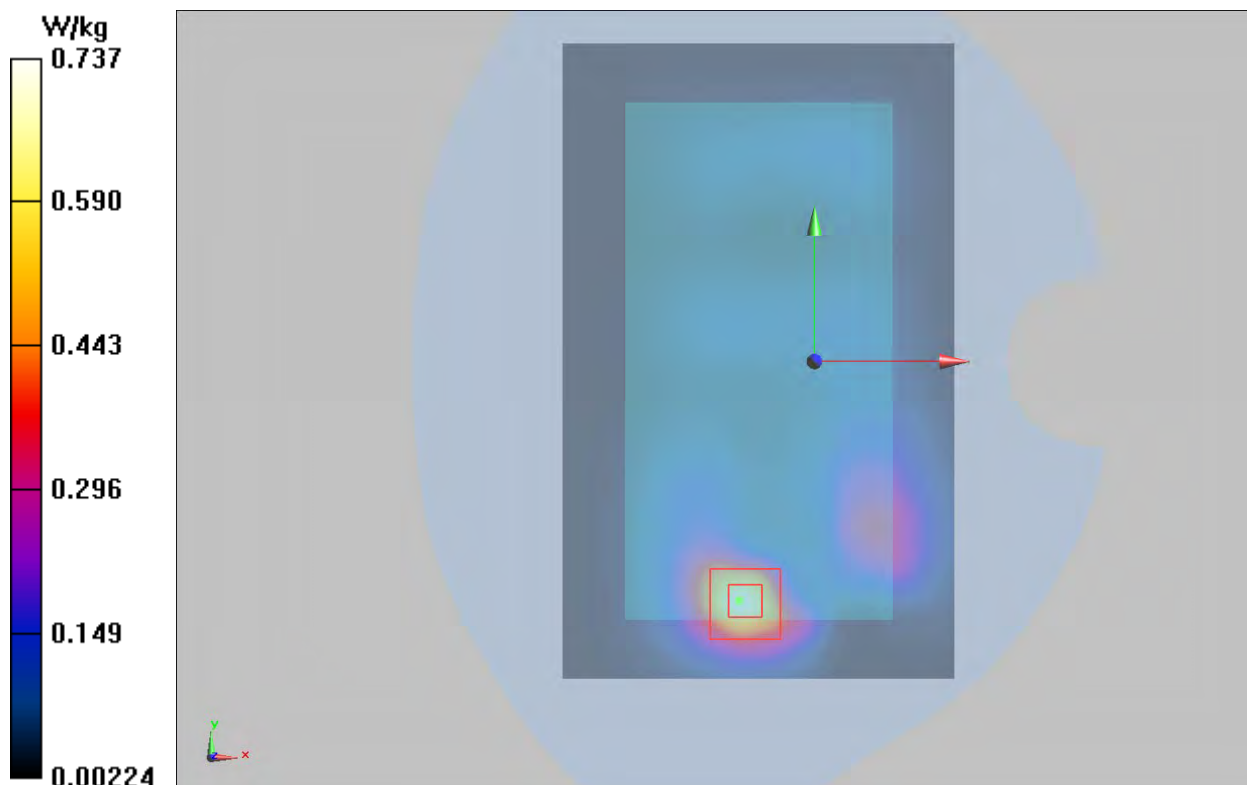
**Back Side High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm,, dz=5mm

Reference Value = 5.534 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 1.29 W/kg

**SAR(1 g) = 0.650 W/kg; SAR(10 g) = 0.307 W/kg**

Maximum value of SAR (measured) = 0.737 W/kg



**Plot 31 802.11b Left Cheek Middle**

Date: 11/2/2018

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz;Duty Cycle: 1:1.00503

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.833$  S/m;  $\epsilon_r = 39.761$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.57, 7.57, 7.57); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Left Cheek Middle/Area Scan (101x201x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.486 W/kg

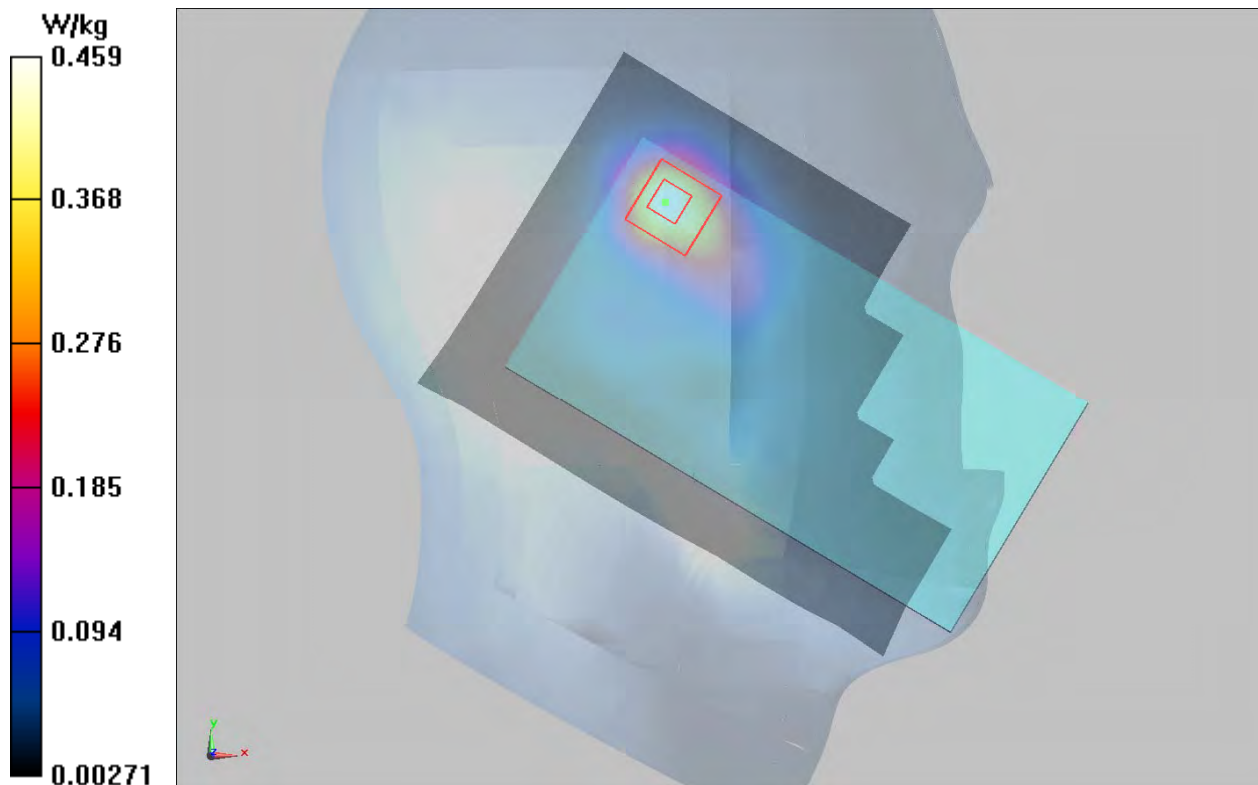
**Left Cheek Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.104 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 0.953 W/kg

**SAR(1 g) = 0.422 W/kg; SAR(10 g) = 0.202 W/kg**

Maximum value of SAR (measured) = 0.459 W/kg



**Plot 32 802.11b Back Side Middle (Distance 15mm)**

Date: 11/2/2018

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1.00503

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.959$  S/m;  $\epsilon_r = 51.134$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.53, 7.53, 7.53); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side Middle/Area Scan (101x201x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0793 W/kg

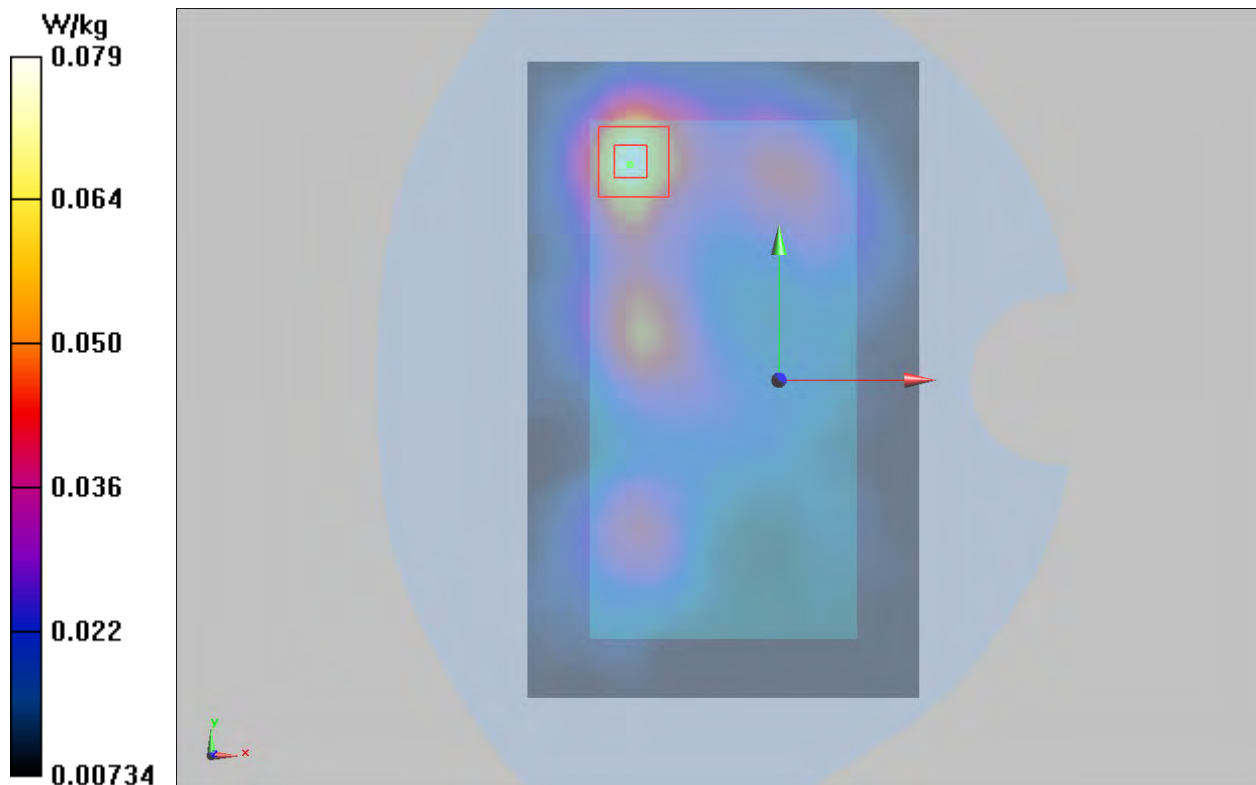
**Back Side Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.688 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.137 W/kg

**SAR(1 g) = 0.071 W/kg; SAR(10 g) = 0.039 W/kg**

Maximum value of SAR (measured) = 0.0786 W/kg





**Plot 33 802.11b Front Side Middle (Distance 10mm)**

Date: 11/2/2018

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1.00502

Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.959$  S/m;  $\epsilon_r = 51.134$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.53, 7.53, 7.53); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Front Side Middle/Area Scan (101x201x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.133 W/kg

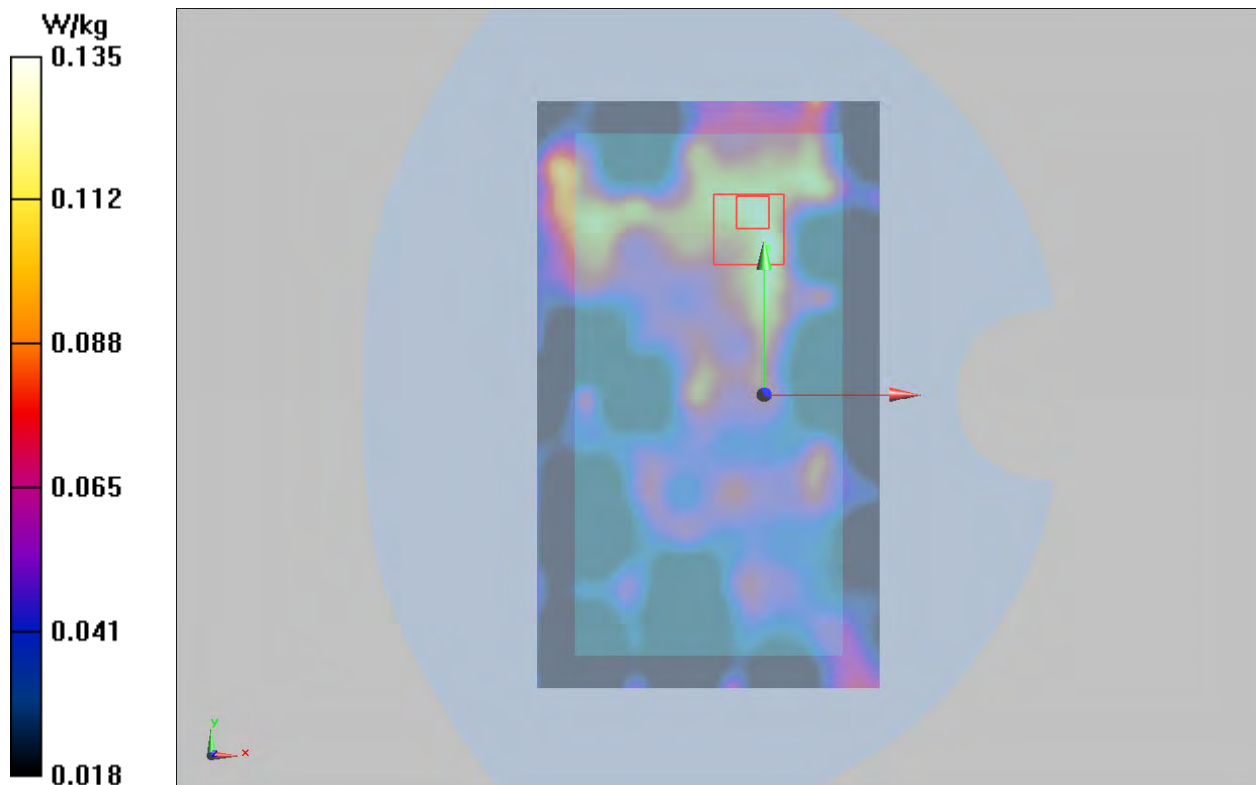
**Front Side Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.742 V/m; Power Drift = -0.065 dB

Peak SAR (extrapolated) = 0.234 W/kg

**SAR(1 g) = 0.105 W/kg; SAR(10 g) = 0.063 W/kg**

Maximum value of SAR (measured) = 0.135 W/kg



**Plot 34 802.11a U-NII-2A Left Cheek CH52**

Date: 11/2/2018

Communication System: UID 0, 802.11a (0); Frequency: 5260 MHz; Duty Cycle: 1:1.02564

Medium parameters used:  $f = 5260$  MHz;  $\sigma = 4.795$  S/m;  $\epsilon_r = 36.874$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(5.60, 5.60, 5.60); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Left Cheek CH52/Area Scan (121x211x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.447 W/kg

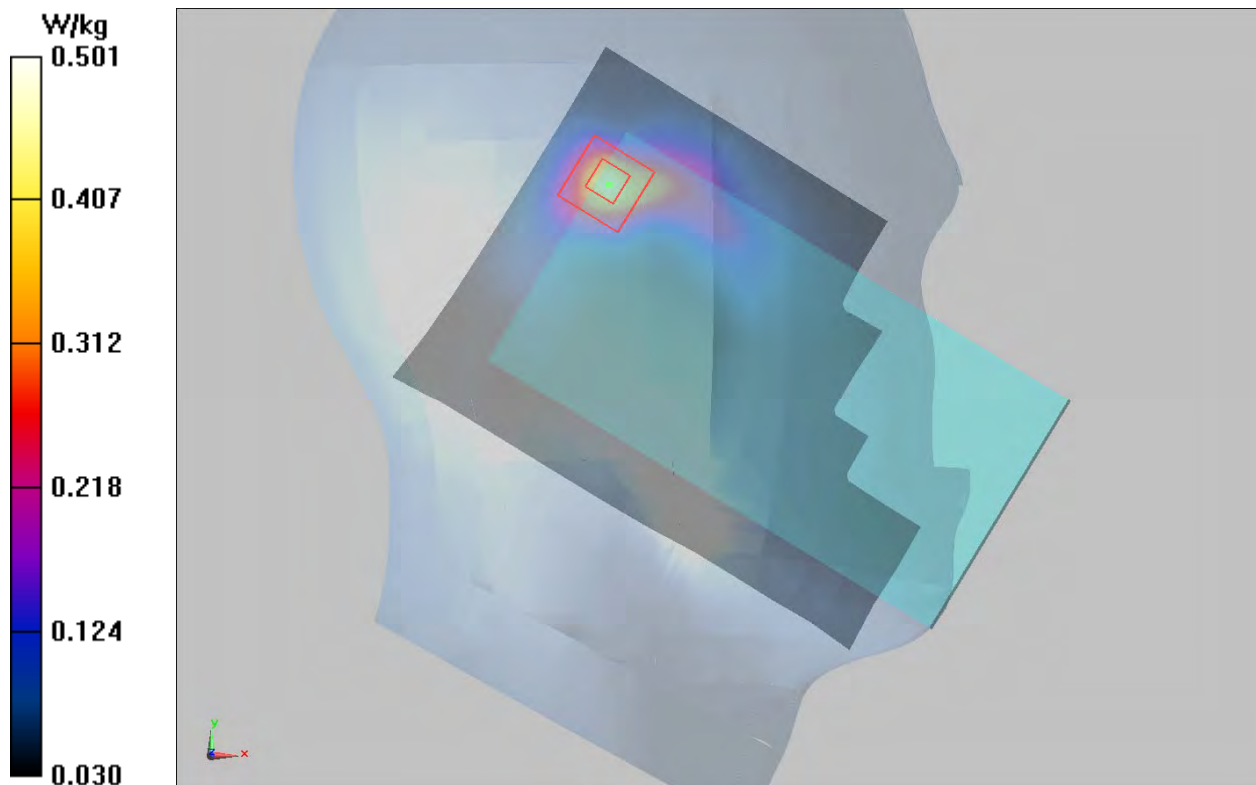
**Left Cheek CH52/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 3.435 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.17 W/kg

**SAR(1 g) = 0.414 W/kg; SAR(10 g) = 0.170 W/kg**

Maximum value of SAR (measured) = 0.501 W/kg



**Plot 35 802.11a U-NII-2A Back Side CH52 (Distance 15mm)**

Date: 11/2/2018

Communication System: UID 0, 802.11a (0); Frequency: 5260 MHz; Duty Cycle: 1:1.02564

Medium parameters used:  $f = 5260$  MHz;  $\sigma = 5.416$  S/m;  $\epsilon_r = 49.162$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(5.04, 5.04, 5.04); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side CH52/Area Scan (121x211x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.165 W/kg

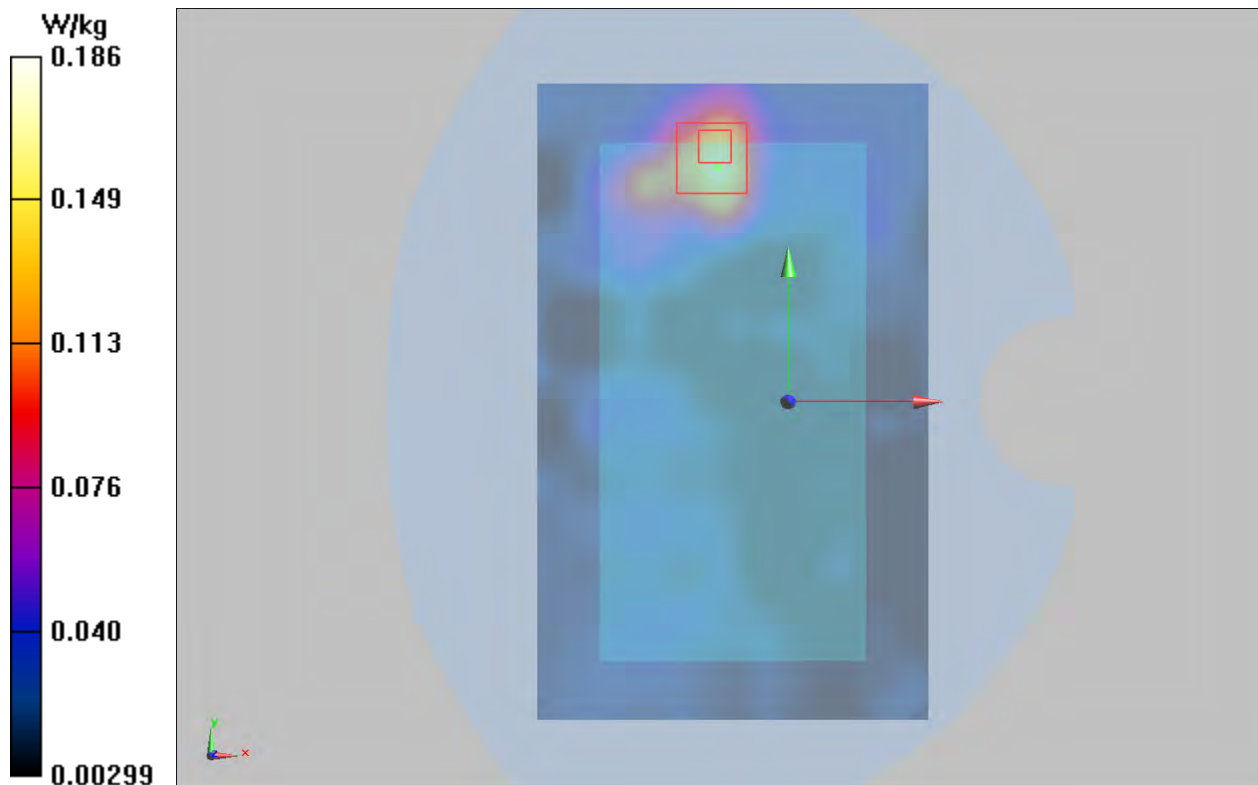
**Back Side CH52/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm,, dz=2mm

Reference Value = 0.8860 V/m; Power Drift = 0.039 dB

Peak SAR (extrapolated) = 0.757 W/kg

**SAR(1 g) = 0.160 W/kg; SAR(10 g) = 0.070 W/kg**

Maximum value of SAR (measured) = 0.186 W/kg



**Plot 36 802.11a U-NII-2A Back Side CH52 (Distance 0mm)**

Date: 11/2/2018

Communication System: UID 0, 802.11a (0); Frequency: 5260 MHz; Duty Cycle: 1:1.02564

Medium parameters used:  $f = 5260$  MHz;  $\sigma = 5.416$  S/m;  $\epsilon_r = 49.162$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(5.04, 5.04, 5.04); Calibrated: 5/29/2018;

Electronics: DAE4 SN1317; Calibrated: 3/23/2018

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side CH52/Area Scan(121x211x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.36 W/kg

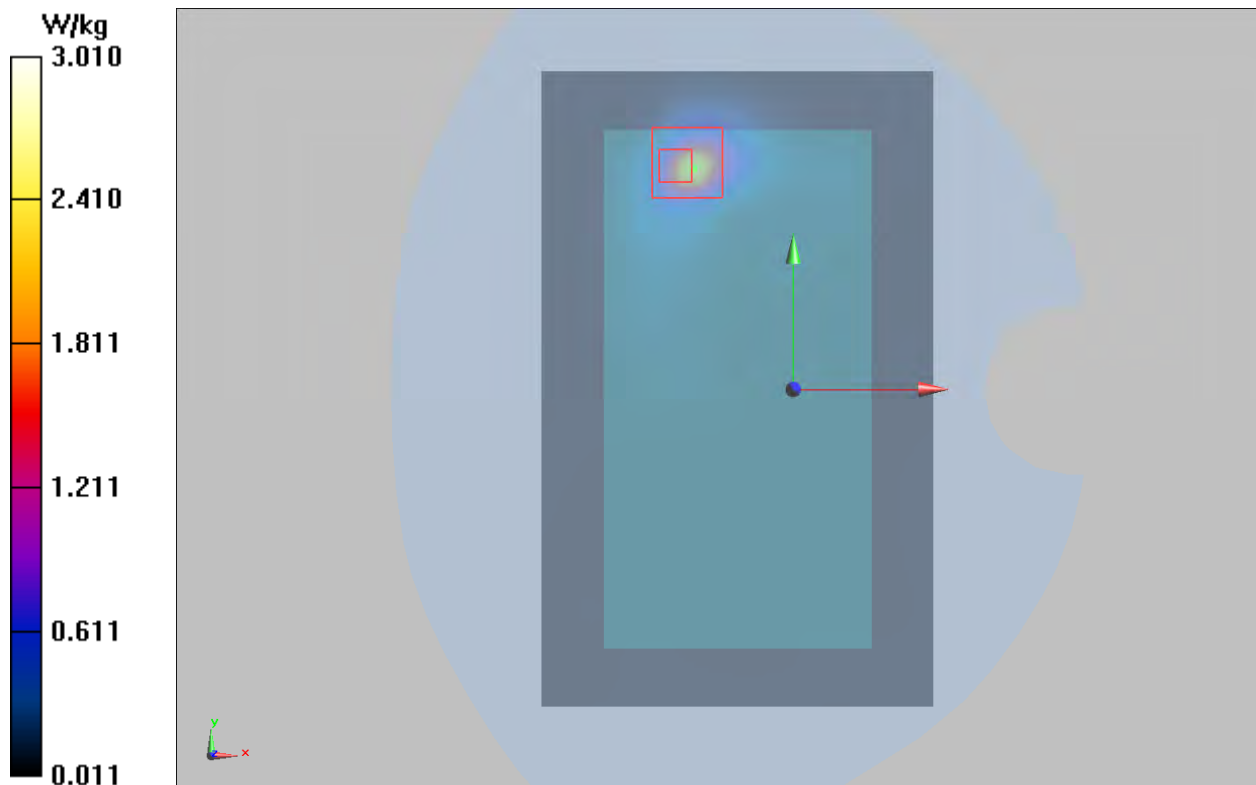
**Back Side CH52/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 1.388 V/m; Power Drift = 0.063 dB

Peak SAR (extrapolated) = 6.34 W/kg

**SAR(1 g) = 2.1 W/kg; SAR(10 g) = 0.672 W/kg**

Maximum value of SAR (measured) = 3.010 W/kg



**Plot 37 802.11a U-NII-2C Left Tilt CH100**

Date: 12/5/2018

Communication System: UID 0, 802.11a (0); Frequency: 5500 MHz; Duty Cycle: 1:1.025

Medium parameters used:  $f = 5500 \text{ MHz}$ ;  $\sigma = 5.12 \text{ S/m}$ ;  $\epsilon_r = 36.25$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3 \text{ }^\circ\text{C}$       Liquid Temperature:  $21.5 \text{ }^\circ\text{C}$

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(4.87, 4.87, 4.87); Calibrated: 5/29/2018;

Electronics: DAE4 Sn1317; Calibrated: 2018/3/23

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Left Tilt CH100/Area Scan (121x211x1):** Interpolated grid:  $dx=10 \text{ mm}$ ,  $dy=10 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.608 \text{ W/kg}$

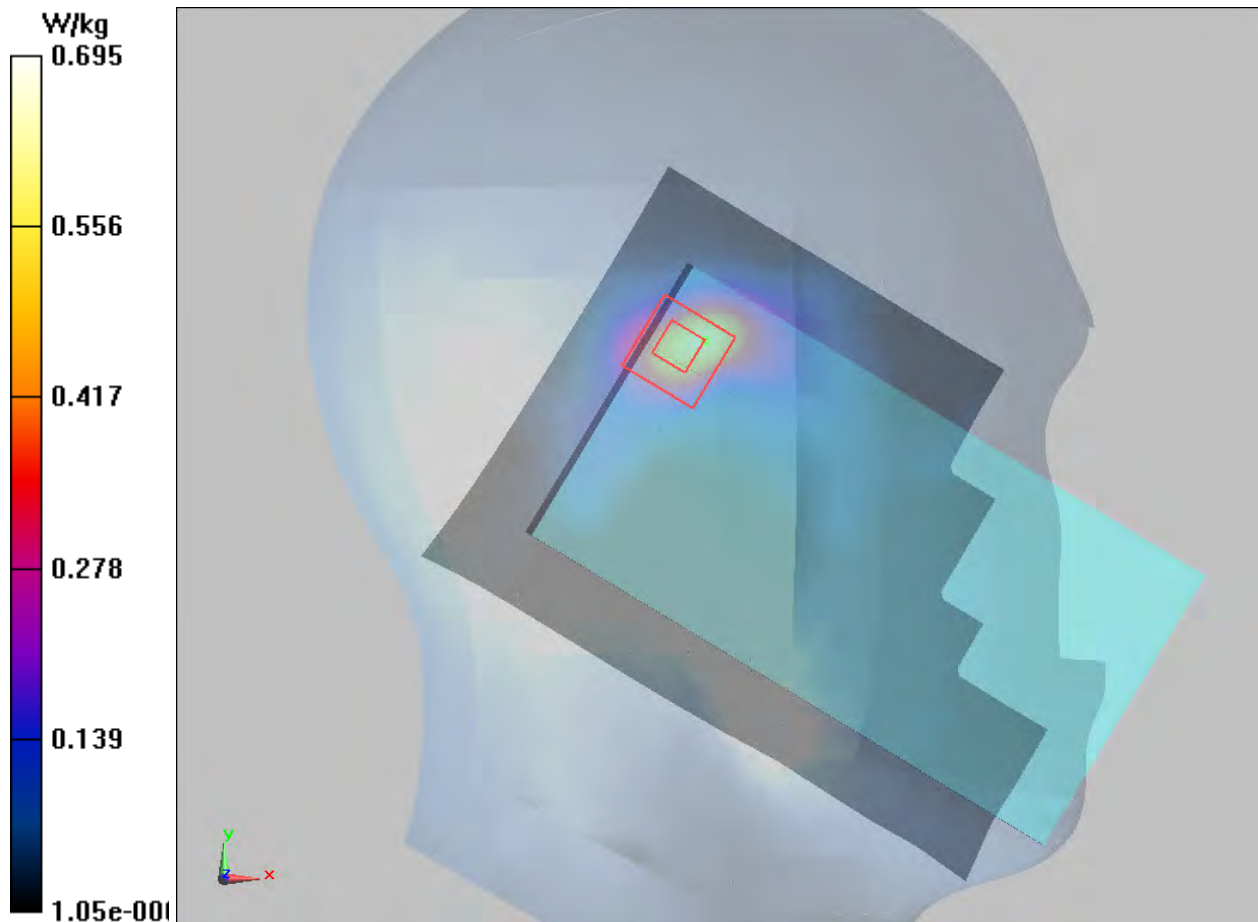
**Left Tilt CH100/Zoom Scan (7x7x12)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=2\text{mm}$

Reference Value =  $3.839 \text{ V/m}$ ; Power Drift =  $0.154 \text{ dB}$

Peak SAR (extrapolated) =  $1.80 \text{ W/kg}$

**SAR(1 g) =  $0.615 \text{ W/kg}$ ; SAR(10 g) =  $0.224 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.695 \text{ W/kg}$



**Plot 38 802.11a U-NII-2C Back Side CH100 (Distance 15mm)**

Date: 12/5/2018

Communication System: UID 0, 802.11a (0); Frequency: 5500 MHz; Duty Cycle: 1:1.025

Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.8$  S/m;  $\epsilon_r = 48.468$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(4.27, 4.27, 4.27); Calibrated: 5/29/2018;

Electronics: DAE4 Sn1317; Calibrated: 2018/3/23

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side CH100/Area Scan (121x211x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.140 W/kg

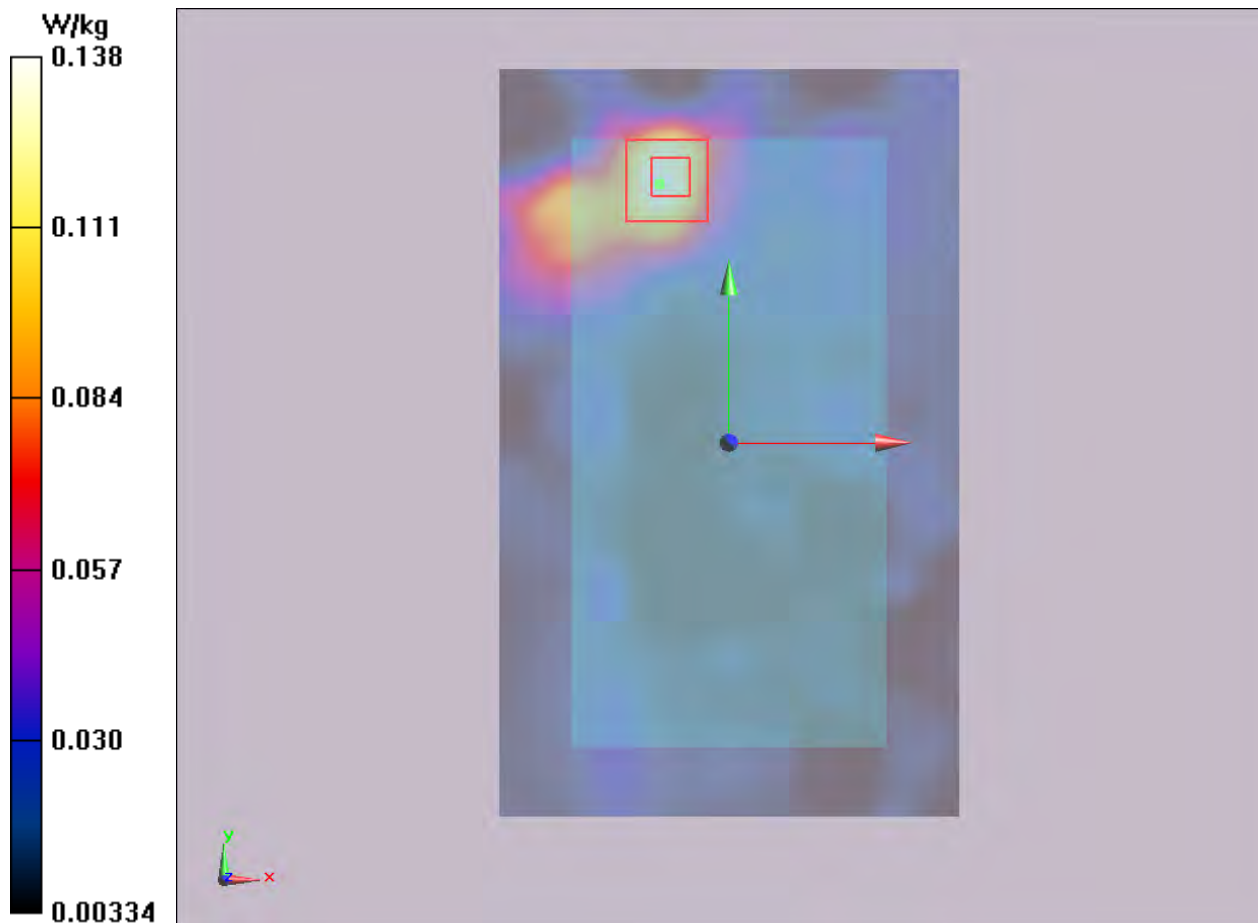
**Back Side CH100/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 1.000 V/m; Power Drift = 0.053dB

Peak SAR (extrapolated) = 0.378 W/kg

**SAR(1 g) = 0.131 W/kg; SAR(10 g) = 0.058 W/kg**

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



**Plot 39 802.11a U-NII-2C Back Side CH100 (Distance 0mm)**

Date: 12/5/2018

Communication System: UID 0, 802.11a (0); Frequency: 5500 MHz; Duty Cycle: 1:1.025

Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.8$  S/m;  $\epsilon_r = 48.468$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(4.27, 4.27, 4.27); Calibrated: 5/29/2018;

Electronics: DAE4 Sn1317; Calibrated: 2018/3/23

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Back Side CH100/Area Scan (121x211x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.70 W/kg

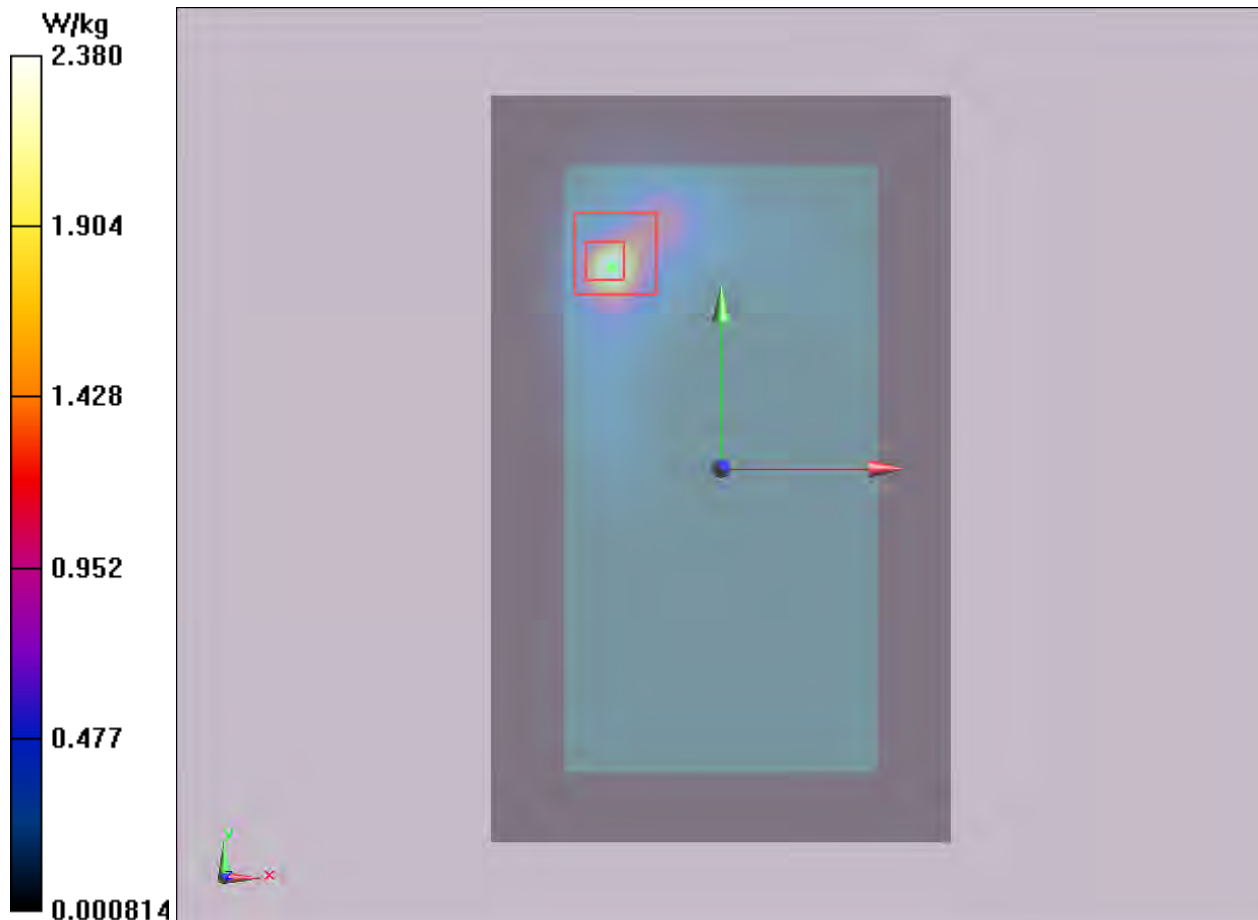
**Back Side CH100/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0.8550 V/m; Power Drift = 0.054dB

Peak SAR (extrapolated) = 5.41 W/kg

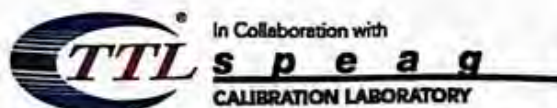
**SAR(1 g) = 1.78 W/kg; SAR(10 g) = 0.607 W/kg**

Maximum value of SAR (measured) = 2.38 W/kg





## ANNEX D: Probe Calibration Certificate



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

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: [ctl@chinattl.com](mailto:ctl@chinattl.com) <http://www.chinattl.cn>



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Client **TA(shanghai)**Certificate No: **Z18-60093****CALIBRATION CERTIFICATE**

Object: **EX3DV4 - SN:3677**

Calibration Procedure(s): **FF-Z11-004-01**  
**Calibration Procedures for Dosimetric E-field Probes**

Calibration date: **May 29, 2018**

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 NRP2	101919	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101547	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101548	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Reference10dBAttenuator	18N50W-10dB	09-Feb-18(CTTL, No.J18X01133)	Feb-20
Reference20dBAttenuator	18N50W-20dB	09-Feb-18(CTTL, No.J18X01132)	Feb-20
Reference Probe EX3DV4	SN 3846	25-Jan-18(SPEAG,No.EX3-3846_Jan18)	Jan-19
DAE4	SN 777	15-Dec-17(SPEAG, No.DAE4-777_Dec17)	Dec -18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-17 (CTTL, No.J17X05858)	Jun-18
Network Analyzer E5071C	MY46110673	14-Jan-18 (CTTL, No.J18X00561)	Jan -19

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

Issued: May 31, 2018

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

Certificate No: Z18-60093

Page 1 of 11





Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
 E-mail: [ctl@chinatl.com](mailto:ctl@chinatl.com) <http://www.chinatl.cn>

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization $\Phi$	$\Phi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), $\theta=0$ is normal to probe axis

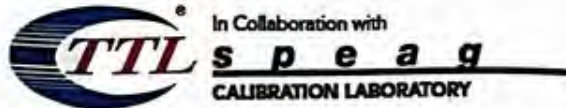
Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: [ttl@chinattl.com](mailto:ttl@chinattl.com) [Http://www.chinattl.cn](http://www.chinattl.cn)

# Probe EX3DV4

## SN: 3677

Calibrated: May 29, 2018

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com Http://www.chinattl.cn

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3677

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm( $\mu V/(V/m)^2$ ) <sup>A</sup>	0.41	0.46	0.41	±10.0%
DCP(mV) <sup>B</sup>	99.9	102.7	102.1	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB· $\mu V$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	152.4	±2.4%
		Y	0.0	0.0	1.0		161.7	
		Z	0.0	0.0	1.0		152.2	

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

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5 and Page 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
 E-mail: ttl@chinattl.com <http://www.chinattl.cn>

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3677

### Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	9.40	9.40	9.40	0.40	0.80	± 12.1%
835	41.5	0.90	9.10	9.10	9.10	0.15	1.41	± 12.1%
1750	40.1	1.37	8.19	8.19	8.19	0.21	1.15	± 12.1%
1900	40.0	1.40	7.96	7.96	7.96	0.25	1.01	± 12.1%
2300	39.5	1.67	7.91	7.91	7.91	0.40	0.78	± 12.1%
2450	39.2	1.80	7.57	7.57	7.57	0.53	0.76	± 12.1%
2600	39.0	1.96	7.28	7.28	7.28	0.64	0.70	± 12.1%
5250	35.9	4.71	5.60	5.60	5.60	0.40	1.15	± 13.3%
5600	35.5	5.07	4.87	4.87	4.87	0.45	1.05	± 13.3%
5750	35.4	5.22	4.99	4.99	4.99	0.45	1.35	± 13.3%

<sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



In Collaboration with  
**TTL SPEAG**  
**CALIBRATION LABORATORY**  
 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
 E-mail: cttl@chinattl.com Http://www.chinattl.cn

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3677

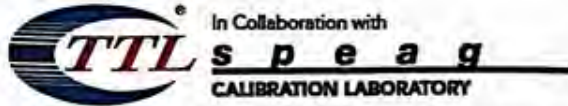
### Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	9.79	9.79	9.79	0.40	0.80	±12.1%
835	55.2	0.97	9.32	9.32	9.32	0.15	1.51	±12.1%
1750	53.4	1.49	7.91	7.91	7.91	0.23	1.09	±12.1%
1900	53.3	1.52	7.70	7.70	7.70	0.20	1.18	±12.1%
2300	52.9	1.81	7.65	7.65	7.65	0.53	0.82	±12.1%
2450	52.7	1.95	7.53	7.53	7.53	0.37	1.10	±12.1%
2600	52.5	2.16	7.16	7.16	7.16	0.55	0.80	±12.1%
5250	48.9	5.36	5.04	5.04	5.04	0.50	1.55	±13.3%
5600	48.5	5.77	4.27	4.27	4.27	0.51	1.66	±13.3%
5750	48.3	5.94	4.43	4.43	4.43	0.50	1.81	±13.3%

<sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

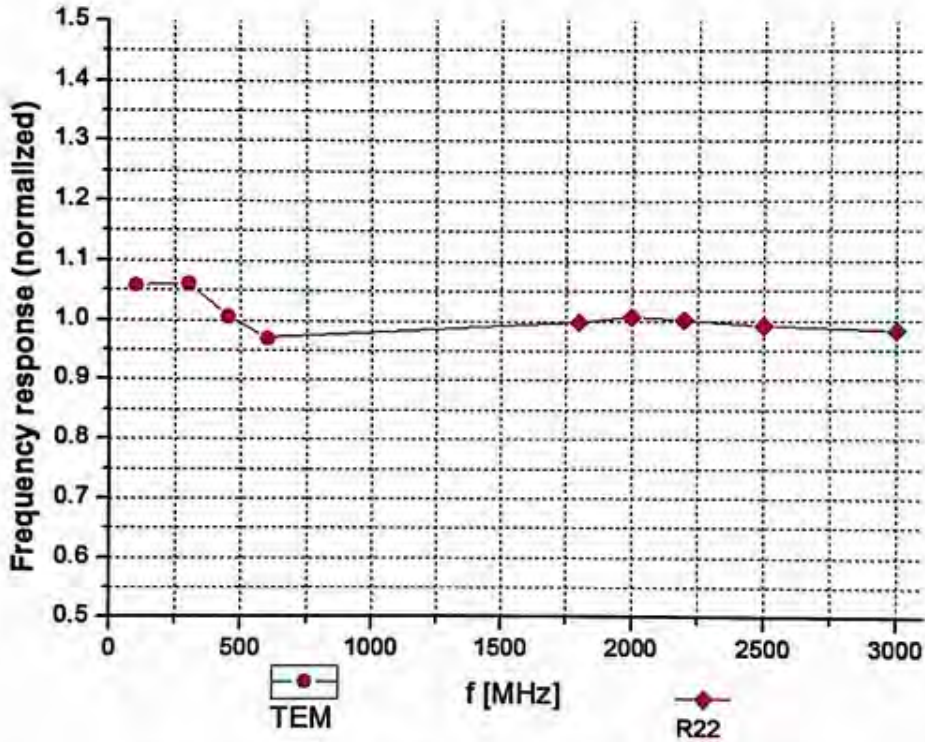
<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

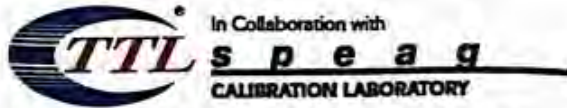


Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

### Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 7.4\%$  (k=2)

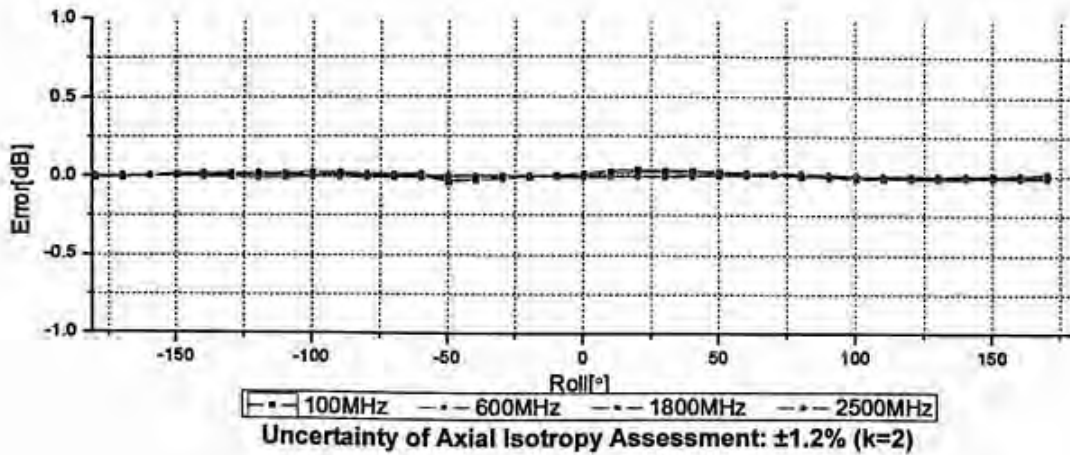
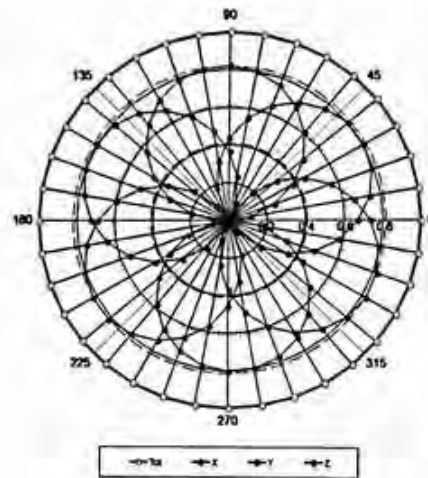
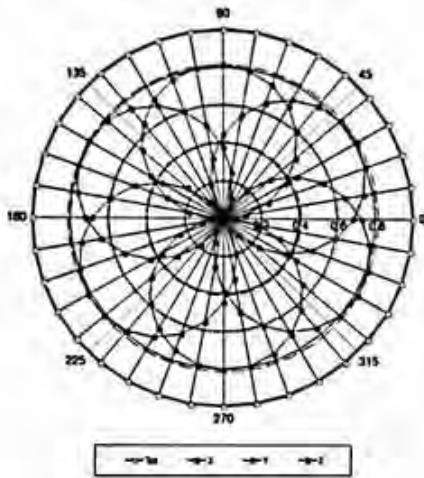


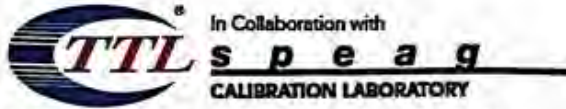
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
 E-mail: cttl@chinattl.com <http://www.chinattl.cn>

### Receiving Pattern ( $\Phi$ ), $\theta=0^\circ$

**f=600 MHz, TEM**

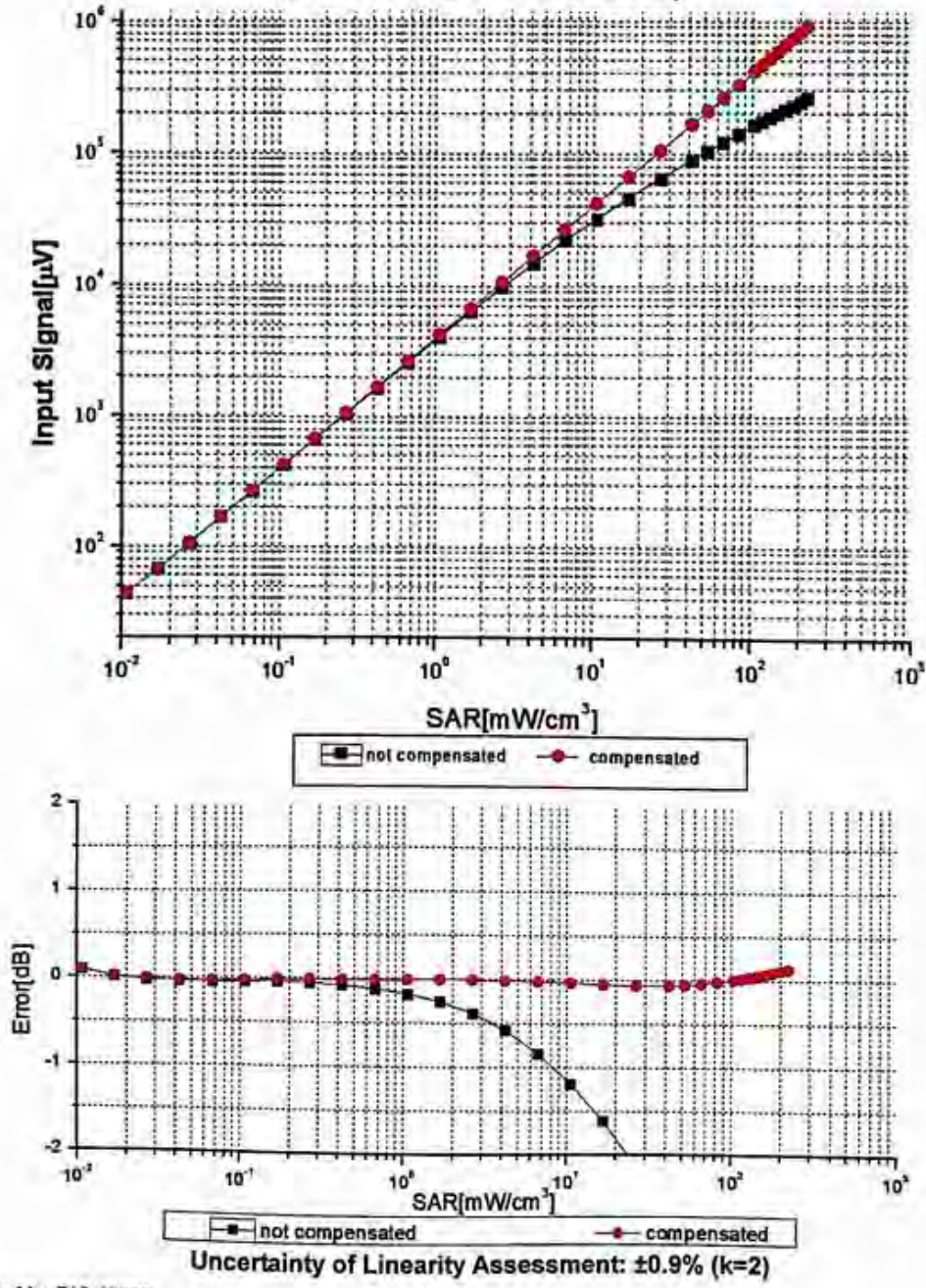
**f=1800 MHz, R22**





Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
 E-mail: cttl@chinattl.com <http://www.chinattl.cn>

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f = 900 MHz)



Certificate No: Z18-60093

Page 9 of 11



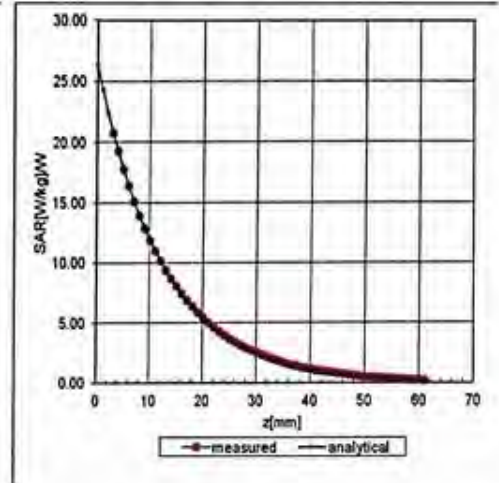
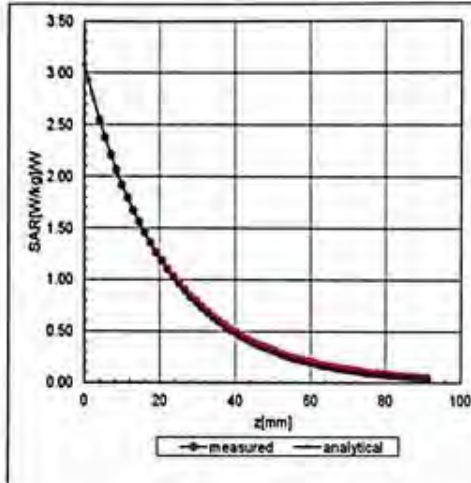


Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cntl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

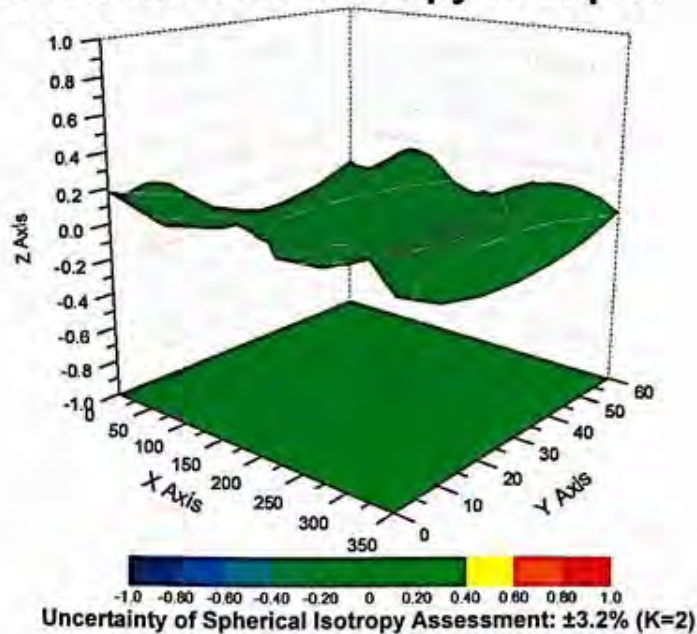
## Conversion Factor Assessment

f=750 MHz, WGLS R9(H\_convF)

f=1750 MHz, WGLS R22(H\_convF)



## Deviation from Isotropy in Liquid





Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
 E-mail: [ctl@chinattl.com](mailto:ctl@chinattl.com) [Http://www.chinattl.cn](http://www.chinattl.cn)

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3677

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	118.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm



## ANNEX E: D835V2 Dipole Calibration Certificate



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

TA(Shanghai)

Certificate No:

Z17-97114

## CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d020

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

Calibration date: August 28, 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&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	22-Sep-16 (CTTL, No.J16X06809)	Sep-17
Power sensor NRV-Z5	100595	22-Sep-16 (CTTL, No.J16X06809)	Sep-17
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG,No.Z17-97015)	Jan-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: August 31, 2017

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

Certificate No: Z17-97114

Page 1 of 8



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

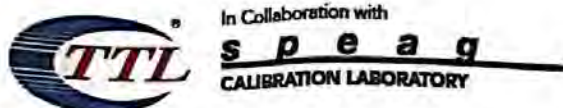
#### Additional Documentation:

- 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: cntl@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 ± 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 ± 0.2) °C	41.2 ± 6 %	0.89 mho/m ± 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	2.34 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.45 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.51 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.09 mW / g ± 18.7 % (k=2)

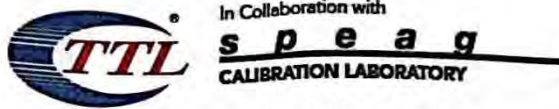
**Body TSL parameters**

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 ± 0.2) °C	55.6 ± 6 %	0.98 mho/m ± 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	2.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.75 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.63 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.47 mW / g ± 18.7 % (k=2)



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	50.3Ω- 2.54jΩ
Return Loss	- 31.9dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	46.8Ω- 4.57jΩ
Return Loss	- 24.8dB

**General Antenna Parameters and Design**

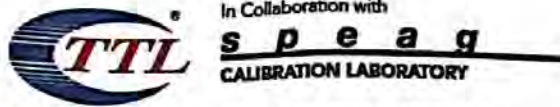
Electrical Delay (one direction)	1.495 ns
----------------------------------	----------

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
-----------------	-------



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: 08.28.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.887 \text{ S/m}$ ;  $\epsilon_r = 41.22$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left 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: DAE4 Sn1331; Calibrated: 1/19/2017
- 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)

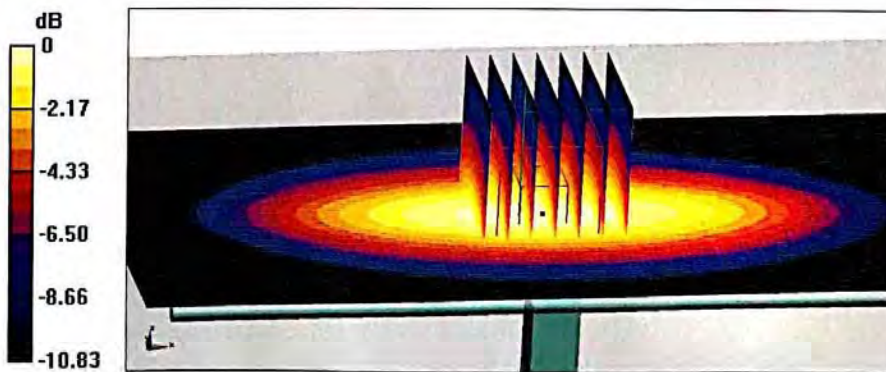
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.74V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.60 W/kg

**SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.51 W/kg**

Maximum value of SAR (measured) = 3.16 W/kg



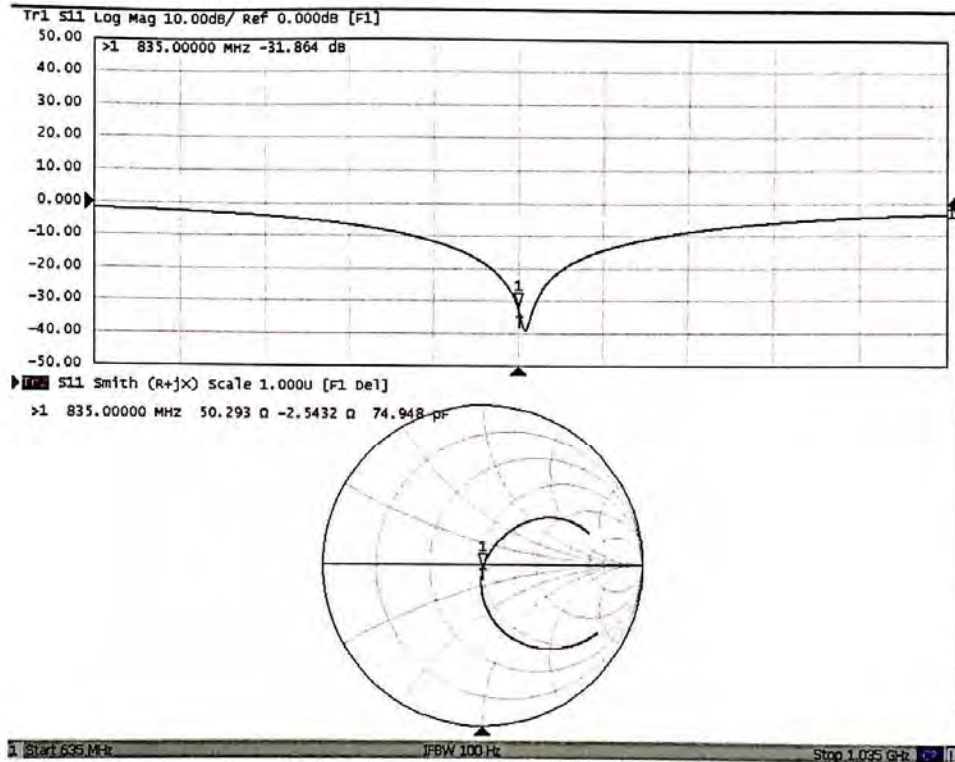
0 dB = 3.16 W/kg = 5.00 dBW/kg



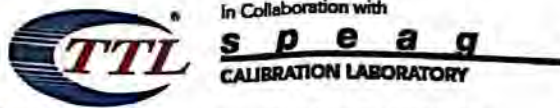
In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinatl.com http://www.chinatl.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: 08.27.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.984 \text{ S/m}$ ;  $\epsilon_r = 55.62$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right 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: DAE4 Sn1331; Calibrated: 1/19/2017
- 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)

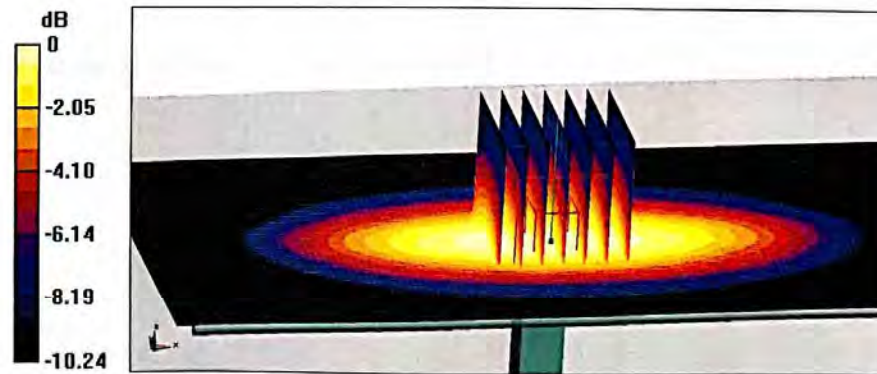
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 56.55 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.63 W/kg

Maximum value of SAR (measured) = 3.29 W/kg



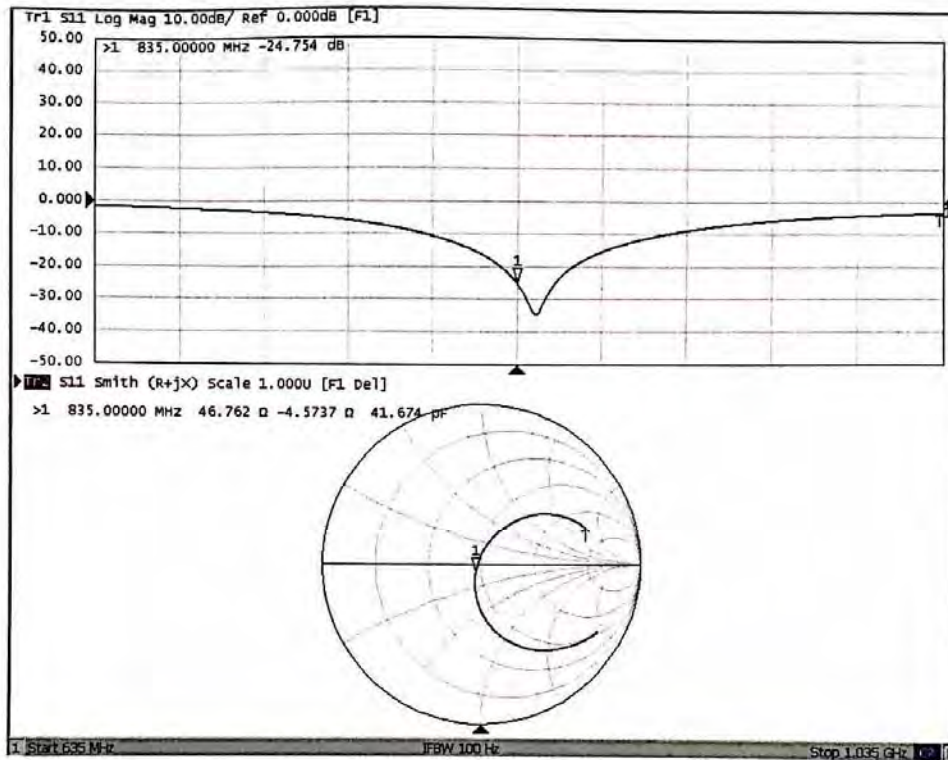
0 dB = 3.29 W/kg = 5.17 dBW/kg



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





## ANNEX F: D1900V2 Dipole Calibration Certificate



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

TA(Shanghai)

Certificate No: Z17-97115

## CALIBRATION CERTIFICATE

Object

D1900V2 - SN: 5d060

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

August 26, 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&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	22-Sep-16 (CTTL, No.J16X06809)	Sep-17
Power sensor NRV-Z5	100595	22-Sep-16 (CTTL, No.J16X06809)	Sep-17
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG,No.Z17-97015)	Jan-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: August 30, 2017

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

Certificate No: Z17-97115

Page 1 of 8



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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.41 mho/m ± 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	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>40.1 mW / g ± 18.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>20.7 mW / g ± 18.7 % (k=2)</b>

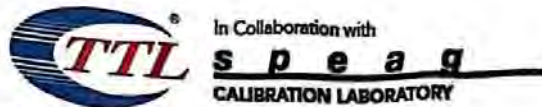
**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.6 ± 6 %	1.53 mho/m ± 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	9.90 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>39.5 mW / g ± 18.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.8 mW / g ± 18.7 % (k=2)</b>



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: ettl@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	52.0Ω+ 6.59jΩ
Return Loss	- 23.4dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	52.7Ω+ 8.35jΩ
Return Loss	- 21.4dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.302 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
-----------------	-------



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: 08.26.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.413$  S/m;  $\epsilon_r = 39.85$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(8.26, 8.26, 8.26); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- 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)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:**

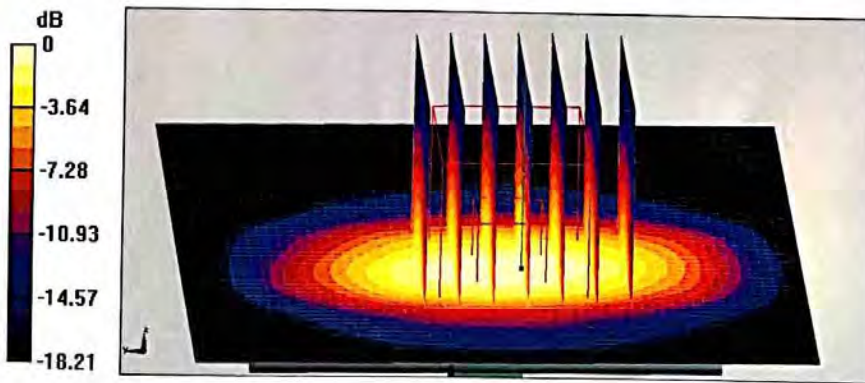
$dx=5mm, dy=5mm, dz=5mm$

Reference Value = 94.94 V/m; Power Drift = 0.01 dB

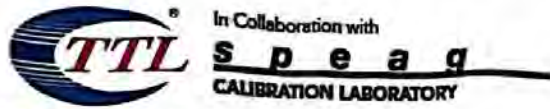
Peak SAR (extrapolated) = 19.5 W/kg

**SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.19 W/kg**

Maximum value of SAR (measured) = 15.9 W/kg

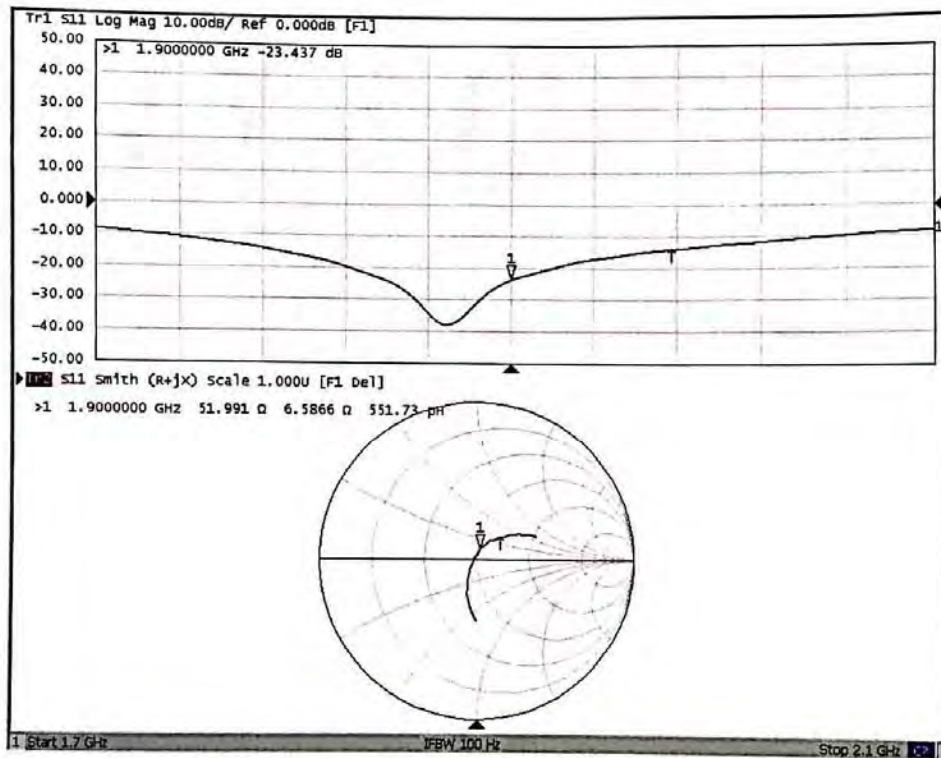


**0 dB = 15.9 W/kg = 12.01 dBW/kg**

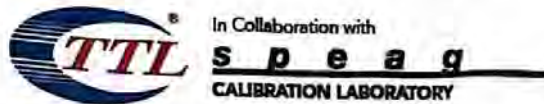


Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### 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: 08.26.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.528$  S/m;  $\epsilon_r = 53.55$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(7.95, 7.95, 7.95); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- 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)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:**

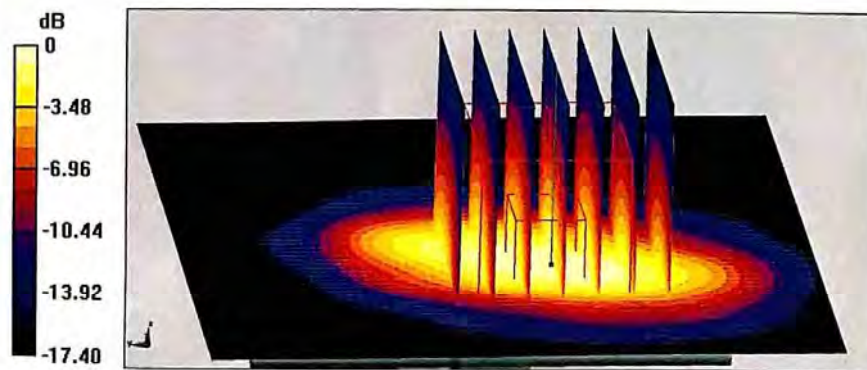
dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.19 V/m; Power Drift = 0.01 dB

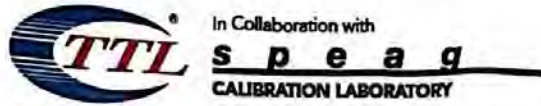
Peak SAR (extrapolated) = 18.1 W/kg

**SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5.21 W/kg**

Maximum value of SAR (measured) = 15.3 W/kg

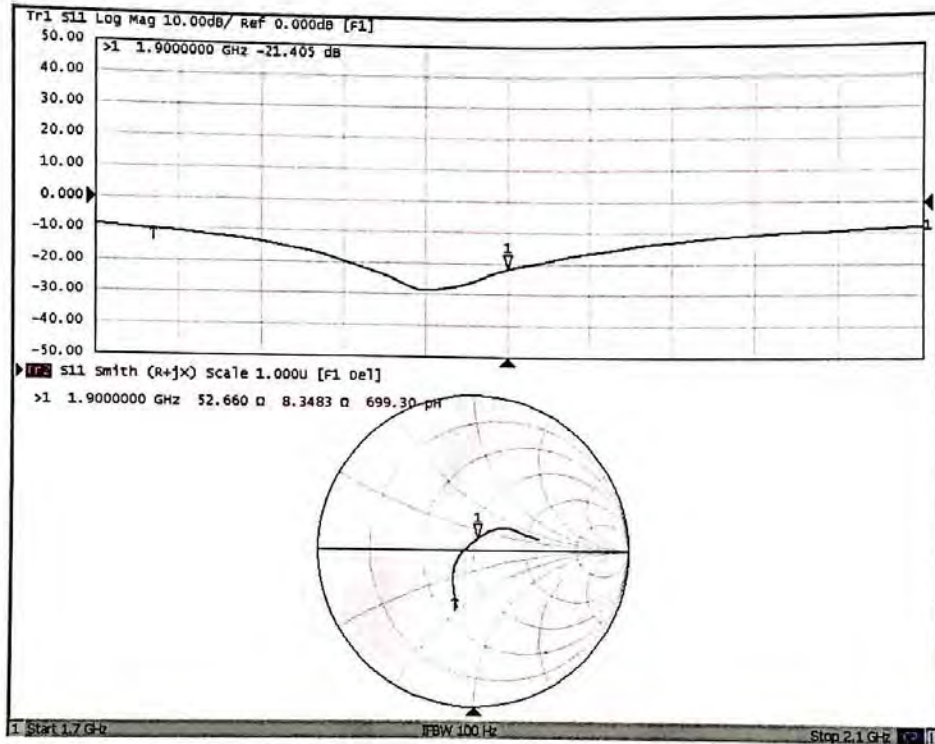


0 dB = 15.3 W/kg = 11.85 dBW/kg



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

### Impedance Measurement Plot for Body TSL





## ANNEX G: D2450V2 Dipole Calibration Certificate



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 TA(Shanghai)

Certificate No: Z17-97116

## CALIBRATION CERTIFICATE

Object D2450V2 - SN: 786

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

Calibration date: August 29, 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&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	22-Sep-16 (CTTL, No.J16X06809)	Sep-17
Power sensor NRV-Z5	100595	22-Sep-16 (CTTL, No.J16X06809)	Sep-17
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG,No.Z17-97015)	Jan-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: September 1, 2017

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

Certificate No: Z17-97116

Page 1 of 8



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: ett@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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.7 ± 6 %	1.82 mho/m ± 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	13.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.6 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.16 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.6 mW /g ± 18.7 % (k=2)

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	1.94 mho/m ± 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	12.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	50.8 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.87 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.5 mW /g ± 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	53.4Ω+ 4.29jΩ
Return Loss	- 25.5dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	51.0Ω+ 6.61jΩ
Return Loss	- 23.6dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.265 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: 08.29.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.822$  S/m;  $\epsilon_r = 39.65$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(7.74, 7.74, 7.74); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- 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)

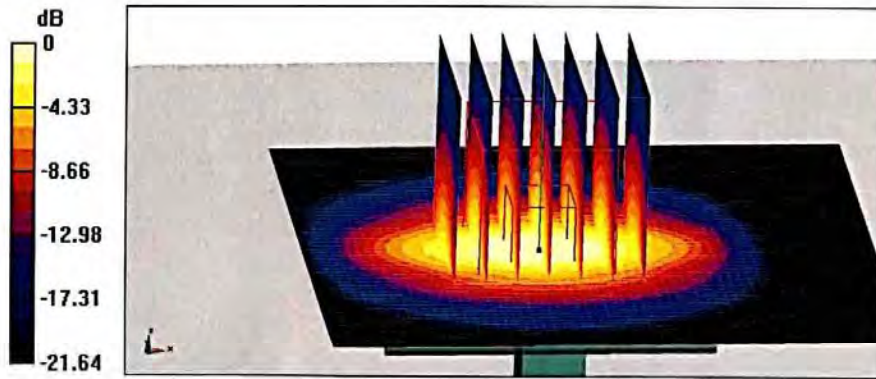
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 105.1 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 27.5 W/kg

**SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.16 W/kg**

Maximum value of SAR (measured) = 22.2 W/kg



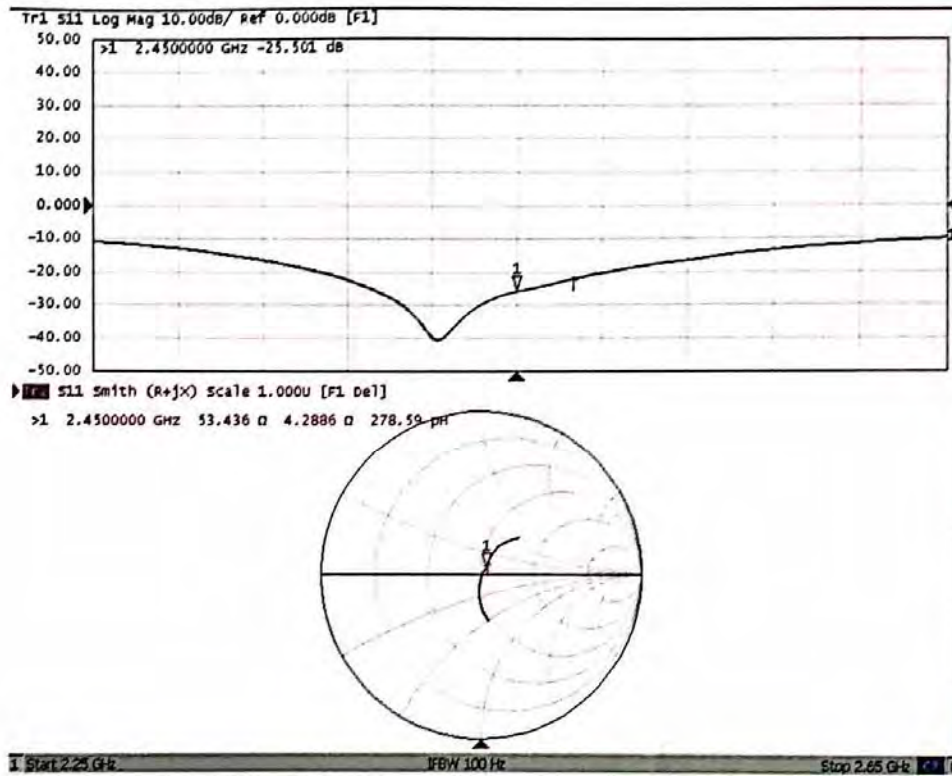
0 dB = 22.2 W/kg = 13.46 dBW/kg



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: ettl@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: 08.29.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.943$  S/m;  $\epsilon_r = 52.45$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- 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)

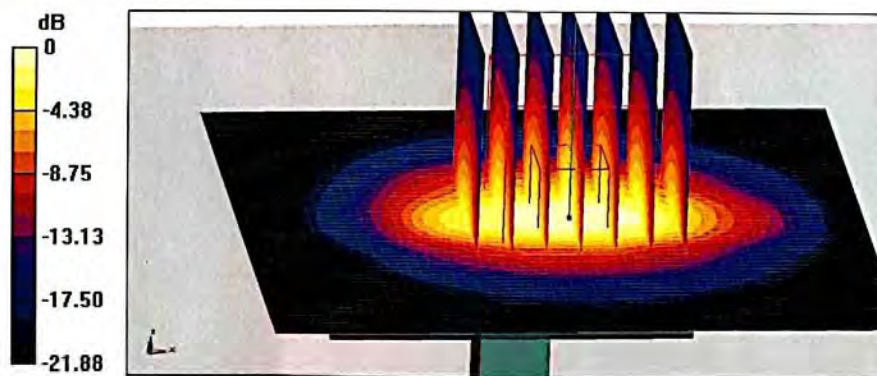
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 92.28 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 27.0 W/kg

**SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.87 W/kg**

Maximum value of SAR (measured) = 21.5 W/kg

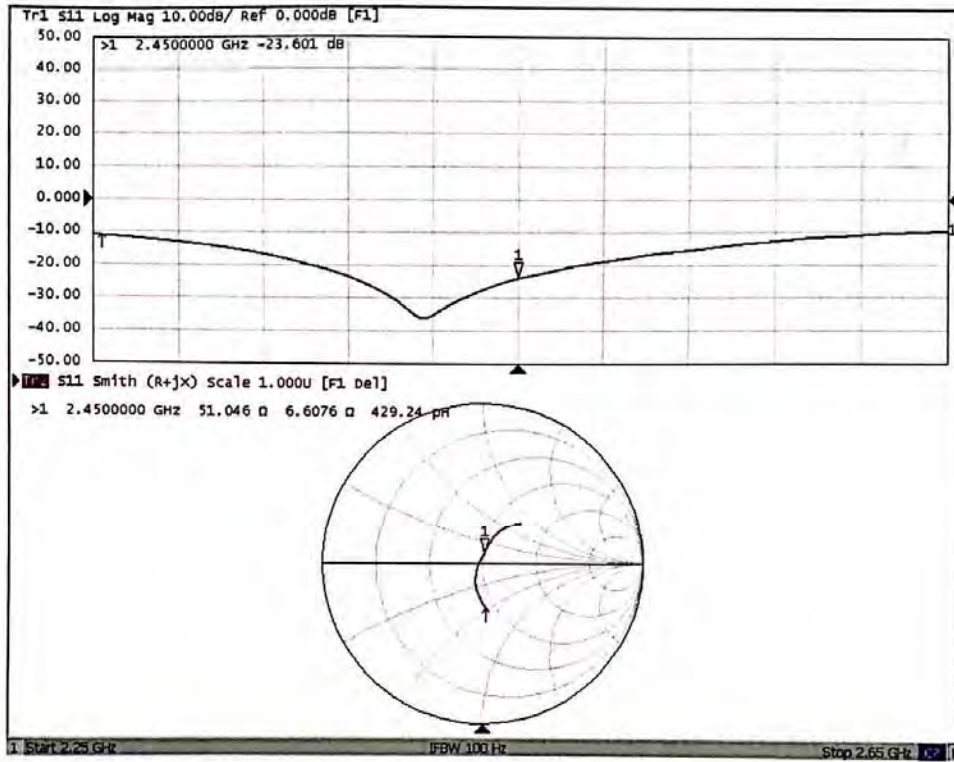
**0 dB = 21.5 W/kg = 13.32 dBW/kg**



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: ettl@chinattl.com http://www.chinattl.cn

### Impedance Measurement Plot for Body TSL





## ANNEX H: D2600V2 Dipole Calibration Certificate



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 **TA(Shanghai)**Certificate No: **Z18-60094****CALIBRATION CERTIFICATE**

Object **D2600V2 - SN: 1025**

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

Calibration date: **May 2, 2018**

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	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG, No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1525	02-Oct-17(SPEAG, No.DAE4-1525_Oct17)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
Network Analyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	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: May 5, 2018

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

Certificate No: Z18-60094

Page 1 of 8



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@chinatt.com http://www.chinatt.com

**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: ttl@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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.1 ± 6 %	2.01 mho/m ± 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	13.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.1 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.03 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.1 mW / g ± 18.7 % (k=2)

**Body TSL parameters**

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.1 ± 6 %	2.15 mho/m ± 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	13.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	54.5 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.06 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.3 mW / g ± 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: cttf@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	48.1Ω- 7.55jΩ
Return Loss	- 22.0dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	46.6Ω- 7.06jΩ
Return Loss	- 21.9dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.014 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: 05.02.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025**

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.014$  S/m;  $\epsilon_r = 40.09$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7464; ConvF(7.76, 7.76, 7.76); Calibrated: 9/12/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 10/2/2017
- 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)

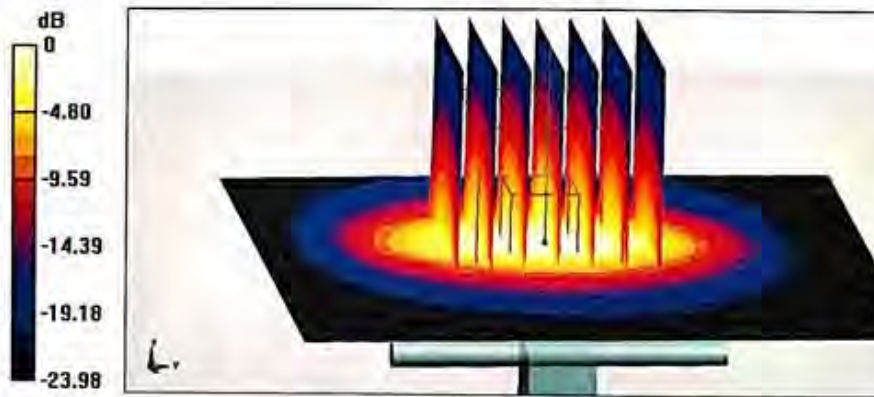
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 98.50 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 29.6 W/kg

**SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.03 W/kg**

Maximum value of SAR (measured) = 23.5 W/kg



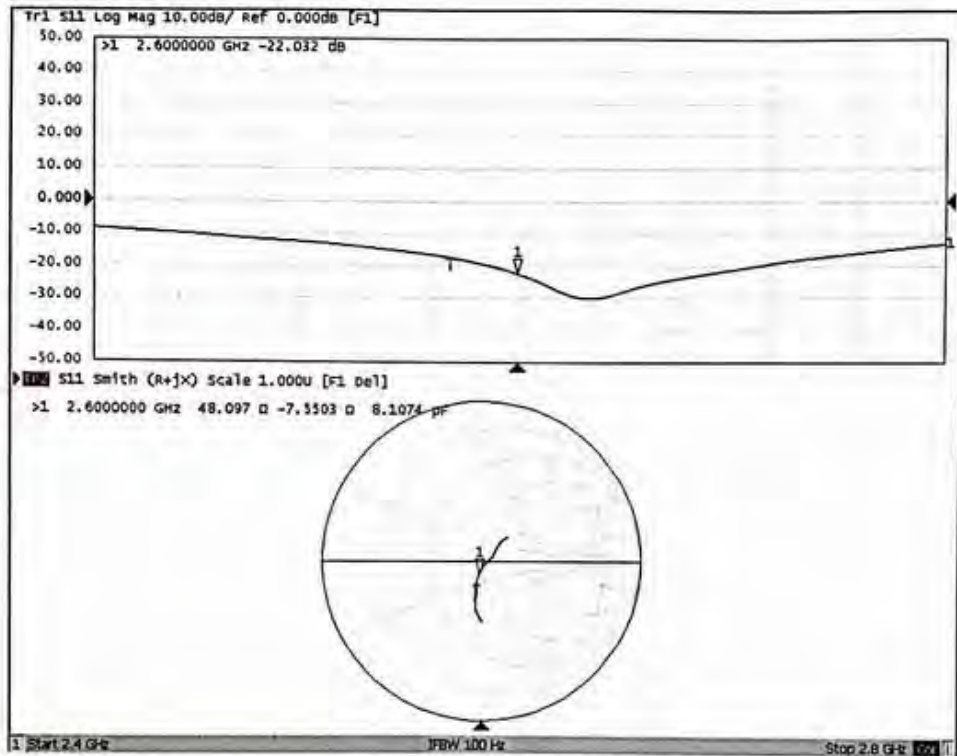
0 dB = 23.5 W/kg = 13.71 dBW/kg



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: [ettl@chinattl.com](mailto:ettl@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: 05.02.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025**

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.146$  S/m;  $\epsilon_r = 52.09$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7464; ConvF(7.84, 7.84, 7.84); Calibrated: 9/12/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 10/2/2017
- 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 = 83.79 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 29.7 W/kg

**SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.06 W/kg**

Maximum value of SAR (measured) = 23.6 W/kg



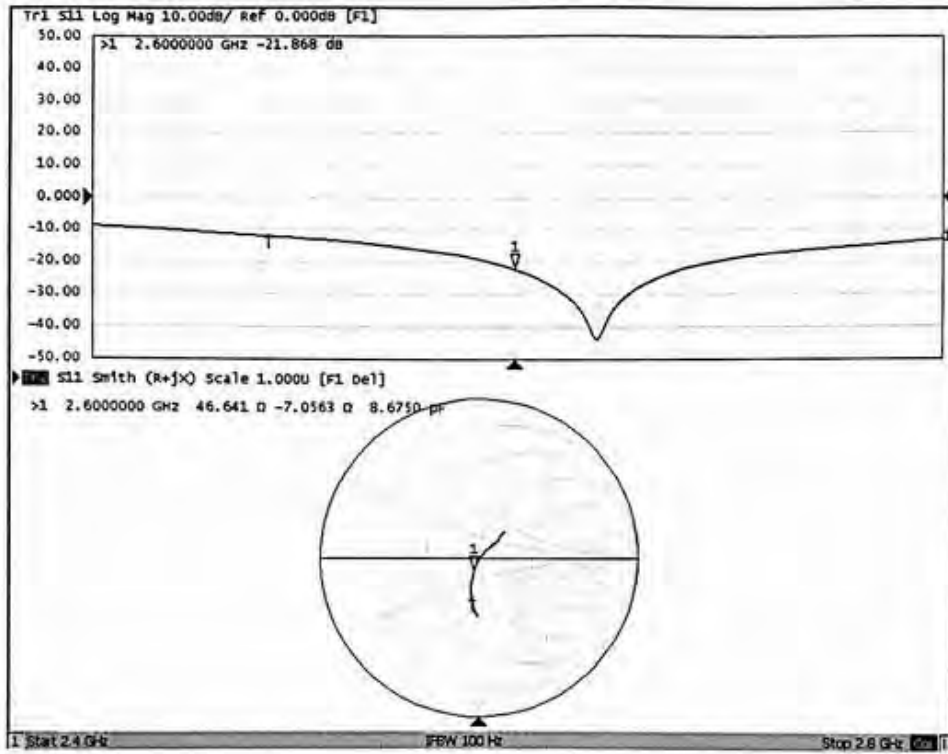
0 dB = 23.6 W/kg = 13.73 dBW/kg



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





## ANNEX I: D5GHzV2 Dipole Calibration Certificate



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Client **TA(Shanghai)**Certificate No: **Z17-97001****CALIBRATION CERTIFICATE**

Object **D5GHzV2 - SN: 1151**

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

Calibration date: **January 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)°C and humidity<70%.

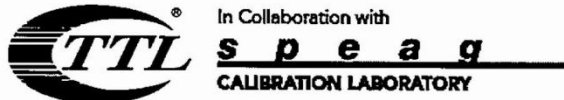
Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
ReferenceProbe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
NetworkAnalyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: January 7, 2017

This calibration certificate shall not be reproduced except in full without written approval of the 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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- 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%.