

# Variant FCC SAR Test Report

APPLICANT : Motorola Mobility LLC  
EQUIPMENT : Mobile Cellular Phone  
BRAND NAME : Motorola  
MODEL NAME : 9840  
FCC ID : IHDT56VE4  
STANDARD : FCC 47 CFR Part 2 (2.1093)  
ANSI/IEEE C95.1-1992  
IEEE 1528-2013

This is a variant report which is only valid together with the original test report. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.



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**1. Statement of Compliance**

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, 9840** are as follows.

Equipment Class	Frequency Band		Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)
			Head (Separation 0mm)	Body-worn (Separation 10mm)	Hotspot (Separation 10mm)	
			1g SAR (W/kg)			
Licensed	GSM	GSM850	0.17	0.29	0.34	1.33
		GSM1900	<0.10	0.38	0.58	
	WCDMA	Band V	0.33	0.38	0.56	
		Band II	<0.10	0.51	0.69	
	LTE	Band 5	0.30	0.32	0.54	
		Band 7	0.48	0.76	<b>1.17</b>	
Band 41		0.23	<b>1.02</b>	1.02		
DTS	WLAN	2.4GHz WLAN	0.86	<0.10	<0.10	1.33
NII		5GHz WLAN	<b>0.61</b>	0.15	0.14	1.17
DSS	2.4GHz Band	Bluetooth		<0.10		1.04
Date of Testing:			2016/12/19 ~ 2016/12/23			

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



## **2. Administration Data**

<b>Testing Site</b>	
<b>Test Site</b>	SPORTON INTERNATIONAL (KUNSHAN) INC.
<b>Test Site Location</b>	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958

<b>Applicant</b>	
<b>Company Name</b>	Motorola Mobility LLC
<b>Address</b>	222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

<b>Manufacturer</b>	
<b>Company Name</b>	Motorola Mobility LLC
<b>Address</b>	222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

## **3. Guidance Applied**

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D05A Rel.10 LTE SAR Test Guidance v01r02
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01



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

**4.1 General Information**

Product Feature & Specification	
Equipment Name	Mobile Cellular Phone
Brand Name	Motorola
Model Name	9840
FCC ID	IHDT56VE4
IMEI Code	351859080038197/351859080038205
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2557.5 MHz ~ 2652.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	<ul style="list-style-type: none"> <li>· GSM/GPRS/EGPRS</li> <li>· RMC/AMR 12.2Kbps</li> <li>· HSDPA</li> <li>· HSUPA</li> <li>· DC-HSDPA</li> <li>· HSPA+(16QAM uplink is not supported)</li> <li>· LTE: QPSK, 16QAM</li> <li>· 802.11b/g/n HT20</li> <li>· 802.11a /n HT20/HT40</li> <li>· Bluetooth v3.0 + EDR, Bluetooth v4.0 LE, Bluetooth v4.2 LE</li> </ul>
HW Version	DVT2
SW Version	potter_oem_userdebug_7.0_NPN25.124_1787_intcfg-test-keys_oem
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
<b>Remark:</b> <ol style="list-style-type: none"> <li>1. 802.11n-HT40 is not supported in 2.4GHz WLAN.</li> <li>2. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.</li> <li>3. This device 2.4GHz WLAN/5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only).</li> <li>4. This device does not support DTM operation.</li> <li>5. This device supports GRPS/EGRPS mode up to multi-slot class 12.</li> <li>6. When the phone is in talking mode, receiver worked, all WWAN power are full power.</li> <li>7. The device employs proximity sensors that detect the presence of the user’s body at the front or back faces of the device. when front or back body worn condition is detected, GSM1900, WCDMA band 2 ,LTE Band 7 reduced power will be active. (P-sensor can’t work at detecting presence of the user’s body at the four edges of the device.)</li> <li>8. When WLAN hotspot worked, WWAN GSM1900, WCDMA band 2,LTE Band 7 reduced power will be active.</li> <li>9. This device hotspot reduced power and P-sensor reduced power level are the same. So only show one reduced power level for hotspot reduced power and P-sensor reduced power for this application.</li> <li>10. The dual SIM card mobile has 2 SIM slots and supports dual SIM dual Standby. The WWAN radio transmission will be enabled by either one SIM at a time (Single active). After pre-scan dual SIM card mobile and single card mobile, they have no effect on SAR distribution. So chose dual SIM card mobile to do SAR testing for this application.</li> </ol>	

**4.2 Specification of Accessory**

Specification of Accessory				
AC Adapter	Brand Name	Motorola(Salom)	Model Name	SSW-2680US/SSW-2680UK/ SSW-2680EU/SSW-2680JP/ SSW-2680TW/SSW-2680AU
	Power Rating	I/P: 100-240 Vac, 500mA, O/P: 5 Vdc,1600mA or 9Vdc,1600mA or 12Vdc,1200mA		
Battery	Brand Name	Motorola(SUNWODA)	Model Name	HG40
	Power Rating	3.8Vdc,2810/3000mAh (Min/Typ)	Type	Li-ion
USB Cable	Brand Name	Motorola	Model Name	SKN6461A
	Signal Line Type	1.0 meter, non-shielded cable, without ferrite core		
Earphone	Brand Name	Motorola (Jiangxi Lianchuang)	Model Name	MEMD1532B080008
	Signal Line Type	1.2 meter, non-shielded cable, without ferrite core		



**4.3 General LTE SAR Test and Reporting Considerations**

Summarized necessary items addressed in KDB 941225 D05 v02r05																																							
FCC ID	IHDT56VE4																																						
Equipment Name	Mobile Cellular Phone																																						
Operating Frequency Range of each LTE transmission band	LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2557.5 MHz ~ 2652.5 MHz																																						
Channel Bandwidth	LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz																																						
uplink modulations used	QPSK, and 16QAM																																						
LTE Voice / Data requirements	Voice and Data																																						
LTE MPR permanently built-in by design	<p align="center"><b>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th> <th rowspan="2">MPR (dB)</th> </tr> <tr> <th>1.4 MHz</th> <th>3.0 MHz</th> <th>5 MHz</th> <th>10 MHz</th> <th>15 MHz</th> <th>20 MHz</th> </tr> </thead> <tbody> <tr> <td>QPSK</td> <td>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 18</td> <td>≤ 2</td> </tr> </tbody> </table>	Modulation	Channel bandwidth / Transmission bandwidth (RB)						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
Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)																																
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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 A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)																																						
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.																																						
Power reduction applied to satisfy SAR compliance	Yes, when operating in hotspot mode and P-sensor, WWAN GSM1900, WCDMA band 2, LTE band 7 power reductions applied to satisfy SAR compliance.																																						
LTE Release Version	R10, Cat 6																																						
CA Support	Yes																																						
LTE Carrier Aggregation Combinations	Inter-Band and Intra-Band possible combinations as below page and the detail power verification please referred to page49.																																						
LTE Carrier Aggregation Additional Information	This device does not support full CA features on 3GPP Release 10. It supports a maximum of 2 carriers in the downlink only. All uplink communications are identical to the Release 8 Specifications. Uplink communications are done on the PCC. Due to carrier capability, only the combinations listed above are supported. The following LTE Release features are not supported: Relay, HetNet, Enhanced MIMO, eICI, WiFi Offloading, MDH, eMBMA, Cross-Carrier Scheduling, Enhanced SC-FDMA.																																						



Transmission (H, M, L) channel numbers and frequencies in each LTE band								
LTE Band 5								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844
LTE Band 7								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560
LTE Band 38								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	37775	2572.5	37800	2575	37825	2577.5	37850	2580
M	38000	2595	38000	2595	38000	2595	38000	2595
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610
LTE Band 41								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	40265	2557.5	40290	2560	40315	2562.5	40340	2565
L	40585	2589.5	40590	2590	40595	2590.5	40600	2591
M								
H	40905	2621.5	40890	2620	40885	2619.5	40870	2618
H	41215	2652.5	41190	2650	41165	2647.5	41140	2645



LTE Carrier Aggregation Combinations			
Inter-Band Combinations			
(PCC) B5	(SCC) B7	(PCC) B7	(SCC) B5
10M + 20M		20M + 10M	
10M + 15M		20M + 5M	
10M + 10M		20M + 3M	
5M + 20M		20M + 1.4M	
5M + 15M		15M + 10M	
5M + 10M		15M + 5M	
3M + 20M		15M + 3M	
3M + 15M		15M + 1.4M	
3M + 10M		10M + 10M	
1.4M + 20M		10M + 5M	
1.4M + 15M		10M + 3M	
1.4M + 10M		10M + 1.4M	

LTE Carrier Aggregation Combinations	
Intra-Band Combinations LTE Band 7	
Contiguous	Non-Contiguous
20M+20M	20M+20M
20M+15M	15M+20M
20M+10M	15M+15M
15M+20M	10M+15M
15M+15M	10M+10M
10M+20M	5M+15M
	20M+15M
	15M+10M
	15M+5M



## **4.4 Re-use of Measured Data**

### **4.4.1 Introduction Section**

This application re-uses data collected on a similar device. The subject device of this application (Model: 9840, FCC ID: IHDT56VE4) is electrically identical to the reference device (Model: 9370, 9842, FCC ID: IHDT56VE2) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 178919 D01.

### **4.4.2 Difference Section**

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Product Equality Declaration "PED" file.

The re-used RF data includes the following bands provided in Appendix F (Sporton RF Report No. FA6O1212-11 for the reference device Model: 9370, 9842, FCC ID: IHDT56VE2):

- 2.4G/5GHz WLAN
- Bluetooth

Spot check for WLAN are performed for ensure that SAR measurement for both device are the same. So, the original SAR value can represent this application.



**4.4.3 Spot Check Verification Data Section**

Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Original model (FCC ID: IHDT56VE2)				Spot check model (FCC ID: IHDT56VE4)				Deviation
											Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	
WLAN 2.4GHz	-	-	-	-	802.11b 1Mbps	Left Cheek	0mm	Off	1	2412	16.39	16.5	0.813	0.855	16.39	16.5	0.803	0.844	-1.29%
WLAN 5.3GHz	-	-	-	-	802.11a 6Mbps	Left Tilted	0mm	Off	52	5260	13.76	15	0.216	0.329	13.76	15	0.255	0.390	18.54%
WLAN 5.5GHz	-	-	-	-	802.11a 6Mbps	Left Tilted	0mm	Off	140	5700	12.03	12.5	0.407	0.520	12.03	12.5	0.338	0.433	-16.73%
WLAN 5.8GHz	-	-	-	-	802.11a 6Mbps	Left Tilted	0mm	Off	157	5785	14.99	15.5	0.476	0.613	14.99	15.5	0.481	0.628	2.45%
WLAN 5.2GHz	-	-	-	-	802.11a 6Mbps	Front	0mm	Off	36	5180	14.08	15	0.032	0.045	14.08	15	0.035	0.050	11.11%
Bluetooth	-	-	-	-	1Mbps	Front	0mm	Off	39	2441	11.12	11.5	0.017	0.020	11.12	11.5	0.019	0.022	10.00%

**Note:** In the table above, all the deviation of SAR test results are compliant with uncertainty budget.

**5. RF Exposure Limits**

**5.1 Uncontrolled Environment**

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

**5.2 Controlled Environment**

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

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

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

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

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

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

## **6. Specific Absorption Rate (SAR)**

### **6.1 Introduction**

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

### **6.2 SAR Definition**

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

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

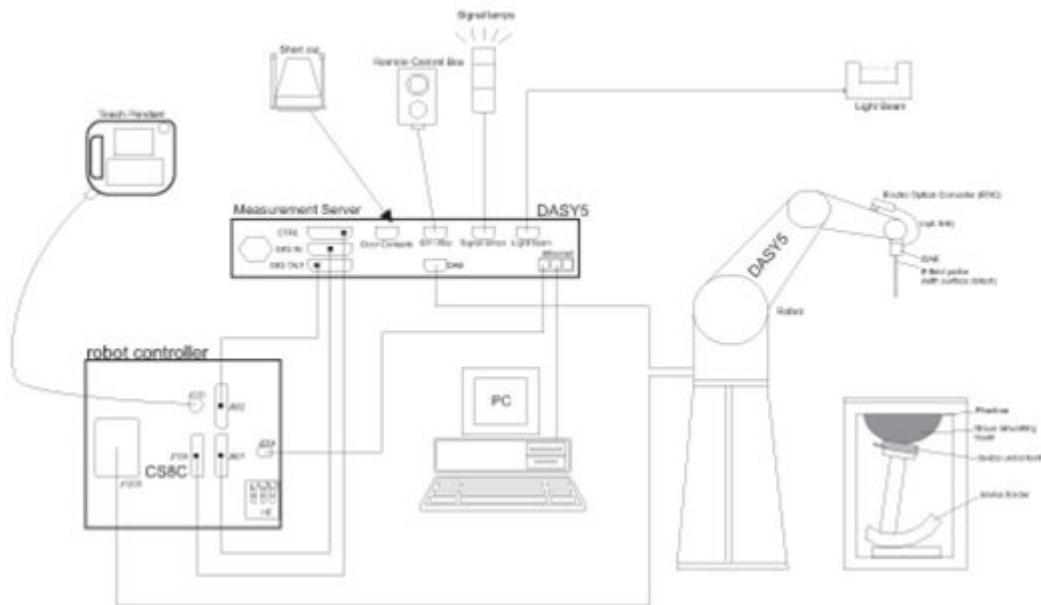
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

## **7. System Description and Setup**

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

**7.1 E-Field Probe**

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

**<EX3DV4 Probe>**

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



**7.2 Data Acquisition Electronics (DAE)**

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

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



**Fig 5.1 Photo of DAE**

**7.3 Phantom**

**<SAM Twin Phantom>**

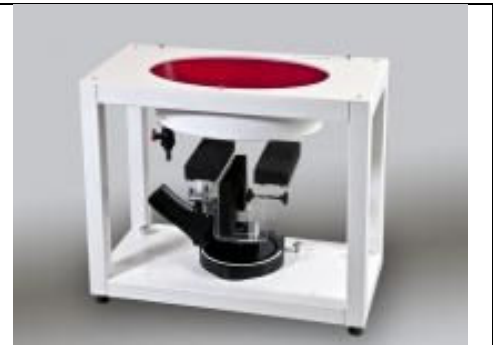
<b>Shell Thickness</b>	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
<b>Filling Volume</b>	Approx. 25 liters
<b>Dimensions</b>	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
<b>Measurement Areas</b>	Left Hand, Right Hand, Flat Phantom



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

**<ELI Phantom>**

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



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

### **7.4 Device Holder**

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

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



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

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

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



Mounting Device for Laptops



## **8. Measurement Procedures**

The measurement procedures are as follows:

### <Conducted power measurement>

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

### <SAR measurement>

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

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

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

### **8.1 Spatial Peak SAR Evaluation**

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

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

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

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

**8.2 Power Reference Measurement**

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

**8.3 Area Scan**

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

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$	≤ 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.	

**8.4 Zoom Scan**

Zoom scans are used 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 shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

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

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

**8.5 Volume Scan Procedures**

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

**8.6 Power Drift Monitoring**

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



**9. Test Equipment List**

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d151	2016/3/16	2017/3/15
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	2016/11/24	2017/11/23
SPEAG	2600MHz System Validation Kit	D2600V2	1008	2016/8/30	2017/8/29
SPEAG	Data Acquisition Electronics	DAE4	1210	2016/5/18	2017/5/17
SPEAG	Data Acquisition Electronics	DAE4	1279	2016/4/4	2017/4/3
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	2016/5/25	2017/5/24
SPEAG	Dosimetric E-Field Probe	EX3DV4	3954	2016/11/28	2017/11/27
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1477	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1479	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1542	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201563814	2016/3/21	2017/3/20
Agilent	Wireless Communication Test Set	E5515C	MY52102706	2016/4/22	2017/4/21
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	2016/4/22	2017/4/21
Agilent	Dielectric Probe Kit	85070E	MY44300475	NCR	NCR
R&S	Signal Generator	SMBV100A	258305	2016/1/20	2017/1/19
Anritsu	Power Sensor	MA2411B	0917070	2016/1/20	2017/1/19
Anritsu	Power Meter	ML2495A	1005002	2016/1/20	2017/1/19
Anritsu	Power Sensor	MA2411B	1339163	2016/1/20	2017/1/19
Anritsu	Power Meter	ML2495A	1435004	2016/1/20	2017/1/19
R&S	Spectrum Analyzer	FSV7	101631	2016/8/8	2017/8/7
ARRA	Power Divider	A3200-2	NA	Note	
Agilent	Dual Directional Coupler	778D	50422	Note	
PASTERNAK	Dual Directional Coupler	PE2214-10	N/A	Note	
AR	Amplifier	5S1G4	333096	Note	
mini-circuits	Amplifier	ZVE-3W-83+	162601250	Note	
MCL	Attenuation1	BW-S10W5+	N/A	Note	
MCL	Attenuation2	BW-S10W5+	N/A	Note	
MCL	Attenuation3	BW-S10W5+	N/A	Note	

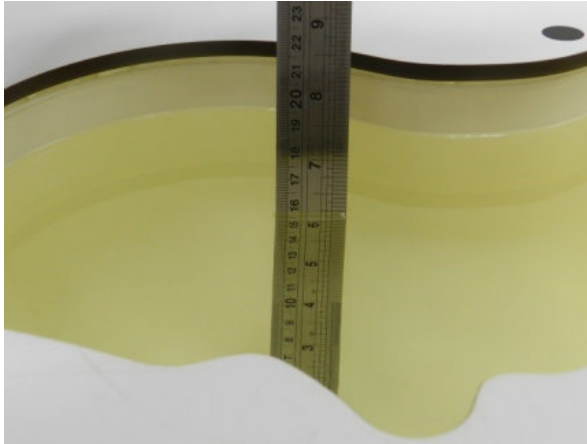
**Note:**

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

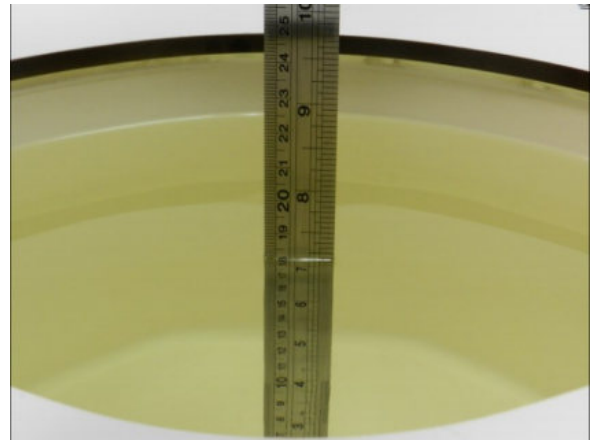
## **10. System Verification**

### **10.1 Tissue Simulating Liquids**

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



**Fig 10.1**Photo of Liquid Height for Head SAR



**Fig 10.2** Photo of Liquid Height for Body SAR



**10.2 Tissue Verification**

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )
<b>For Head</b>								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
<b>For Body</b>								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

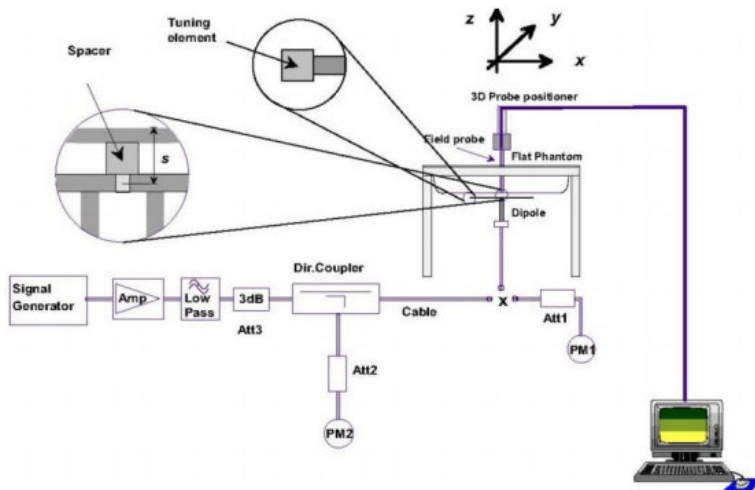
**<Tissue Dielectric Parameter Check Results>**

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Conductivity Target ( $\sigma$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\sigma$ ) (%)	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
835	Head	22.6	0.925	41.558	0.90	41.5	2.78	0.14	±5	2016/12/19
1900	Head	22.8	1.412	40.487	1.40	40	0.86	1.22	±5	2016/12/22
2600	Head	22.9	2.000	39.594	1.96	39	2.04	1.52	±5	2016/12/23
835	Body	22.6	0.973	55.714	0.97	55.2	0.31	0.93	±5	2016/12/19
1900	Body	22.8	1.567	55.061	1.52	53.3	3.09	3.30	±5	2016/12/22
2600	Body	22.9	2.261	53.171	2.16	52.5	4.68	1.28	±5	2016/12/23

**10.3 System Performance Check Results**

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

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2016/12/19	835	Head	250	4d151	3857	1210	2.45	9.26	9.8	5.83
2016/12/22	1900	Head	250	5d118	3954	1279	9.42	40.4	37.68	-6.73
2016/12/23	2600	Head	250	1008	3857	1210	13.9	56.8	55.6	-2.11
2016/12/19	835	Body	250	4d151	3857	1210	2.39	9.52	9.56	0.42
2016/12/22	1900	Body	250	5d118	3857	1210	10.0	40.8	40	-1.96
2016/12/23	2600	Body	250	1008	3857	1210	14.2	55.2	56.8	2.90



**Fig 8.3.1 System Performance Check Setup**

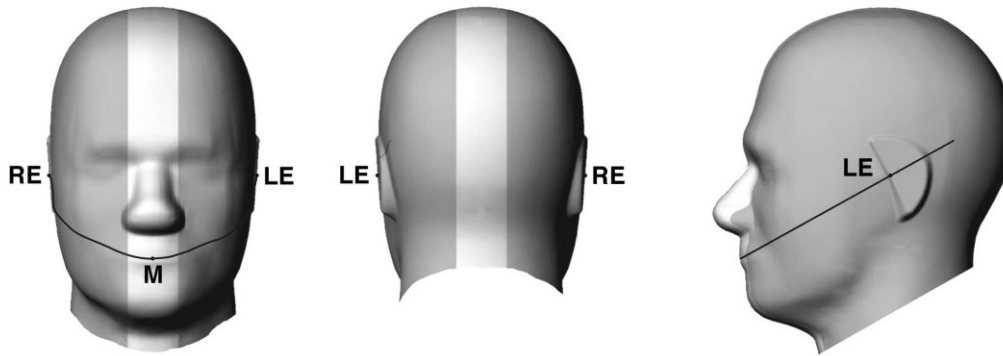


**Fig 8.3.2 Setup Photo**

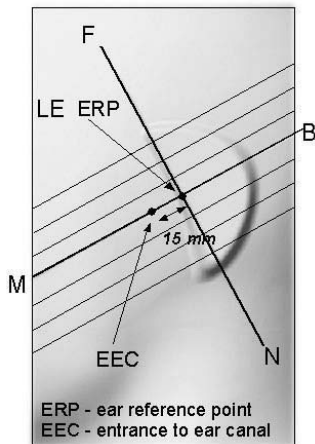
## **11. RF Exposure Positions**

### **11.1 Ear and handset reference point**

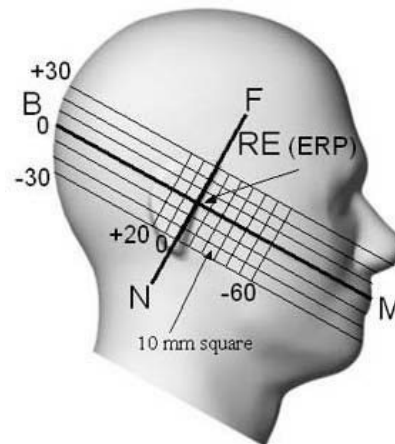
Figure 9.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 9.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 9.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 9.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.



**Fig 9.1.1 Front, back, and side views of SAM twin phantom**



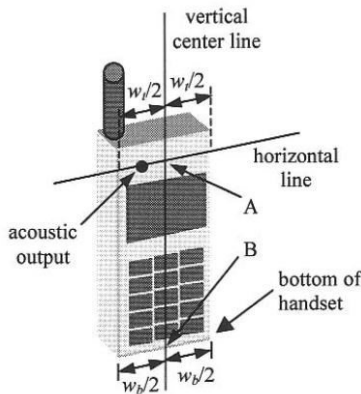
**Fig 9.1.2 Close-up side view of phantom showing the ear region.**



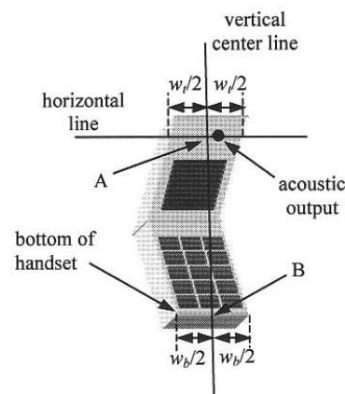
**Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations**

**11.2 Definition of the cheek position**

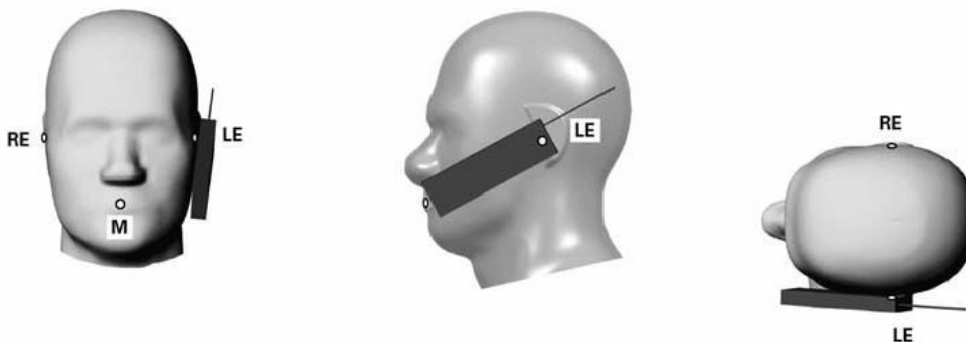
1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width  $w_t$  of the handset at the level of the acoustic output (point A in Figure 9.2.1 and Figure 9.2.2), and the midpoint of the width  $w_b$  of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 9.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 9.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 9.2.3. The actual rotation angles should be documented in the test report.



**Fig 9.2.1 Handset vertical and horizontal reference lines—“fixed case”**



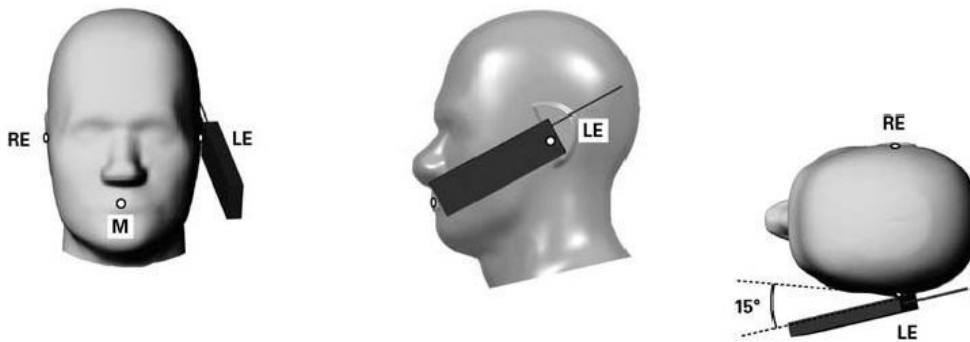
**Fig 9.2.2 Handset vertical and horizontal reference lines—“clam-shell case”**



**Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.**

### **11.3 Definition of the tilt position**

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 9.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

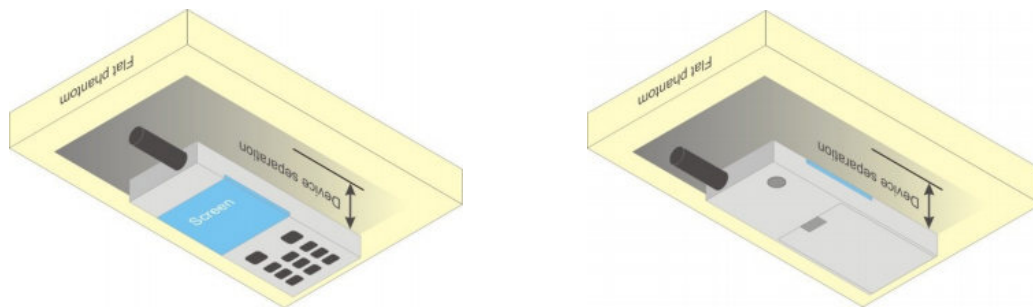


**Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.**

### **11.4 Body Worn Accessory**

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for 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 handset 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.



**Fig 9.4 Body Worn Position**

### **11.5 Wireless Router**

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets ( $L \times W \geq 9$  cm  $\times$  5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

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



**12. Conducted RF Output Power (Unit: dBm)**

**<GSM Conducted Power>**

**<Full Power Mode>**

GSM850 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM 1 Tx slot	33.19	<b>33.23</b>	33.19	33.50	24.19	24.23	24.19	24.50
GPRS 1 Tx slot	33.17	33.21	33.18	33.50	24.17	24.21	24.18	24.50
GPRS 2 Tx slots	29.57	28.98	28.89	30.00	23.57	22.98	22.89	24.00
GPRS 3 Tx slots	27.50	27.44	27.35	28.00	23.24	23.18	23.09	23.74
GPRS 4 Tx slots	26.02	25.36	25.24	26.50	23.02	22.36	22.24	23.50
EDGE 1 Tx slot	26.41	26.37	26.22	26.50	17.41	17.37	17.22	17.50
EDGE 2 Tx slots	26.24	25.84	25.78	26.50	20.24	19.84	19.78	20.50
EDGE 3 Tx slots	24.89	24.80	24.67	25.50	20.63	20.54	20.41	21.24
EDGE 4 Tx slots	23.39	22.74	22.69	23.50	20.39	19.74	19.69	20.50

**Remark:** The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.  
 The calculated method are shown as below:  
 Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB  
 Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB  
 Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB  
 Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

GSM1900 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM 1 Tx slot	29.51	30.09	<b>30.19</b>	30.50	20.51	21.09	21.19	21.50
GPRS 1 Tx slot	29.48	30.05	30.06	30.50	20.48	21.05	21.06	21.50
GPRS 2 Tx slots	26.49	26.53	26.49	27.00	20.49	20.53	20.49	21.00
GPRS 3 Tx slots	24.71	25.12	24.67	25.50	20.45	20.86	20.41	21.24
GPRS 4 Tx slots	23.23	23.05	22.88	23.50	20.23	20.05	19.88	20.50
EDGE 1 Tx slot	25.62	26.02	25.99	26.50	16.62	17.02	16.99	17.50
EDGE 2 Tx slots	25.48	25.40	25.27	26.00	19.48	19.40	19.27	20.00
EDGE 3 Tx slots	24.08	24.43	24.26	25.00	19.82	20.17	20.00	20.74
EDGE 4 Tx slots	22.72	22.41	22.12	23.00	19.72	19.41	19.12	20.00

**Remark:** The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.  
 The calculated method are shown as below:  
 Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB  
 Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB  
 Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB  
 Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB



**<Hotspot Reduced Power Mode>**

GSM1900 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM 1 Tx slot	28.16	28.08	28.37	28.50	19.16	19.08	19.38	19.50
GPRS 1 Tx slot	28.17	28.10	28.38	28.50	19.17	19.10	19.37	19.50
GPRS 2 Tx slots	24.27	24.14	24.08	25.00	18.27	18.14	18.08	19.00
GPRS 3 Tx slots	22.70	22.62	22.62	23.00	18.44	18.36	18.36	18.74
GPRS 4 Tx slots	21.34	21.30	21.26	22.00	18.34	18.30	18.26	19.00
EDGE 1 Tx slot	25.17	25.15	25.26	26.00	16.17	16.15	16.26	17.00
EDGE 2 Tx slots	22.70	22.62	22.69	23.00	16.70	16.62	16.69	17.00
EDGE 3 Tx slots	21.59	21.53	21.59	22.00	17.33	17.27	17.33	17.74
EDGE 4 Tx slots	20.97	20.94	20.97	21.50	17.97	17.94	17.97	18.50

**Remark:** The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.

The calculated method are shown as below:

- Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
- Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
- Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
- Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

**<WCDMA Conducted Power>**

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

**HSDPA Setup Configuration:**

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

**Table C.10.1.4:  $\beta$  values for transmitter characteristics tests with HS-DPCCH**

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

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

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

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

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

**Setup Configuration**

**HSUPA Setup Configuration:**

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting \* :
  - i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
  - ii. Set the Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
  - iii. Set Cell Power = -86 dBm
  - iv. Set Channel Type = 12.2k + HSPA
  - v. Set UE Target Power
  - vi. Power Ctrl Mode= Alternating bits
  - vii. Set and observe the E-TFCl
  - viii. Confirm that E-TFCl is equal to the target E-TFCl of 75 for sub-test 1, and other subtest's E-TFCl
- d. The transmitted maximum output power was recorded.

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

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{HS}$ (Note 1)	$\beta_{ec}$	$\beta_{ed}$ (Note 5) (Note 6)	$\beta_{ed}$ (SF)	$\beta_{ed}$ (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCl
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/25	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

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

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

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

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

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

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

**Setup Configuration**

**DC-HSDPA 3GPP release 8 Setup Configuration:**

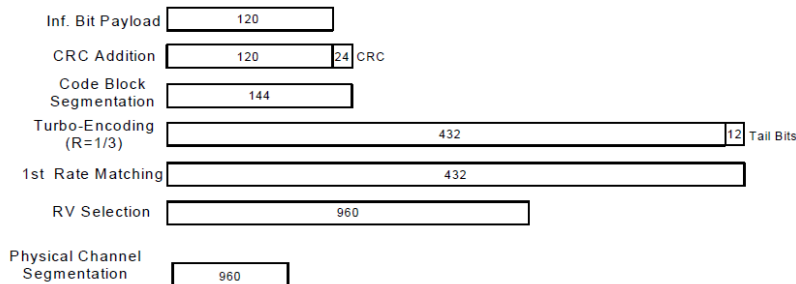
- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
  - i. Set RMC 12.2Kbps + HSDPA mode.
  - ii. Set Cell Power = -25 dBm
  - iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
  - iv. Select HSDPA Uplink Parameters
  - v. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
    - a). Subtest 1:  $\beta_c/\beta_d=2/15$
    - b). Subtest 2:  $\beta_c/\beta_d=12/15$
    - c). Subtest 3:  $\beta_c/\beta_d=15/8$
    - d). Subtest 4:  $\beta_c/\beta_d=15/4$
  - vi. Set Delta ACK, Delta NACK and Delta CQI = 8
  - vii. Set Ack-Nack Repetition Factor to 3
  - viii. Set CQI Feedback Cycle (k) to 4 ms
  - ix. Set CQI Repetition Factor to 2
  - x. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

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

**C.8.1.12 Fixed Reference Channel Definition H-Set 12**

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload ( $N_{INF}$ )	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		



**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**

**Setup Configuration**



**<WCDMA Conducted Power>**

**<Full Power Mode>**

Band		WCDMA Band II			Tune-up Limit (dBm)	WCDMA Band V			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		4132	4182	4233	
Rx Channel		9662	9800	9938		4357	4407	4458	
Frequency (MHz)		1852.4	1880	1907.6		826.4	836.4	846.6	
3GPP Rel 99	AMR 12.2Kbps	22.46	22.96	22.93	24.00	22.93	22.81	22.60	24.00
3GPP Rel 99	RMC 12.2Kbps	22.50	<b>22.97</b>	22.94	24.00	<b>22.94</b>	22.83	22.61	24.00
3GPP Rel 6	HSDPA Subtest-1	21.66	22.23	22.20	22.50	22.29	22.15	21.92	22.50
3GPP Rel 6	HSDPA Subtest-2	21.79	22.33	22.40	22.50	22.39	22.36	22.06	22.50
3GPP Rel 6	HSDPA Subtest-3	21.31	21.97	21.95	22.00	21.93	21.89	21.59	22.00
3GPP Rel 6	HSDPA Subtest-4	21.30	21.87	21.95	22.00	21.94	21.80	21.60	22.00
3GPP Rel 8	DC-HSDPA Subtest-1	21.65	22.22	22.18	22.50	22.25	21.13	21.90	22.50
3GPP Rel 8	DC-HSDPA Subtest-2	21.83	22.30	22.36	22.50	22.24	22.23	21.48	22.50
3GPP Rel 8	DC-HSDPA Subtest-3	21.28	21.95	21.93	22.00	21.92	21.78	21.59	22.00
3GPP Rel 8	DC-HSDPA Subtest-4	21.25	21.91	21.91	22.00	21.78	21.65	21.63	22.00
3GPP Rel 6	HSUPA Subtest-1	21.72	22.38	22.26	22.50	22.37	22.20	22.00	22.50
3GPP Rel 6	HSUPA Subtest-2	19.83	20.41	20.32	20.50	20.32	20.31	19.99	20.50
3GPP Rel 6	HSUPA Subtest-3	20.88	21.38	21.29	21.50	21.27	21.18	20.98	21.50
3GPP Rel 6	HSUPA Subtest-4	19.82	20.48	20.47	20.50	20.30	20.27	20.07	20.50
3GPP Rel 6	HSUPA Subtest-5	21.70	22.30	22.20	22.50	22.20	22.20	21.90	22.50

**<Hotspot Reduced Power Mode>**

Band		WCDMA Band II			Tune-up Limit (dBm)
TX Channel		9262	9400	9538	
Rx Channel		9662	9800	9938	
Frequency (MHz)		1852.4	1880	1907.6	
3GPP Rel 99	AMR 12.2Kbps	19.15	19.38	19.27	20.00
3GPP Rel 99	RMC 12.2Kbps	19.16	<b>19.40</b>	19.29	20.00
3GPP Rel 6	HSDPA Subtest-1	18.27	18.64	18.54	19.00
3GPP Rel 6	HSDPA Subtest-2	18.42	18.73	18.71	19.00
3GPP Rel 6	HSDPA Subtest-3	17.96	18.36	18.27	19.00
3GPP Rel 6	HSDPA Subtest-4	17.91	18.28	18.29	19.00
3GPP Rel 8	DC-HSDPA Subtest-1	18.26	18.61	18.48	19.00
3GPP Rel 8	DC-HSDPA Subtest-2	18.31	18.71	18.61	19.00
3GPP Rel 8	DC-HSDPA Subtest-3	17.88	18.25	18.18	19.00
3GPP Rel 8	DC-HSDPA Subtest-4	17.73	18.28	18.23	19.00
3GPP Rel 6	HSUPA Subtest-1	18.37	18.77	18.58	19.00
3GPP Rel 6	HSUPA Subtest-2	16.44	16.82	16.66	17.00
3GPP Rel 6	HSUPA Subtest-3	17.51	17.78	17.60	18.00
3GPP Rel 6	HSUPA Subtest-4	16.47	16.87	16.79	17.00
3GPP Rel 6	HSUPA Subtest-5	18.31	18.71	18.54	19.00



**<LTE Conducted Power>**

**<Full Power Mode>**

**<LTE Band 5>**

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.73	22.63	22.53	24.00	0
10	QPSK	1	25	23.21	23.16	23.19		
10	QPSK	1	49	22.88	22.87	22.35		
10	QPSK	25	0	22.18	22.12	22.17	23.00	1
10	QPSK	25	12	22.15	22.08	21.91		
10	QPSK	25	25	22.15	21.93	21.77		
10	QPSK	50	0	22.14	22.07	21.83	23.00	1
10	16QAM	1	0	22.25	21.76	21.81		
10	16QAM	1	25	21.87	21.99	21.82		
10	16QAM	1	49	21.83	21.63	21.64	22.00	2
10	16QAM	25	0	21.25	21.16	20.86		
10	16QAM	25	12	21.38	21.00	20.90		
10	16QAM	25	25	21.36	20.82	20.77	22.00	2
10	16QAM	50	0	21.22	21.05	20.83		
Channel				20425	20525	20625		
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.81	22.56	22.46	24.00	0
5	QPSK	1	12	23.04	23.00	23.18		
5	QPSK	1	24	22.65	22.66	22.30		
5	QPSK	12	0	22.05	22.03	21.80	23.00	1
5	QPSK	12	7	22.01	22.02	21.84		
5	QPSK	12	13	22.00	22.07	21.78		
5	QPSK	25	0	22.01	22.03	21.77	23.00	1
5	16QAM	1	0	21.92	21.96	21.71		
5	16QAM	1	12	22.29	22.12	21.76		
5	16QAM	1	24	21.89	21.84	21.72	22.00	2
5	16QAM	12	0	20.97	20.90	20.78		
5	16QAM	12	7	21.11	21.16	20.88		
5	16QAM	12	13	21.08	21.11	20.97	22.00	2
5	16QAM	25	0	21.10	20.93	20.79		



Channel				20415	20525	20635	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.83	22.98	22.52	24.00	0
3	QPSK	1	8	22.80	22.92	22.65		
3	QPSK	1	14	22.67	22.81	22.34		
3	QPSK	8	0	22.01	22.14	21.87	23.00	1
3	QPSK	8	4	22.06	22.06	21.79		
3	QPSK	8	7	22.11	22.12	21.81		
3	QPSK	15	0	22.01	21.99	21.73	23.00	1
3	16QAM	1	0	22.10	22.06	21.79		
3	16QAM	1	8	21.97	21.98	21.83		
3	16QAM	1	14	21.85	22.05	21.69	22.00	2
3	16QAM	8	0	21.26	21.01	20.75		
3	16QAM	8	4	21.07	21.04	20.69		
3	16QAM	8	7	21.09	21.08	20.68	22.00	2
3	16QAM	15	0	21.17	21.06	20.61		
Channel				20407	20525	20643	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.91	22.91	22.64	24.00	0
1.4	QPSK	1	3	22.93	23.00	22.63		
1.4	QPSK	1	5	22.71	22.92	22.55		
1.4	QPSK	3	0	23.09	23.05	22.89		
1.4	QPSK	3	1	23.08	22.88	22.86		
1.4	QPSK	3	3	22.97	22.93	22.62	23.00	1
1.4	QPSK	6	0	22.08	22.04	21.75		
1.4	16QAM	1	0	21.59	21.49	21.29	23.00	1
1.4	16QAM	1	3	21.76	21.38	21.23		
1.4	16QAM	1	5	21.78	21.46	21.20		
1.4	16QAM	3	0	22.17	21.67	22.00		
1.4	16QAM	3	1	22.19	22.11	22.00		
1.4	16QAM	3	3	22.26	22.21	21.93	22.00	2
1.4	16QAM	6	0	20.97	20.92	20.71		



**<LTE Band 7>**

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	22.98	22.93	22.78	24	0
20	QPSK	1	49	23.28	23.32	23.33		
20	QPSK	1	99	22.86	22.90	22.93		
20	QPSK	50	0	22.31	22.21	22.32	23	1
20	QPSK	50	24	22.23	22.14	22.25		
20	QPSK	50	50	22.18	22.17	22.30		
20	QPSK	100	0	22.16	22.15	22.25		
20	16QAM	1	0	21.78	21.68	21.62	23	1
20	16QAM	1	49	21.84	21.40	21.86		
20	16QAM	1	99	21.83	21.49	21.77		
20	16QAM	50	0	21.34	21.15	21.36	22	2
20	16QAM	50	24	21.28	21.17	21.34		
20	16QAM	50	50	21.22	21.14	21.40		
20	16QAM	100	0	21.20	21.17	21.22		
Channel				20825	21100	21375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	23.16	23.11	23.13	24	0
15	QPSK	1	37	23.27	23.30	23.34		
15	QPSK	1	74	23.19	23.10	23.14		
15	QPSK	36	0	22.34	22.24	22.26	23	1
15	QPSK	36	20	22.29	22.10	22.41		
15	QPSK	36	39	22.36	22.16	22.36		
15	QPSK	75	0	22.31	22.19	22.31		
15	16QAM	1	0	21.82	21.81	21.88	23	1
15	16QAM	1	37	21.93	21.90	21.96		
15	16QAM	1	74	21.77	21.81	21.95		
15	16QAM	36	0	21.32	21.19	21.22	22	2
15	16QAM	36	20	21.26	21.16	21.38		
15	16QAM	36	39	21.32	21.12	21.45		
15	16QAM	75	0	21.36	21.34	21.26		



Channel				20800	21100	21400	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	22.72	22.82	22.98	24	0
10	QPSK	1	25	23.27	23.30	23.31		
10	QPSK	1	49	22.91	22.71	23.02		
10	QPSK	25	0	22.25	22.19	22.36	23	1
10	QPSK	25	12	22.29	22.08	22.45		
10	QPSK	25	25	22.29	22.12	22.35		
10	QPSK	50	0	22.28	22.14	22.39		
10	16QAM	1	0	21.81	21.91	21.90	23	1
10	16QAM	1	25	21.94	21.78	21.95		
10	16QAM	1	49	21.89	21.71	21.93		
10	16QAM	25	0	21.34	21.29	21.55	22	2
10	16QAM	25	12	21.30	21.16	21.56		
10	16QAM	25	25	21.57	21.22	21.64		
10	16QAM	50	0	21.34	21.12	21.50		
Channel				20775	21100	21425	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	22.58	22.63	22.70	24	0
5	QPSK	1	12	23.23	23.14	23.19		
5	QPSK	1	24	22.75	22.59	22.81		
5	QPSK	12	0	22.14	22.01	22.31	23	1
5	QPSK	12	7	22.31	22.08	22.35		
5	QPSK	12	13	22.26	22.04	22.26		
5	QPSK	25	0	22.22	22.10	22.35		
5	16QAM	1	0	21.96	21.94	21.95	23	1
5	16QAM	1	12	21.89	21.76	21.95		
5	16QAM	1	24	21.80	21.67	21.86		
5	16QAM	12	0	21.13	21.04	21.32	22	2
5	16QAM	12	7	21.39	21.20	21.38		
5	16QAM	12	13	21.43	21.24	21.31		
5	16QAM	25	0	21.37	21.26	21.42		



**<Reduced Power Mode>**

**<LTE Band 7>**

BW [MHz]	Modulation	RB Size	RB Offset	Measured Power			Tune-up limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	21.57	21.56	21.62	22.5	0
20	QPSK	1	49	22.08	22.02	22.22		
20	QPSK	1	99	21.65	21.60	21.77		
20	QPSK	50	0	22.11	21.96	22.13	22.5	0-1
20	QPSK	50	24	22.06	21.93	22.03		
20	QPSK	50	50	21.95	21.84	22.09		
20	QPSK	100	0	21.91	21.95	21.99	22.5	0-1
20	16QAM	1	0	21.73	21.76	21.69		
20	16QAM	1	49	21.91	21.69	21.90		
20	16QAM	1	99	21.75	21.76	21.79	22.5	0-2
20	16QAM	50	0	22.02	22.03	22.02		
20	16QAM	50	24	22.08	21.90	22.04		
20	16QAM	50	50	22.04	21.84	22.04	22.5	0-2
20	16QAM	100	0	21.98	22.04	22.03		
Channel				20825	21100	21375		
Frequency (MHz)				2507.5	2535	2562.5	Tune-up limit (dBm)	MPR (dB)
15	QPSK	1	0	21.80	21.96	21.94	22.5	0
15	QPSK	1	37	22.25	22.08	22.27		
15	QPSK	1	74	21.94	21.86	21.97		
15	QPSK	36	0	22.04	21.93	22.00	22.5	0-1
15	QPSK	36	20	22.08	21.85	22.11		
15	QPSK	36	39	22.06	21.88	22.12		
15	QPSK	75	0	22.10	21.95	22.00	22.5	0-1
15	16QAM	1	0	21.79	21.79	21.80		
15	16QAM	1	37	21.80	21.56	21.77		
15	16QAM	1	74	21.78	21.64	21.85	22.5	0-2
15	16QAM	36	0	22.11	21.92	22.04		
15	16QAM	36	20	22.06	21.89	22.15		
15	16QAM	36	39	22.12	21.88	22.18	22.5	0-2
15	16QAM	75	0	22.16	22.03	22.05		



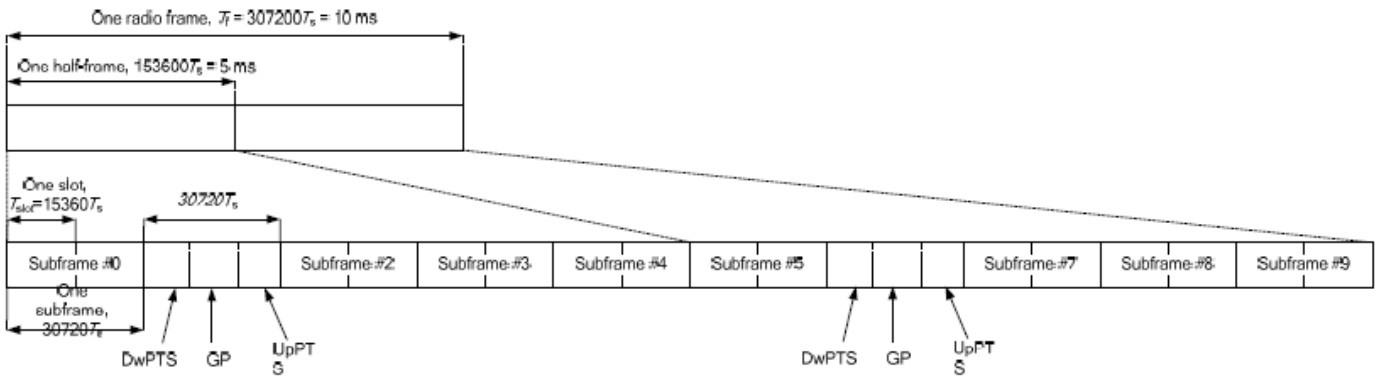
Channel				20800	21100	21400	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	21.61	21.66	21.81	22.5	0
10	QPSK	1	25	22.19	21.77	22.50		
10	QPSK	1	49	21.75	21.54	21.88		
10	QPSK	25	0	22.09	22.02	22.20	22.5	0-1
10	QPSK	25	12	22.04	21.88	22.17		
10	QPSK	25	25	22.02	21.83	22.17		
10	QPSK	50	0	22.09	21.95	22.12		
10	16QAM	1	0	21.69	21.68	21.85	22.5	0-1
10	16QAM	1	25	21.81	21.58	21.84		
10	16QAM	1	49	21.79	21.49	21.81		
10	16QAM	25	0	22.12	22.02	22.16	22.5	0-2
10	16QAM	25	12	22.11	21.84	22.43		
10	16QAM	25	25	22.00	21.84	22.40		
10	16QAM	50	0	21.99	21.87	22.18		
Channel				20775	21100	21425	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	21.75	21.61	21.64	22.5	0
5	QPSK	1	12	22.37	22.12	22.15		
5	QPSK	1	24	21.82	21.44	21.67		
5	QPSK	12	0	21.94	21.84	22.03	22.5	0-1
5	QPSK	12	7	22.11	21.87	22.06		
5	QPSK	12	13	22.05	21.83	22.07		
5	QPSK	25	0	22.00	21.79	22.03		
5	16QAM	1	0	21.68	21.67	21.77	22.5	0-1
5	16QAM	1	12	21.77	21.55	22.20		
5	16QAM	1	24	21.76	21.53	21.76		
5	16QAM	12	0	21.85	21.64	22.07	22.5	0-2
5	16QAM	12	7	22.00	21.85	22.11		
5	16QAM	12	13	22.04	21.70	22.13		
5	16QAM	25	0	21.91	21.96	22.26		

**<TDD LTE SAR Measurement>**

TDD LTE configuration setup for SAR measurement

SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

- a. 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- b. "special subframe S" contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
- c. Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.



**Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).**

**Table 4.2-2: Uplink-downlink configurations.**

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

**Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).**

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

<b>Special subframe (30720·T<sub>s</sub>): Normal cyclic prefix in downlink (UpPTS)</b>			
	<b>Special subframe configuration</b>	<b>Normal cyclic prefix in uplink</b>	<b>Extended cyclic prefix in uplink</b>
<b>Uplink duty factor in one special subframe</b>	<b>0~4</b>	7.13%	8.33%
	<b>5~9</b>	14.3%	16.7%

<b>Special subframe(30720·T<sub>s</sub>): Extended cyclic prefix in downlink (UpPTS)</b>			
	<b>Special subframe configuration</b>	<b>Normal cyclic prefix in uplink</b>	<b>Extended cyclic prefix in uplink</b>
<b>Uplink duty factor in one special subframe</b>	<b>0~3</b>	7.13%	8.33%
	<b>4~7</b>	14.3%	16.7%

The highest duty factor is resulted from:

- i. Uplink-downlink configuration: 0. In a half-frame consisted of 5 subframes, uplink operation is in 3 uplink subframes and 1 special subframe.
- ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
- iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is:  $(3+0.167)/5 = 63.3\%$
- iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is:  $(3+0.143)/5 = 62.9\%$
- v. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix  $63.3\%/62.9\% = 1.006$  is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)\* Tune-up Scaling Factor\* scaling factor for extended cyclic prefix.



**<Full Power Mode>**

**<LTE Band 38>**

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				37850	38000	38150		
Frequency (MHz)				2580	2595	2610		
20	QPSK	1	0	22.88	22.74	22.68	24.00	0
20	QPSK	1	49	22.85	22.84	22.72		
20	QPSK	1	99	22.74	22.55	22.56		
20	QPSK	50	0	22.05	21.92	21.87	23.00	1
20	QPSK	50	24	22.03	21.82	21.84		
20	QPSK	50	50	22.04	21.83	21.77		
20	QPSK	100	0	22.06	21.84	21.79	23.00	1
20	16QAM	1	0	21.37	21.21	21.11		
20	16QAM	1	49	21.73	21.52	21.45		
20	16QAM	1	99	21.61	21.09	21.36	22.00	2
20	16QAM	50	0	21.41	20.93	20.84		
20	16QAM	50	24	21.01	20.82	20.82		
20	16QAM	50	50	21.03	20.85	20.76	22.00	2
20	16QAM	100	0	20.98	20.84	20.78		
Channel				37825	38000	38175		
Frequency (MHz)				2577.5	2595	2612.5		
15	QPSK	1	0	22.82	22.83	22.73	24.00	0
15	QPSK	1	37	23.13	23.08	22.91		
15	QPSK	1	74	22.64	22.52	22.49		
15	QPSK	36	0	22.39	22.10	21.86	23.00	1
15	QPSK	36	20	22.07	21.79	21.78		
15	QPSK	36	39	22.01	21.86	21.72		
15	QPSK	75	0	22.09	21.86	21.80	23.00	1
15	16QAM	1	0	21.99	21.47	21.37		
15	16QAM	1	37	21.88	21.60	21.94		
15	16QAM	1	74	21.41	21.20	21.56	22.00	2
15	16QAM	36	0	21.08	21.03	20.96		
15	16QAM	36	20	21.09	20.83	20.78		
15	16QAM	36	39	21.07	21.12	21.02	22.00	2
15	16QAM	75	0	21.07	20.93	20.78		



Channel				37800	38000	38200	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2575	2595	2615		
10	QPSK	1	0	22.91	22.67	22.67	24.00	0
10	QPSK	1	25	23.29	22.94	22.88		
10	QPSK	1	49	22.93	22.69	22.59		
10	QPSK	25	0	22.12	21.84	21.80	23.00	1
10	QPSK	25	12	22.06	21.83	21.77		
10	QPSK	25	25	22.05	21.81	21.77		
10	QPSK	50	0	22.05	21.82	21.76	23.00	1
10	16QAM	1	0	21.50	21.52	21.17		
10	16QAM	1	25	21.79	21.46	21.44		
10	16QAM	1	49	21.43	21.25	21.44	22.00	2
10	16QAM	25	0	21.29	21.04	21.01		
10	16QAM	25	12	21.30	20.99	21.02		
10	16QAM	25	25	21.24	20.98	20.96	22.00	2
10	16QAM	50	0	21.04	20.79	20.82		
Channel				37775	38000	38225		
Frequency (MHz)				2572.5	2595	2617.5		
5	QPSK	1	0	22.75	22.58	22.47	24.00	0
5	QPSK	1	12	23.52	22.73	22.78		
5	QPSK	1	24	22.79	22.46	22.45		
5	QPSK	12	0	22.38	21.73	21.73	23.00	1
5	QPSK	12	7	22.12	21.75	21.71		
5	QPSK	12	13	22.09	21.76	21.71		
5	QPSK	25	0	22.02	21.77	21.71	23.00	1
5	16QAM	1	0	21.83	21.57	21.37		
5	16QAM	1	12	21.98	21.66	21.57		
5	16QAM	1	24	21.74	21.48	21.36	22.00	2
5	16QAM	12	0	21.05	21.03	20.97		
5	16QAM	12	7	21.13	20.79	20.76		
5	16QAM	12	13	21.38	21.03	20.72	22.00	2
5	16QAM	25	0	21.28	21.01	20.95		



**<LTE Band 41>**

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Low Ch. / Freq.	Power Middle High Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				40340	40600	40870	41140		
Frequency (MHz)				2565	2591	2618	2645		
20	QPSK	1	0	23.76	23.53	23.43	23.04	24.00	0
20	QPSK	1	49	23.89	23.55	23.52	23.36		
20	QPSK	1	99	23.58	23.39	22.95	23.03		
20	QPSK	50	0	22.96	22.90	22.75	22.55	23.00	1
20	QPSK	50	24	22.95	22.88	22.69	22.49		
20	QPSK	50	50	22.90	22.77	22.45	22.29		
20	QPSK	100	0	22.88	22.74	22.60	22.38	23.00	1
20	16QAM	1	0	22.64	22.22	22.23	21.71		
20	16QAM	1	49	22.60	22.84	22.25	22.06		
20	16QAM	1	99	22.46	22.29	21.86	21.87	22.00	2
20	16QAM	50	0	21.75	21.76	21.73	21.22		
20	16QAM	50	24	21.80	21.84	21.68	21.26		
20	16QAM	50	50	21.86	21.70	21.53	21.48	22.00	2
20	16QAM	100	0	21.88	21.83	21.50	21.15		
Channel				40315	40595	40885	41165		
Frequency (MHz)				2562.5	2590.5	2619.5	2647.5		
15	QPSK	1	0	23.74	23.56	23.51	22.99	24.00	0
15	QPSK	1	37	23.88	23.83	23.54	23.36		
15	QPSK	1	74	23.76	23.45	23.20	23.21		
15	QPSK	36	0	22.94	22.95	22.65	22.31	23.00	1
15	QPSK	36	20	22.86	22.90	22.47	22.29		
15	QPSK	36	39	22.87	22.72	22.50	22.53		
15	QPSK	75	0	22.99	22.73	22.56	22.47	23.00	1
15	16QAM	1	0	22.71	22.31	22.20	21.78		
15	16QAM	1	37	22.69	22.42	22.55	22.44		
15	16QAM	1	74	22.53	22.39	22.19	21.77	22.00	2
15	16QAM	36	0	21.80	21.93	21.73	21.24		
15	16QAM	36	20	21.96	21.86	21.54	21.42		
15	16QAM	36	39	21.89	21.86	21.44	21.37	22.00	2
15	16QAM	75	0	21.89	21.82	21.50	21.33		



Channel				40290	40590	40890	41190	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2560	2590	2620	2650		
10	QPSK	1	0	23.80	23.61	23.35	23.12	24.00	0
10	QPSK	1	25	23.80	23.71	23.23	23.16		
10	QPSK	1	49	23.77	23.53	23.20	23.09		
10	QPSK	25	0	22.81	22.74	22.58	22.28	23.00	1
10	QPSK	25	12	22.94	22.89	22.51	22.29		
10	QPSK	25	25	22.93	22.75	22.46	22.31		
10	QPSK	50	0	22.97	22.76	22.50	22.35	23.00	1
10	16QAM	1	0	22.49	22.25	22.20	21.84		
10	16QAM	1	25	22.75	22.59	22.53	22.09		
10	16QAM	1	49	22.47	22.28	22.01	21.83	22.00	2
10	16QAM	25	0	21.80	21.86	21.85	21.48		
10	16QAM	25	12	21.79	21.89	21.74	21.47		
10	16QAM	25	25	21.83	21.83	21.90	21.45	22.00	2
10	16QAM	50	0	21.80	21.84	21.59	21.23		
Channel				40265	40585	40905	41215		
Frequency (MHz)				2557.5	2589.5	2621.5	2652.5		
5	QPSK	1	0	23.58	23.46	23.14	22.97	24.00	0
5	QPSK	1	12	23.85	23.63	23.43	23.29		
5	QPSK	1	24	23.70	23.39	23.04	22.93		
5	QPSK	12	0	22.89	22.66	22.47	22.31	23.00	1
5	QPSK	12	7	22.91	22.69	22.45	22.28		
5	QPSK	12	13	22.94	22.73	22.57	22.33		
5	QPSK	25	0	22.87	22.69	22.51	22.26	23.00	1
5	16QAM	1	0	22.51	22.23	21.99	22.10		
5	16QAM	1	12	22.99	22.40	22.44	22.03		
5	16QAM	1	24	22.69	22.23	22.19	21.80	22.00	2
5	16QAM	12	0	21.90	21.79	21.51	21.26		
5	16QAM	12	7	21.89	21.83	21.58	21.22		
5	16QAM	12	13	21.86	21.68	21.40	21.25	22.00	2
5	16QAM	25	0	21.88	21.73	21.90	21.45		



**LTE Carrier Aggregation Conducted Power**

**General Note:**

- i. According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink carrier aggregation active.
- ii. Uplink maximum output power with downlink carrier aggregation active does not show more than ¼ dB higher than the maximum output power without downlink carrier aggregation active, therefore SAR evaluation with downlink carrier aggregation active can be excluded.
- iii. The device supports downlink carrier aggregation only. Uplink carrier aggregation is not supported. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
- iv. Selected highest measured power when downlink carrier aggregation is inactive for conducted power comparison with downlink carrier aggregation is active, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.
- v. For non-contiguous intra-band CA, the SCC selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band. For SCC DL RB size and offset will base on the PCC corresponding RB allocation.
- vi. For inter-band CA, the SCC selected highest bandwidth and near the middle of its transmission band. For SCC DL RB size and offset will base on the PCC corresponding RB allocation.



Configure		PCC					SCC				Power		
		LTE Band	BW (MHz)	Freq. (MHz)	Channel	UL# RB	UL RB Offset	LTE Band	BW (MHz)	Freq. (MHz)	Channel	LTE Rel 10 Tx.Power(dBm)	LTE Rel 8 Tx.Power(dBm)
Inter-Band	Band 5	10M	829	20450	1	25	Band 7	20M	2655	3100	23.20	23.21	
	Band 5	10M	836.5	20525	1	25	Band 7	20M	2655	3100	23.15	23.16	
	Band 5	10M	844	20600	1	25	Band 7	20M	2655	3100	23.18	23.19	
	Band 7	20M	2510	20850	1	49	Band 5	10M	881.5	2525	23.27	23.28	
	Band 7	20M	2535	21100	1	49	Band 5	10M	881.5	2525	23.28	23.32	
	Band 7	20M	2560	21350	1	49	Band 5	10M	881.5	2525	23.29	23.33	
Intra-Band	Contiguous	Band 7	20M	2510	20850	1	49	Band 7	20M	2650	3050	23.25	23.28
		Band 7	20M	2535	21100	1	49	Band 7	20M	2635	2900	23.29	23.32
		Band 7	20M	2535	21100	1	49	Band 7	20M	2675	3300	23.32	23.32
		Band 7	20M	2560	21350	1	49	Band 7	20M	2660	3150	23.30	23.33
	Non-Contiguous	Band 7	20M	2510	20850	1	49	Band 7	20M	2680	3350	23.26	23.28
		Band 7	20M	2535	21100	1	49	Band 7	20M	2680	3350	23.31	23.32
		Band 7	20M	2560	21350	1	49	Band 7	20M	2630	2850	23.33	23.33
		Band 7	20M	2560	21350	1	49	Band 7	20M	2655	3100	23.32	23.33

Configure		PCC					SCC				Power		
		LTE Band	BW (MHz)	Freq. (MHz)	Channel	UL# RB	UL RB Offset	LTE Band	BW (MHz)	Freq. (MHz)	Channel	LTE Rel 10 Tx.Power(dBm)	LTE Rel 8 Tx.Power(dBm)
Inter-Band	Band 5	10M	829	20450	1	25	Band 7	20M	2655	3100	23.18	23.21	
	Band 5	10M	836.5	20525	1	25	Band 7	20M	2655	3100	23.15	23.16	
	Band 5	10M	844	20600	1	25	Band 7	20M	2655	3100	23.16	23.19	
	Band 7	20M	2510	20850	1	49	Band 5	10M	881.5	2525	22.05	22.08	
	Band 7	20M	2535	21100	1	49	Band 5	10M	881.5	2525	22.01	22.02	
	Band 7	20M	2560	21350	1	49	Band 5	10M	881.5	2525	22.16	22.22	
Intra-Band	Contiguous	Band 7	20M	2510	20850	1	49	Band 7	20M	2650	3050	22.06	22.08
		Band 7	20M	2535	21100	1	49	Band 7	20M	2635	2900	21.98	22.02
		Band 7	20M	2535	21100	1	49	Band 7	20M	2675	3300	22.17	22.02
		Band 7	20M	2560	21350	1	49	Band 7	20M	2660	3150	22.19	22.22
	Non-Contiguous	Band 7	20M	2510	20850	1	49	Band 7	20M	2680	3350	22.07	22.08
		Band 7	20M	2535	21100	1	49	Band 7	20M	2680	3350	22.00	22.02
		Band 7	20M	2560	21350	1	49	Band 7	20M	2630	2850	22.18	22.22
		Band 7	20M	2560	21350	1	49	Band 7	20M	2655	3100	22.19	22.22



### 13. SAR Test Results

**General Note:**

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
  - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

#### 13.1 Head SAR

**<GSM SAR>**

Plot No.	Band	Mode	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	GSM850	GPRS 1 Tx slot	Left Cheek	OFF	189	836.4	33.21	33.50	1.069	0.17	0.155	<b>0.166</b>
02	GSM1900	GPRS 1 Tx slot	Right Cheek	OFF	810	1909.8	30.06	30.50	1.107	0.19	0.035	<b>0.039</b>

**<WCDMA SAR>**

Plot No.	Band	Mode	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA Band V	RMC 12.2Kbps	Left Cheek	OFF	4132	826.4	22.94	24.00	1.276	0.14	0.259	<b>0.331</b>
04	WCDMA Band II	RMC 12.2Kbps	Right Cheek	OFF	9400	1880	22.97	24.00	1.268	-0.07	0.046	<b>0.058</b>

**<LTE SAR>**

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
05	LTE Band 5	10M	QPSK	1RB	25Offset	Left Cheek	OFF	20525	836.5	23.16	24.00	1.213	0.02	0.244	<b>0.296</b>
06	LTE Band 7	20M	QPSK	1RB	49Offset	Right Cheek	OFF	20850	2510	23.28	24.00	1.180	0.01	0.406	<b>0.479</b>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
07	LTE Band 41	20M	QPSK	1RB	49Offset	Right Cheek	OFF	40340	2565	23.89	24.00	1.026	62.9	1.006	0.11	0.226	<b>0.233</b>

**13.2 Hotspot SAR**

**<GSM SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS 1 Tx slots	Front	10mm	OFF	189	836.4	33.21	33.50	1.069	-0.01	0.272	0.291
08	GSM850	GPRS 1 Tx slots	Left Side	10mm	OFF	189	836.4	33.21	33.50	1.069	0.07	0.315	<b>0.337</b>
	GSM1900	GPRS 1 Tx slot	Front	10mm	ON	810	1909.8	28.38	28.50	1.028	-0.05	0.369	0.379
09	GSM1900	GPRS 1 Tx slot	Bottom Side	10mm	ON	512	1850.2	28.17	28.50	1.079	0.17	0.538	<b>0.580</b>

**<WCDMA SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA Band V	RMC 12.2Kbps	Back	10mm	OFF	4132	826.4	22.94	24.00	1.276	-0.05	0.301	0.384
10	WCDMA Band V	RMC 12.2Kbps	Left Side	10mm	OFF	4132	826.4	22.94	24.00	1.276	0.09	0.439	<b>0.560</b>
	WCDMA Band II	RMC 12.2Kbps	Front	10mm	ON	9400	1880	19.40	20.00	1.148	-0.09	0.448	0.514
11	WCDMA Band II	RMC 12.2Kbps	Bottom Side	10mm	ON	9262	1852.4	19.16	20.00	1.213	0.14	0.569	<b>0.690</b>

**<LTE SAR>**

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1RB	25Offset	Front	10mm	OFF	20525	836.5	23.16	24.00	1.213	-0.06	0.265	0.322
12	LTE Band 5	10M	QPSK	1RB	25Offset	Left Side	10mm	OFF	20525	836.5	23.16	24.00	1.213	-0.19	0.444	<b>0.539</b>
	LTE Band 7	20M	QPSK	1RB	49Offset	Front	10mm	ON	21350	2560	22.22	22.50	1.067	-0.06	0.710	0.757
13	LTE Band 7	20M	QPSK	1RB	49Offset	Bottom Side	10mm	ON	20850	2510	22.08	22.50	1.102	0.18	1.060	<b>1.168</b>
	LTE Band 7	20M	QPSK	1RB	49Offset	Bottom Side	10mm	ON	21100	2535	22.02	22.50	1.117	-0.06	0.974	1.088
	LTE Band 7	20M	QPSK	1RB	49Offset	Bottom Side	10mm	ON	21350	2560	22.22	22.50	1.067	0.01	0.878	0.936

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
14	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	41140	2645	23.36	24.00	1.159	62.9	1.006	0.02	0.875	<b>1.020</b>
	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	40340	2565	23.89	24.00	1.026	62.9	1.006	0.04	0.726	0.749
	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	40600	2591	23.55	24.00	1.109	62.9	1.006	-0.18	0.726	0.810
	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	40870	2618	23.52	24.00	1.117	62.9	1.006	0.15	0.816	0.917



**13.3 Body Worn Accessory SAR**

**<GSM SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
15	GSM850	GPRS 1 Tx slots	Front	10mm	OFF	189	836.4	33.21	33.50	1.069	-0.01	0.272	<b>0.291</b>
16	GSM1900	GPRS 1 Tx slot	Front	10mm	ON	810	1909.8	28.38	28.50	1.028	-0.05	0.369	<b>0.379</b>

**<WCDMA SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
17	WCDMA Band V	RMC 12.2Kbps	Back	10mm	OFF	4132	826.4	22.94	24.00	1.276	-0.05	0.301	<b>0.384</b>
18	WCDMA Band II	RMC 12.2Kbps	Front	10mm	ON	9400	1880	19.40	20.00	1.148	-0.09	0.448	<b>0.514</b>

**<LTE SAR>**

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
19	LTE Band 5	10M	QPSK	1RB	25Offset	Front	10mm	OFF	20525	836.5	23.16	24.00	1.213	-0.06	0.265	<b>0.322</b>
20	LTE Band 7	20M	QPSK	1RB	49Offset	Front	10mm	ON	21350	2560	22.22	22.50	1.067	-0.06	0.710	<b>0.757</b>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
14	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	41140	2645	23.36	24.00	1.159	62.9	1.006	0.02	0.875	<b>1.020</b>
	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	40340	2565	23.89	24.00	1.026	62.9	1.006	0.04	0.726	0.749
	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	40600	2591	23.55	24.00	1.109	62.9	1.006	-0.18	0.726	0.810
	LTE Band 41	20M	QPSK	1RB	49Offset	Front	10mm	OFF	40870	2618	23.52	24.00	1.117	62.9	1.006	0.15	0.816	0.917



**13.4 Repeated SAR Measurement**

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 7	20M	QPSK	1RB	49Offset	Bottom Side	10mm	ON	20850	2510	22.08	22.50	1.102	0.18	1.060	1	1.168
2nd	LTE Band 7	20M	QPSK	1RB	49Offset	Bottom Side	10mm	ON	20850	2510	22.08	22.50	1.102	0.08	1.040	1.019	1.146

**General Note:**

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8W/kg$ .
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is  $\leq 1.2$  and the measured SAR  $< 1.45W/kg$ , only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

### **14. Simultaneous Transmission Analysis**

NO.	Simultaneous Transmission Configurations	Portable Handset			Note
		Head	Body-worn	Hotspot	
1.	GSM Voice + WLAN2.4GHz	Yes	Yes		
2.	GPRS/EDGE + WLAN2.4GHz	Yes	Yes	Yes	Hotspot
3.	WCDMA + WLAN2.4GHz	Yes	Yes	Yes	Hotspot
4.	LTE + WLAN2.4GHz	Yes	Yes	Yes	Hotspot
5.	GSM Voice + WLAN5.3/5.5GHz	Yes	Yes		
6.	GPRS/EDGE + WLAN5.3/5.5GHz	Yes	Yes		WWAN VoIP
7.	WCDMA + WLAN5.3/5.5GHz	Yes	Yes		WWAN VoIP
8.	LTE + WLAN5.3/5.5GHz	Yes	Yes		WWAN VoIP
9.	GSM Voice + WLAN5.2/5.8GHz	Yes	Yes	Yes	
10.	GPRS/EDGE + WLAN5.2/5.8GHz	Yes	Yes	Yes	WWAN VoIP
11.	WCDMA + WLAN5.2/5.8GHz	Yes	Yes	Yes	WWAN VoIP
12.	LTE + WLAN5.2/5.8GHz	Yes	Yes	Yes	WWAN VoIP
13.	GSM Voice + Bluetooth		Yes		
14.	GPRS/EDGE +Bluetooth		Yes		WWAN VoIP
15.	WCDMA + Bluetooth		Yes		WWAN VoIP
16.	LTE + Bluetooth		Yes		WWAN VoIP

**General Note:**

1. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
2. EUT will choose each GSM, WCDMA, and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
3. For simultaneously transmission SAR analysis, WWAN SAR values only considered the worst position which we did perform SAR testing on FA6O1212-13, and WLAN SAR were leverage from the parent model which referred to the test report number FA6O1212-11.
4. The Scaled SAR summation is calculated based on the same configuration and test position.
5. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
  - i) Scalar SAR summation < 1.6W/kg.
  - 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.
  - iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.



**14.1 Head Exposure Conditions**

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
			WWAN	2.4GHz WLAN	5GHz WLAN				
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)				
GSM	GSM850	Right Cheek	0.196	0.855	0.613	1.05	0.81		
		Right Tilted	0.176	0.855	0.613	1.03	0.79		
		Left Cheek	0.166	0.855	0.613	1.02	0.78		
		Left Tilted	0.162	0.855	0.613	1.02	0.78		
	GSM1900	Right Cheek	0.039	0.855	0.613	0.89	0.65		
		Right Tilted	0.072	0.855	0.613	0.93	0.69		
		Left Cheek	0.106	0.855	0.613	0.96	0.72		
		Left Tilted	0.039	0.855	0.613	0.89	0.65		
WCDMA	Band V	Right Cheek	0.278	0.855	0.613	1.13	0.89		
		Right Tilted	0.253	0.855	0.613	1.11	0.87		
		Left Cheek	0.331	0.855	0.613	1.19	0.94		
		Left Tilted	0.223	0.855	0.613	1.08	0.84		
	Band II	Right Cheek	0.058	0.855	0.613	0.91	0.67		
		Right Tilted	0.183	0.855	0.613	1.04	0.80		
		Left Cheek	0.374	0.855	0.613	1.23	0.99		
		Left Tilted	0.118	0.855	0.613	0.97	0.73		
LTE	Band 5	Right Cheek	0.250	0.855	0.613	1.11	0.86		
		Right Tilted	0.164	0.855	0.613	1.02	0.78		
		Left Cheek	0.296	0.855	0.613	1.15	0.91		
		Left Tilted	0.218	0.855	0.613	1.07	0.83		
	Band 7	Right Cheek	0.479	0.855	0.613	<b>1.33</b>	1.09		
		Right Tilted	0.190	0.855	0.613	1.05	0.80		
		Left Cheek	0.450	0.855	0.613	1.31	1.06		
		Left Tilted	0.303	0.855	0.613	1.16	0.92		
	Band 41	Right Cheek	0.233	0.855	0.613	1.09	0.85		
		Right Tilted	0.090	0.855	0.613	0.95	0.70		
		Left Cheek	0.156	0.855	0.613	1.01	0.77		
		Left Tilted	0.147	0.855	0.613	1.00	0.76		



**14.2 Hotspot Exposure Conditions**

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
			WWAN 1g SAR (W/kg)	2.4GHz WLAN 1g SAR (W/kg)	5GHz WLAN 1g SAR (W/kg)				
GSM	GSM850	Front	0.346	0.073	0.135	0.42	0.48		
		Back	0.315	0.073	0.135	0.39	0.45		
		Left side	0.337			0.34	0.34		
		Right side	0.222	0.073	0.135	0.30	0.36		
		Top side		0.073	0.135	0.07	0.14		
	Bottom side	0.212			0.21	0.21			
	GSM1900	Front	0.652	0.073	0.135	0.73	0.79		
		Back	0.427	0.073	0.135	0.50	0.56		
		Left side	0.066			0.07	0.07		
		Right side	0.046	0.073	0.135	0.12	0.18		
Top side			0.073	0.135	0.07	0.14			
Bottom side	0.580			0.58	0.58				
WCDMA	Band V	Front	0.417	0.073	0.135	0.49	0.55		
		Back	0.424	0.073	0.135	0.50	0.56		
		Left side	0.560			0.56	0.56		
		Right side	0.378	0.073	0.135	0.45	0.51		
		Top side		0.073	0.135	0.07	0.14		
	Bottom side	0.250			0.25	0.25			
	Band II	Front	0.736	0.073	0.135	0.81	0.87		
		Back	0.516	0.073	0.135	0.59	0.65		
		Left side	0.085			0.09	0.09		
		Right side	0.059	0.073	0.135	0.13	0.19		
Top side			0.073	0.135	0.07	0.14			
Bottom side	0.690			0.69	0.69				
LTE	Band 5	Front	0.326	0.073	0.135	0.40	0.46		
		Back	0.324	0.073	0.135	0.40	0.46		
		Left side	0.539			0.54	0.54		
		Right side	0.254	0.073	0.135	0.33	0.39		
		Top side		0.073	0.135	0.07	0.14		
		Bottom side	0.245			0.25	0.25		
	Band 7	Front	0.929	0.073	0.135	1.00	1.06		
		Back	0.774	0.073	0.135	0.85	0.91		
		Left side	0.091			0.09	0.09		
		Right side	0.593	0.073	0.135	0.67	0.73		
		Top side		0.073	0.135	0.07	0.14		
		Bottom side	1.168			1.17	<b>1.17</b>		
	Band 41	Front	1.020	0.073	0.135	1.09	1.16		
		Back	0.910	0.073	0.135	0.98	1.05		
		Left side	0.100			0.10	0.10		
		Right side	0.539	0.073	0.135	0.61	0.67		
		Top side		0.073	0.135	0.07	0.14		
		Bottom side	0.932			0.93	0.93		



**14.3 Body-Worn Accessory Exposure Conditions**

WWAN Band		Exposure Position	1	2	3	4	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)	SPLSR	Case No
			WWAN	2.4GHz WLAN	5GHz WLAN	Bluetooth					
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	Bluetooth 1g SAR (W/kg)					
GSM	GSM850	Front	0.291	0.073	0.153	0.020	0.36	0.44	0.31		
		Back	0.315	0.073	0.153	0.006	0.39	0.47	0.32		
	GSM1900	Front	0.379	0.073	0.153	0.020	0.45	0.53	0.40		
		Back	0.427	0.073	0.153	0.006	0.50	0.58	0.43		
WCDMA	Band V	Front	0.417	0.073	0.153	0.020	0.49	0.57	0.44		
		Back	0.384	0.073	0.153	0.006	0.46	0.54	0.39		
	Band II	Front	0.514	0.073	0.153	0.020	0.59	0.67	0.53		
		Back	0.516	0.073	0.153	0.006	0.59	0.67	0.52		
LTE	Band 5	Front	0.322	0.073	0.153	0.020	0.40	0.48	0.34		
		Back	0.324	0.073	0.153	0.006	0.40	0.48	0.33		
	Band 7	Front	0.757	0.073	0.153	0.020	0.83	0.91	0.78		
		Back	0.774	0.073	0.153	0.006	0.85	0.93	0.78		
	Band 41	Front	1.020	0.073	0.153	0.020	1.09	1.17	1.04		
		Back	0.910	0.073	0.153	0.006	0.98	1.06	0.92		

**Test Engineer:** Nick Hu

## **15. Uncertainty Assessment**

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture’s specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

<b>Uncertainty Distributions</b>	<b>Normal</b>	<b>Rectangular</b>	<b>Triangular</b>	<b>U-Shape</b>
Multi-plying Factor <sup>(a)</sup>	1/ $\kappa$ <sup>(b)</sup>	1/ $\sqrt{3}$	1/ $\sqrt{6}$	1/ $\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b)  $\kappa$  is the coverage factor

**Table 15.1. Standard Uncertainty for Assumed Distribution**

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual “root-sum-squares” (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.



Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
<b>Measurement System</b>							
Probe Calibration	6.0	N	1	1	1	6.0	6.0
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2
<b>Test Sample Related</b>							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
<b>Phantom and Setup</b>							
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
<b>Combined Std. Uncertainty</b>						11.4%	11.4%
<b>Coverage Factor for 95 %</b>						K=2	K=2
<b>Expanded STD Uncertainty</b>						22.9%	22.7%

**Table 15.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz**



Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
<b>Measurement System</b>							
Probe Calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	2.0	R	1.732	1	1	1.2	1.2
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	6.7	R	1.732	1	1	3.9	3.9
Max. SAR Eval.	4.0	R	1.732	1	1	2.3	2.3
<b>Test Sample Related</b>							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
<b>Phantom and Setup</b>							
Phantom Uncertainty	6.6	R	1.732	1	1	3.8	3.8
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
<b>Combined Std. Uncertainty</b>						12.5%	12.5%
<b>Coverage Factor for 95 %</b>						K=2	K=2
<b>Expanded STD Uncertainty</b>						25.1%	25.0%

**Table 15.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz**



## **16. References**

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] ANSI/IEEE Std. C95.1-1992, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", September 1992
- [3] IEEE Std. 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 248227 D01 v02r02, "SAR Guidance for IEEE 802.11 (WiFi) Transmitters", Oct 2015.
- [6] FCC KDB 447498 D01 v06, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Oct 2015
- [7] FCC KDB 648474 D04 v01r03, "SAR Evaluation Considerations for Wireless Handsets", Oct 2015.
- [8] FCC KDB 941225 D01 v03r01, "3G SAR MEAUREMENT PROCEDURES", Oct 2015
- [9] FCC KDB 941225 D05 v02r05, "SAR Evaluation Considerations for LTE Devices", Dec 2015
- [10] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.
- [11] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [12] FCC KDB 865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations" Oct 2015.
- [13] FCC KDB 941225 D05A v01r02, "Rel. 10 LTE SAR Test Guidance and KDB Inquiries", Oct 2015



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

The plots are shown as follows.

### System Check\_Head\_835MHz

**DUT: D835V2 - SN:4d151**

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

Medium: HSL\_835 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.925 \text{ S/m}$ ;  $\epsilon_r = 41.558$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.6 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.6 \text{ }^\circ\text{C}$

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.32, 9.32, 9.32); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Maximum value of SAR (interpolated) =  $3.12 \text{ W/kg}$

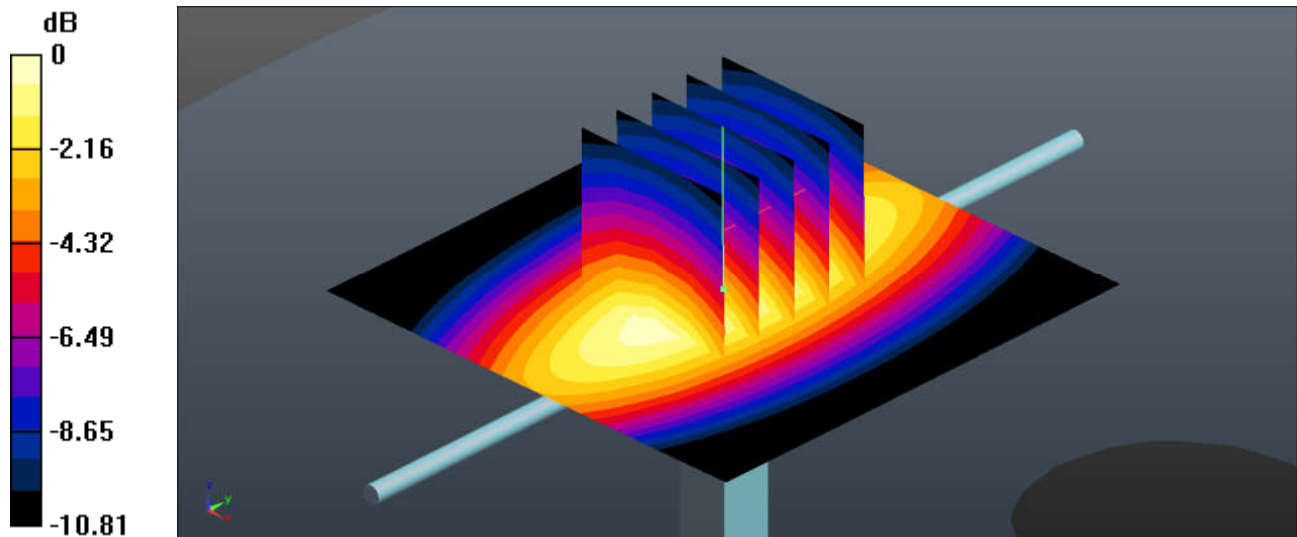
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $53.62 \text{ V/m}$ ; Power Drift =  $-0.02 \text{ dB}$

Peak SAR (extrapolated) =  $3.69 \text{ W/kg}$

**SAR(1 g) =  $2.45 \text{ W/kg}$ ; SAR(10 g) =  $1.6 \text{ W/kg}$**

Maximum value of SAR (measured) =  $3.13 \text{ W/kg}$



0 dB =  $3.13 \text{ W/kg} = 4.96 \text{ dBW/kg}$

### System Check\_Head\_1900MHz

**DUT: D1900V2 - SN:5d118**

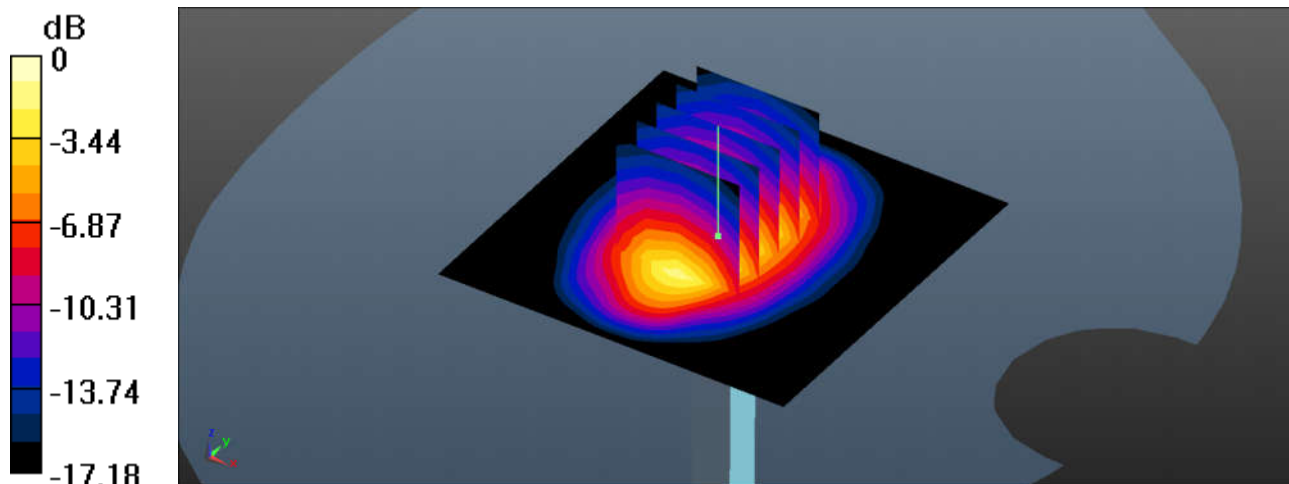
Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium: HSL\_1900 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.412$  S/m;  $\epsilon_r = 40.487$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.32, 8.32, 8.32); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2016.4.4
- Phantom: SAM2; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 13.4 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 85.79 V/m; Power Drift = -0.12 dB  
Peak SAR (extrapolated) = 16.8 W/kg  
**SAR(1 g) = 9.42 W/kg; SAR(10 g) = 4.99 W/kg**  
Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.27 dBW/kg

### System Check\_Head\_2600MHz

**DUT: D2600V2 - SN:1008**

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: HSL\_2600 Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2$  S/m;  $\epsilon_r = 39.594$ ;  $\rho = 1000$  kg/m<sup>3</sup>

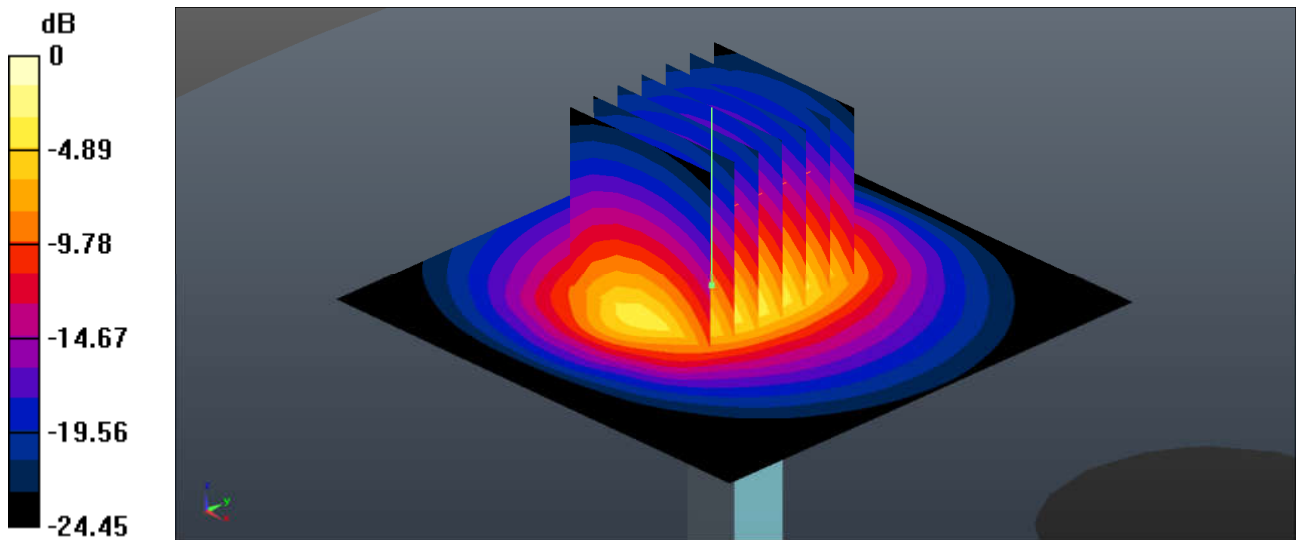
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.9 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.08, 7.08, 7.08); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (71x71x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 22.5 W/kg

**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 87.81 V/m; Power Drift = 0.14 dB  
Peak SAR (extrapolated) = 30.1 W/kg  
**SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.11 W/kg**  
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

### System Check\_Body\_835MHz

#### DUT: D835V2 - SN:4d151

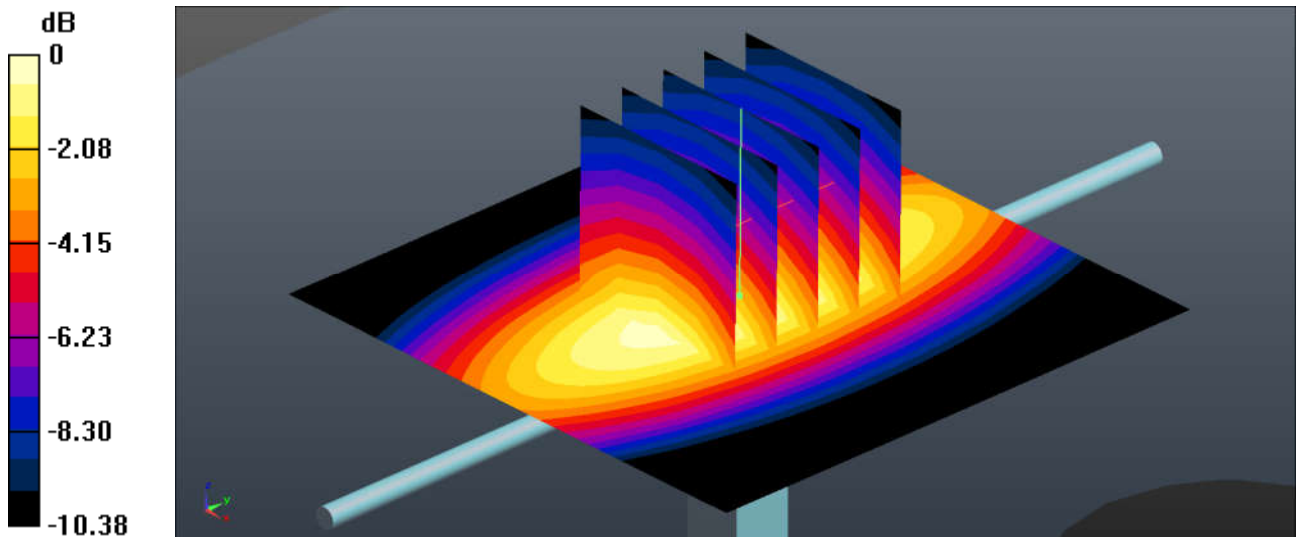
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1  
Medium: MSL\_850 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.973 \text{ S/m}$ ;  $\epsilon_r = 55.714$ ;  $\rho = 1000 \text{ kg/m}^3$   
Ambient Temperature :  $23.6 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.6 \text{ }^\circ\text{C}$

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$   
Maximum value of SAR (interpolated) =  $3.25 \text{ W/kg}$

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value =  $53.47 \text{ V/m}$ ; Power Drift =  $0.03 \text{ dB}$   
Peak SAR (extrapolated) =  $3.78 \text{ W/kg}$   
**SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.61 W/kg**  
Maximum value of SAR (measured) =  $3.26 \text{ W/kg}$



0 dB =  $3.26 \text{ W/kg} = 5.13 \text{ dBW/kg}$

### System Check\_Body\_1900MHz

**DUT: D1900V2 - SN:5d118**

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

Medium: MSL\_1900 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.567$  S/m;  $\epsilon_r = 55.061$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.7 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Maximum value of SAR (interpolated) = 14.4 W/kg

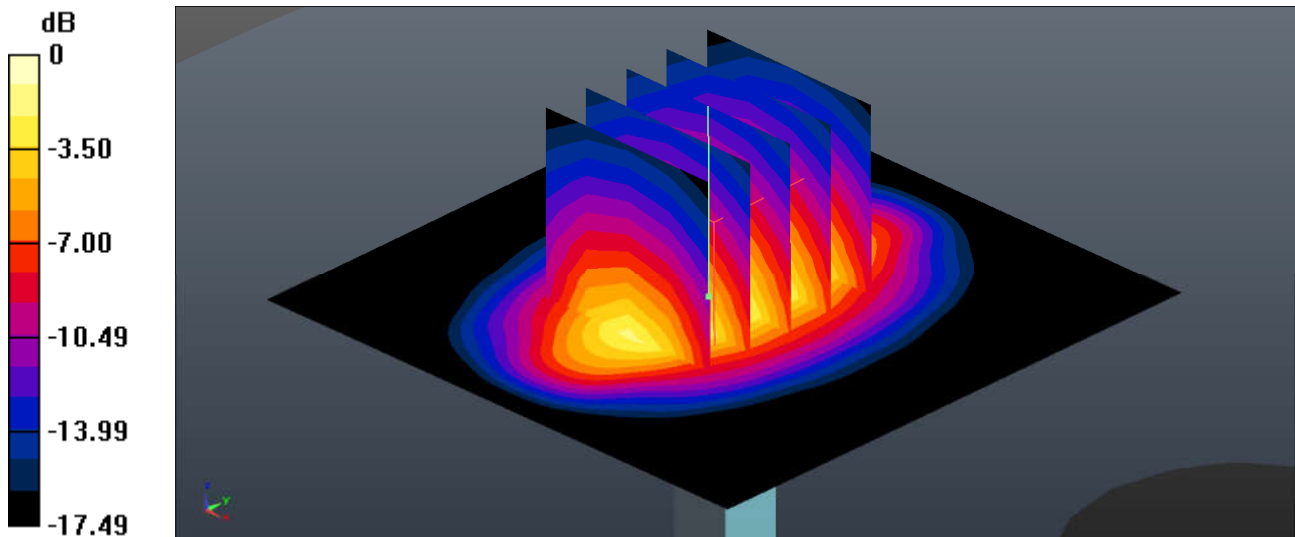
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 84.86 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 18.0 W/kg

**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.23 W/kg**

Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg = 11.55 dBW/kg

### System Check\_Body\_2600MHz

**DUT: D2600V2 - SN:1008**

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: MSL\_2600 Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.261$  S/m;  $\epsilon_r = 53.171$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.7 °C; Liquid Temperature : 22.9 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.13, 7.13, 7.13); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Maximum value of SAR (interpolated) = 22.4 W/kg

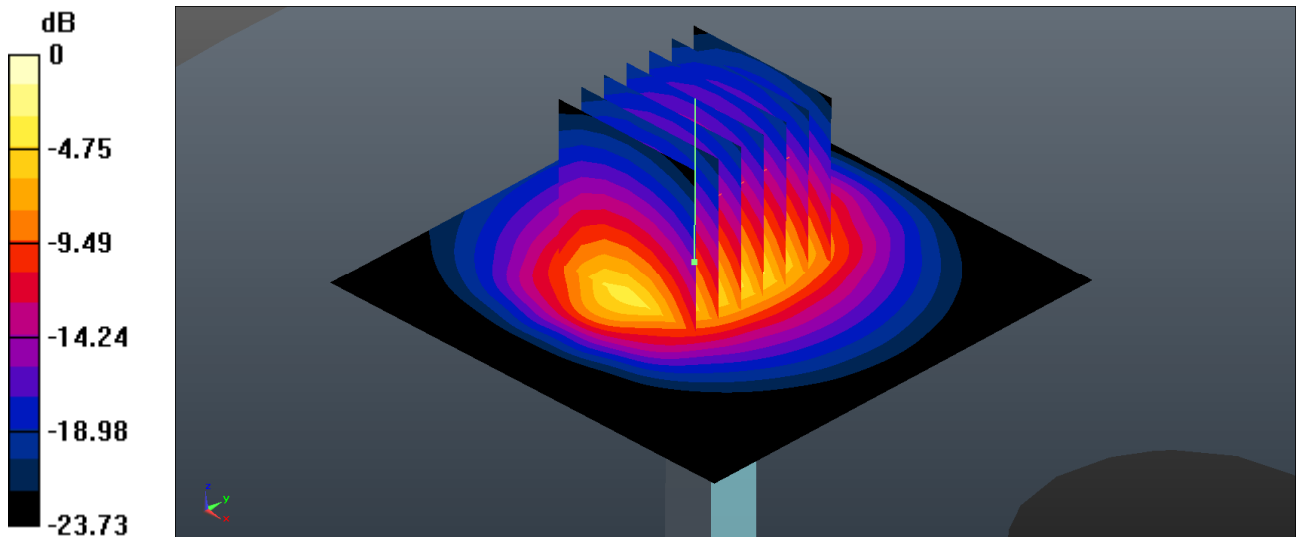
**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 71.21 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.7 W/kg

**SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.27 W/kg**

Maximum value of SAR (measured) = 22.2 W/kg



0 dB = 22.2 W/kg = 13.46 dBW/kg



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

The plots are shown as follows.

### 01\_GSM850\_GSM 1 Tx slot\_Left Cheek\_0mm\_Ch189

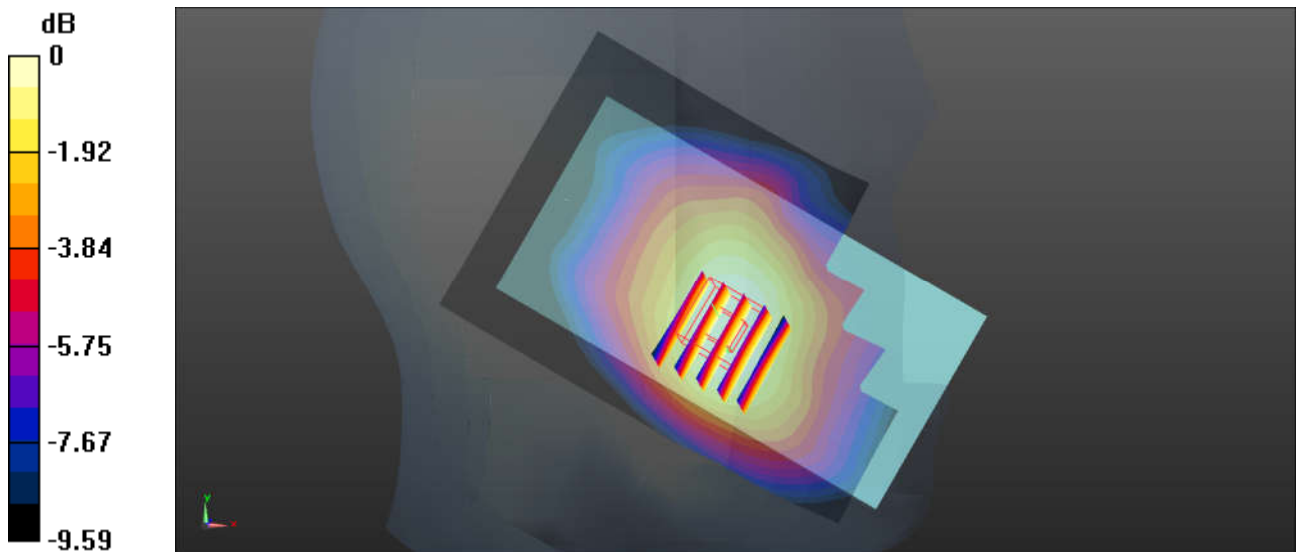
Communication System: UID 0, General GSM (0); Frequency: 836.4 MHz; Duty Cycle: 1:8.3  
Medium: HSL\_850 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.925$  S/m;  $\epsilon_r = 41.38$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.32, 9.32, 9.32); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch189/Area Scan (71x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.183 W/kg

**Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.490 V/m; Power Drift = 0.17 dB  
Peak SAR (extrapolated) = 0.198 W/kg  
**SAR(1 g) = 0.155 W/kg; SAR(10 g) = 0.118 W/kg**  
Maximum value of SAR (measured) = 0.176 W/kg



0 dB = 0.176 W/kg = -7.54 dBW/kg

### 02\_GSM1900\_GPRS 1 Tx slot\_Right Cheek\_0mm\_Ch810

Communication System: UID 0, General GSM (0); Frequency: 1909.8 MHz; Duty Cycle: 1:8.3  
Medium: HSL\_1900 Medium parameters used:  $f = 1909.8$  MHz;  $\sigma = 1.423$  S/m;  $\epsilon_r = 40.45$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.32, 8.32, 8.32); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2016.4.4
- Phantom: SAM2; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch810/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.0474 W/kg

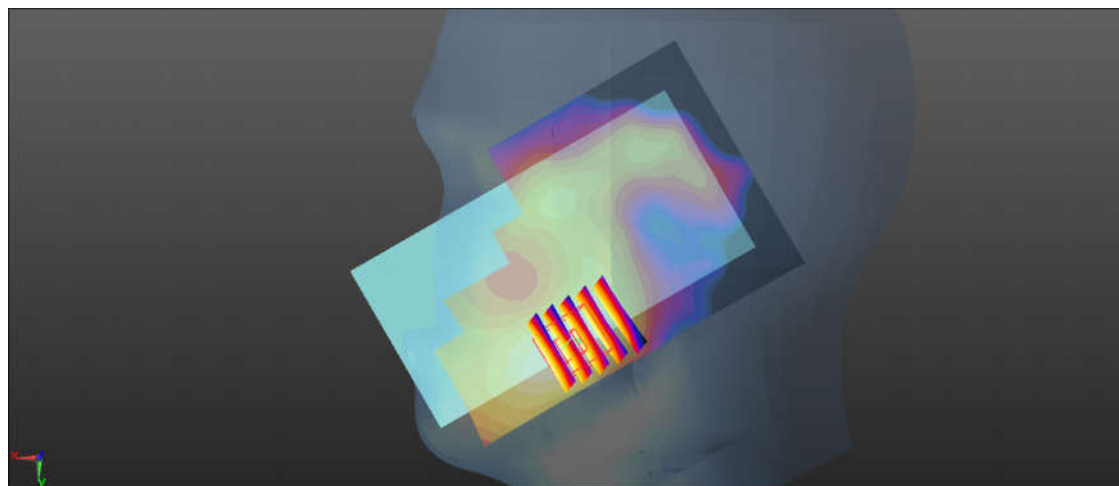
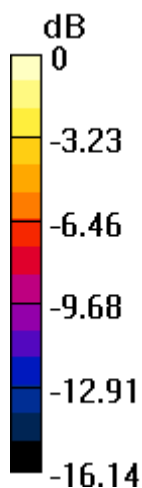
**Ch810/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.380 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.0520 W/kg

**SAR(1 g) = 0.035 W/kg; SAR(10 g) = 0.022 W/kg**

Maximum value of SAR (measured) = 0.0439 W/kg



0 dB = 0.0439 W/kg = -13.58 dBW/kg

### 03\_WCDMA Band V\_RMC 12.2Kbps\_Left Cheek\_0mm\_Ch4132

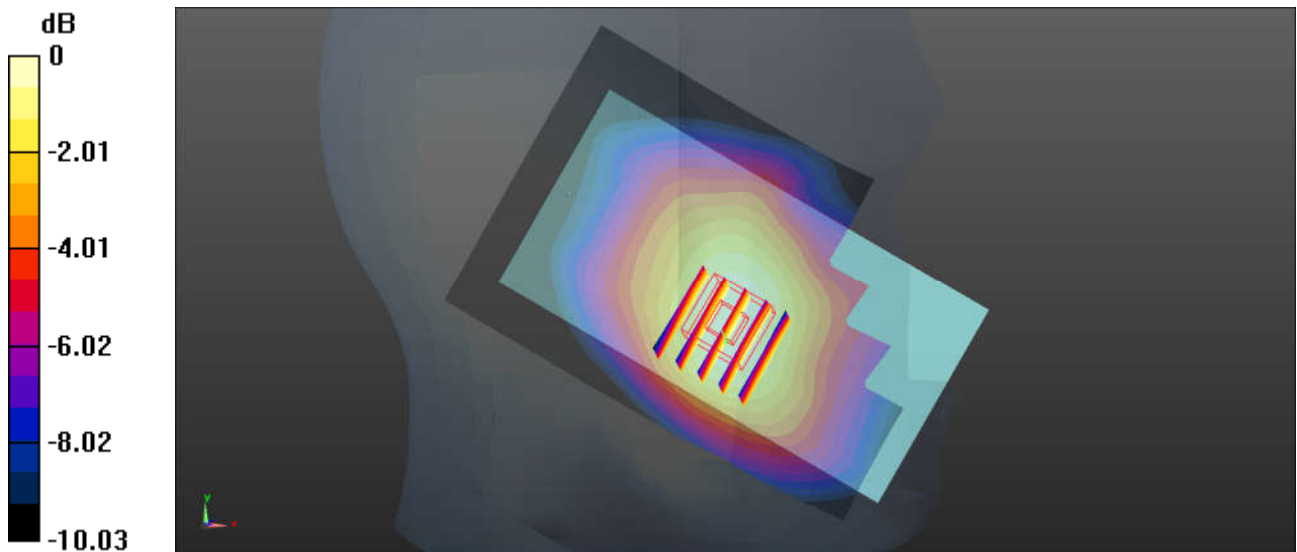
Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz; Duty Cycle: 1:1  
Medium: HSL\_850 Medium parameters used:  $f = 826.4$  MHz;  $\sigma = 0.915$  S/m;  $\epsilon_r = 41.485$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.32, 9.32, 9.32); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (71x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.296 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 5.818 V/m; Power Drift = 0.14 dB  
Peak SAR (extrapolated) = 0.330 W/kg  
**SAR(1 g) = 0.259 W/kg; SAR(10 g) = 0.196 W/kg**  
Maximum value of SAR (measured) = 0.295 W/kg



0 dB = 0.295 W/kg = -5.30 dBW/kg

### 04\_WCDMA Band II\_RMC12.2Kbps\_Right Cheek\_0mm\_Ch9400

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: HSL\_1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.392$  S/m;  $\epsilon_r = 40.566$ ;  $\rho = 1000$

kg/m<sup>3</sup>

Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.32, 8.32, 8.32); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2016.4.4
- Phantom: SAM2; Type: SAM; Serial: TP-1542
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9400/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.0608 W/kg

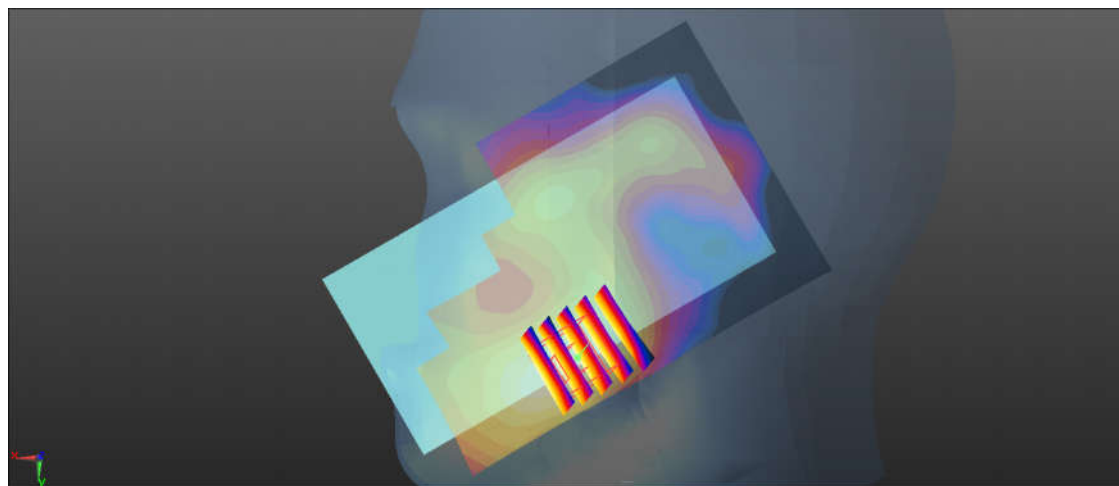
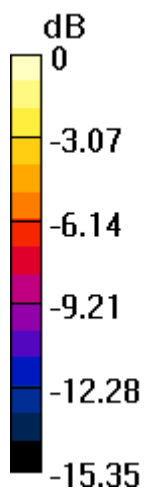
**Ch9400/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.991 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.0700 W/kg

**SAR(1 g) = 0.046 W/kg; SAR(10 g) = 0.030 W/kg**

Maximum value of SAR (measured) = 0.0593 W/kg



0 dB = 0.0593 W/kg = -12.27 dBW/kg

**05\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_Left Cheek\_0mm\_Ch20525**

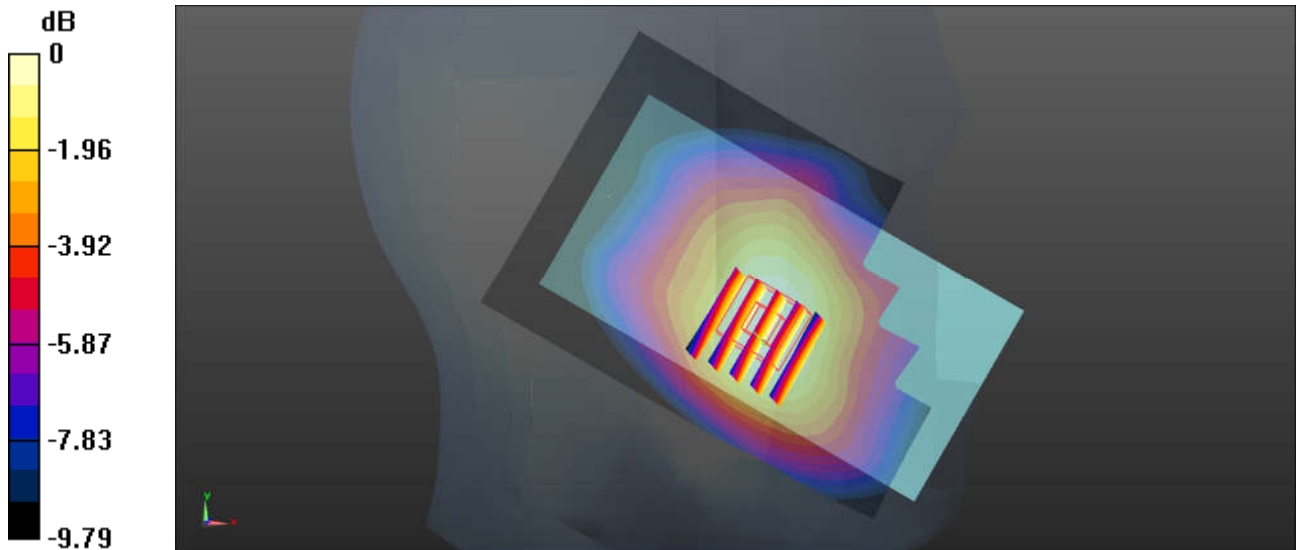
Communication System: UID 0, FDD\_LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1  
Medium: HSL\_850 Medium parameters used:  $f = 836.5$  MHz;  $\sigma = 0.925$  S/m;  $\epsilon_r = 41.379$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.32, 9.32, 9.32); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (71x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.287 W/kg

**Ch20525/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 5.579 V/m; Power Drift = 0.02 dB  
Peak SAR (extrapolated) = 0.312 W/kg  
**SAR(1 g) = 0.244 W/kg; SAR(10 g) = 0.184 W/kg**  
Maximum value of SAR (measured) = 0.278 W/kg



0 dB = 0.278 W/kg = -5.56 dBW/kg

**06\_LTE Band 7\_20M\_QPSK\_1RB\_49Offset\_Right Cheek\_0mm\_Ch20850**

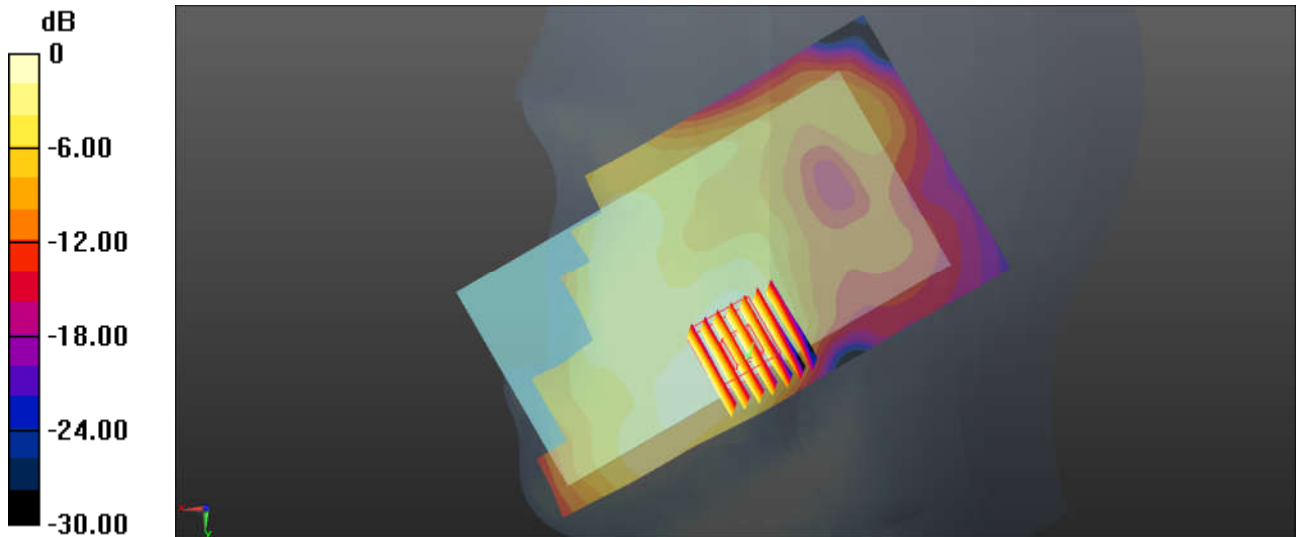
Communication System: UID 0, FDD\_LTE (0); Frequency: 2510 MHz; Duty Cycle: 1:1  
Medium: HSL\_2600 Medium parameters used:  $f = 2510$  MHz;  $\sigma = 1.894$  S/m;  $\epsilon_r = 39.947$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.9 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.08, 7.08, 7.08); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20850/Area Scan (81x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.584 W/kg

**Ch20850/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 4.957 V/m; Power Drift = 0.01 dB  
Peak SAR (extrapolated) = 0.714 W/kg  
**SAR(1 g) = 0.406 W/kg; SAR(10 g) = 0.227 W/kg**  
Maximum value of SAR (measured) = 0.554 W/kg



0 dB = 0.554 W/kg = -2.56 dBW/kg

**07\_LTE Band 41\_20M\_QPSK\_1RB\_49Offset\_Right Cheek\_0mm\_Ch40340**

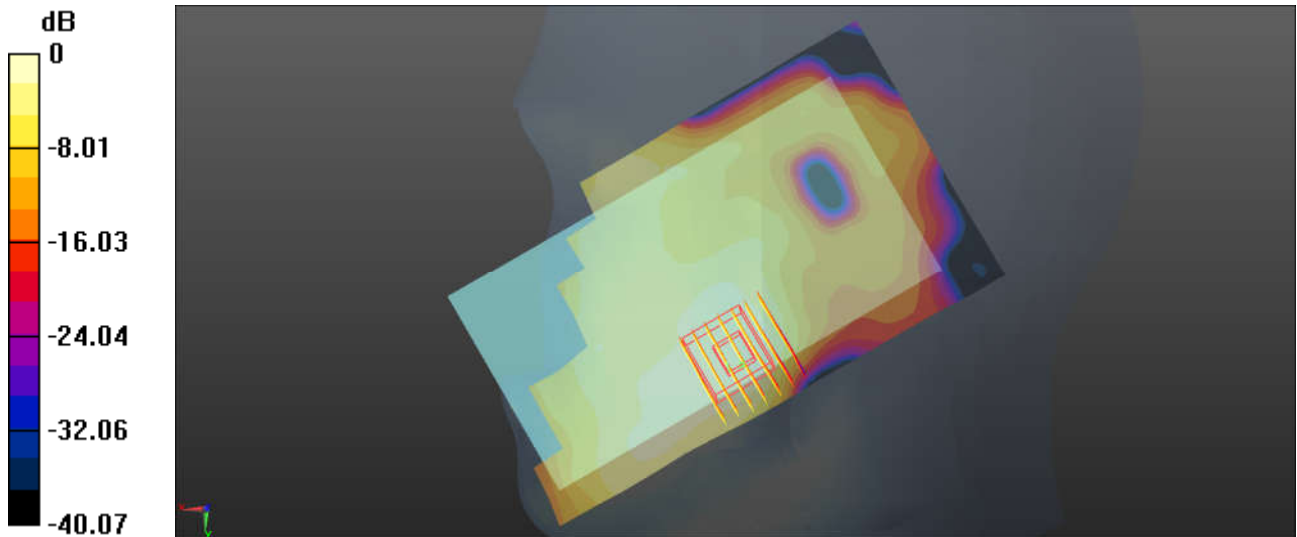
Communication System: UID 0, TDD\_LTE (0); Frequency: 2565 MHz; Duty Cycle: 1:1.59  
Medium: HSL\_2600 Medium parameters used:  $f = 2565$  MHz;  $\sigma = 1.962$  S/m;  $\epsilon_r = 39.724$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.9 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.08, 7.08, 7.08); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch40340/Area Scan (81x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.331 W/kg

**Ch40340/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 3.326 V/m; Power Drift = 0.11 dB  
Peak SAR (extrapolated) = 0.410 W/kg  
**SAR(1 g) = 0.226 W/kg; SAR(10 g) = 0.124 W/kg**  
Maximum value of SAR (measured) = 0.315 W/kg



0 dB = 0.315 W/kg = -5.02 dBW/kg

### 08\_GSM 850\_GSM 1 Tx slot\_Left Side\_10mm\_Ch189

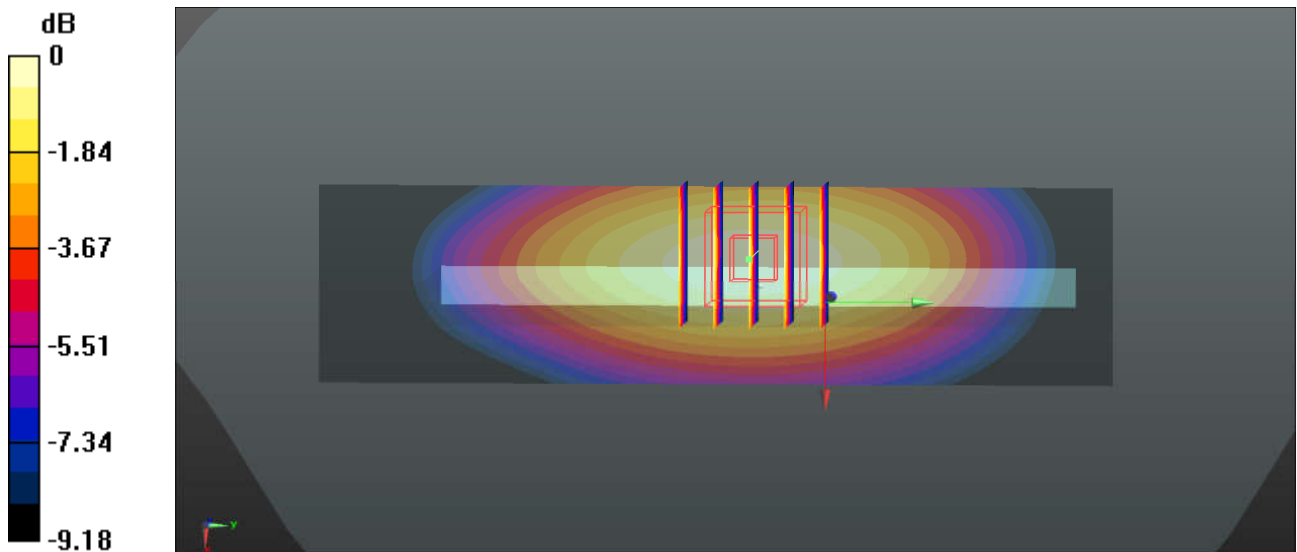
Communication System: UID 0, General GSM (0); Frequency: 836.4 MHz; Duty Cycle: 1:8.3  
Medium: MSL\_850 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 55.697$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch189/Area Scan (31x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.378 W/kg

**Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 19.75 V/m; Power Drift = 0.07 dB  
Peak SAR (extrapolated) = 0.440 W/kg  
**SAR(1 g) = 0.315 W/kg; SAR(10 g) = 0.220 W/kg**  
Maximum value of SAR (measured) = 0.384 W/kg



0 dB = 0.384 W/kg = -4.16 dBW/kg

### 09\_GSM 1900\_GSM 1 Tx slot\_Botton Side\_10mm\_Ch512

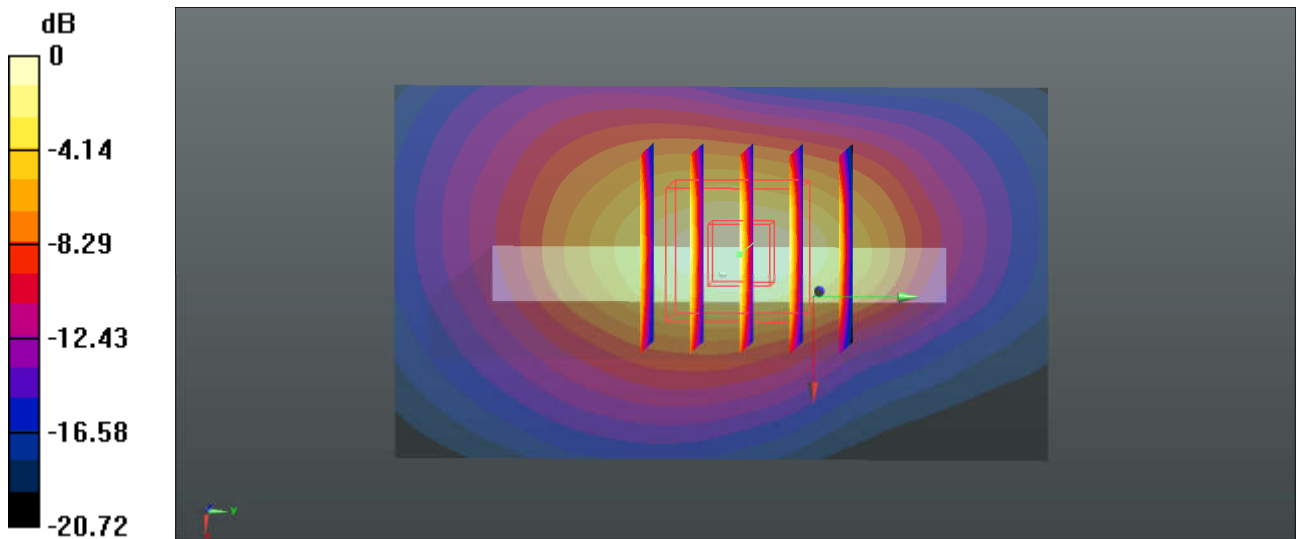
Communication System: UID 0, General GSM (0); Frequency: 1850.2 MHz; Duty Cycle: 1:8.3  
Medium: MSL\_1900 Medium parameters used:  $f = 1850.2$  MHz;  $\sigma = 1.51$  S/m;  $\epsilon_r = 55.229$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch512/Area Scan (41x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.811 W/kg

**Ch512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 21.82 V/m; Power Drift = 0.17 dB  
Peak SAR (extrapolated) = 0.980 W/kg  
**SAR(1 g) = 0.538 W/kg; SAR(10 g) = 0.270 W/kg**  
Maximum value of SAR (measured) = 0.775 W/kg



0 dB = 0.775 W/kg = -1.11 dBW/kg

### 10\_WCDMA Band V\_RMC 12.2Kbps\_Left Side\_10mm\_Ch4132

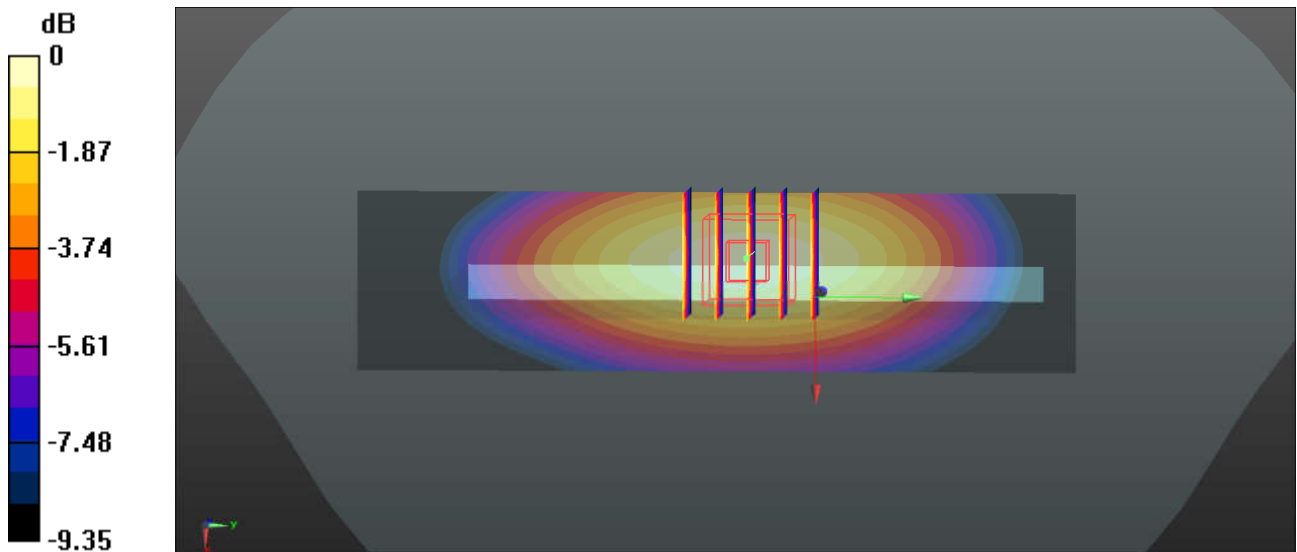
Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz; Duty Cycle: 1:1  
Medium: MSL\_850 Medium parameters used:  $f = 826.4$  MHz;  $\sigma = 0.963$  S/m;  $\epsilon_r = 55.796$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (31x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.523 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 23.41 V/m; Power Drift = 0.09 dB  
Peak SAR (extrapolated) = 0.620 W/kg  
**SAR(1 g) = 0.439 W/kg; SAR(10 g) = 0.303 W/kg**  
Maximum value of SAR (measured) = 0.540 W/kg



0 dB = 0.540 W/kg = -2.68 dBW/kg

### 11\_WCDMA Band II\_RMC 12.2Kbps\_Botton Side\_10mm\_Ch9262

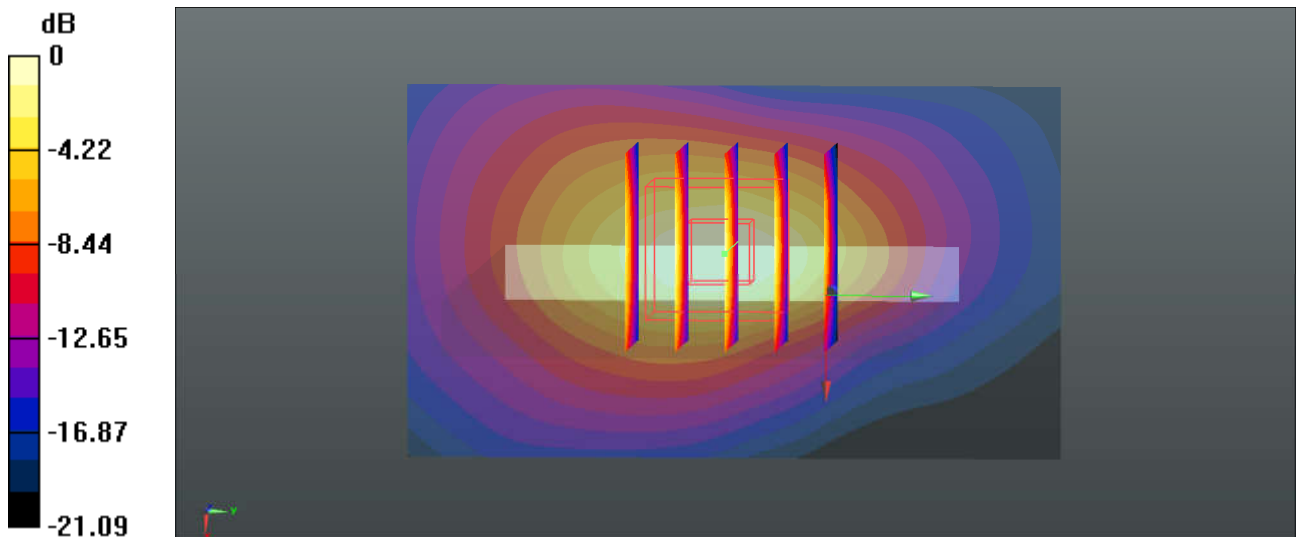
Communication System: UID 0, UMTS (0); Frequency: 1852.4 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900 Medium parameters used:  $f = 1852.4$  MHz;  $\sigma = 1.512$  S/m;  $\epsilon_r = 55.22$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9262/Area Scan (41x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.818 W/kg

**Ch9262/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 22.67 V/m; Power Drift = 0.14 dB  
Peak SAR (extrapolated) = 1.03 W/kg  
**SAR(1 g) = 0.569 W/kg; SAR(10 g) = 0.286 W/kg**  
Maximum value of SAR (measured) = 0.815 W/kg



0 dB = 0.815 W/kg = -0.89 dBW/kg

### 12\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_Left Side\_10mm\_Ch20525

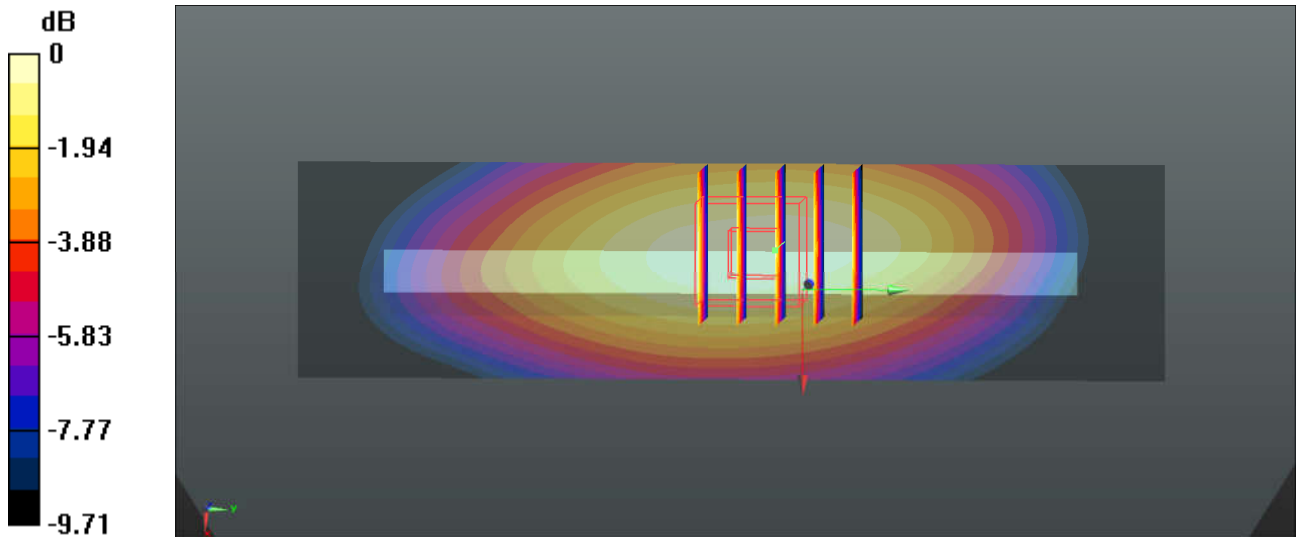
Communication System: UID 0, FDD\_LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1  
Medium: MSL\_850 Medium parameters used:  $f = 836.5$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 55.697$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (31x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.534 W/kg

**Ch20525/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 24.16 V/m; Power Drift = -0.19 dB  
Peak SAR (extrapolated) = 0.633 W/kg  
**SAR(1 g) = 0.444 W/kg; SAR(10 g) = 0.307 W/kg**  
Maximum value of SAR (measured) = 0.546 W/kg



0 dB = 0.546 W/kg = -2.63 dBW/kg

### 13\_LTE Band 7\_20M\_QPSK\_1RB\_49Offset\_\_Bottom Side\_10mm\_Ch20850

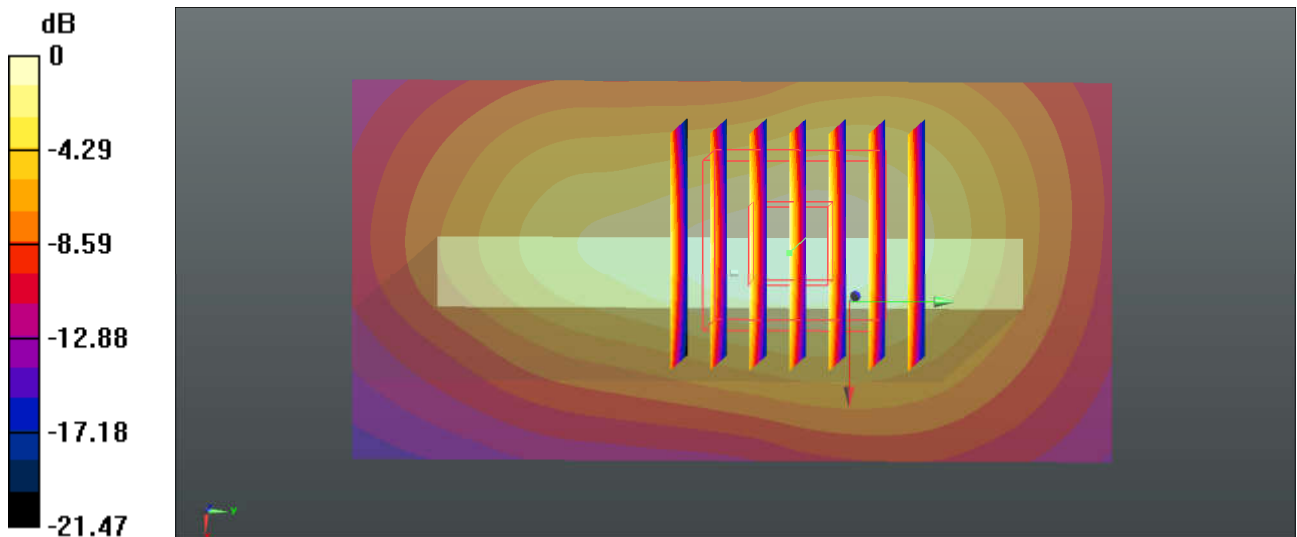
Communication System: UID 0, FDD\_LTE (0); Frequency: 2510 MHz; Duty Cycle: 1:1  
Medium: MSL\_2600 Medium parameters used:  $f = 2510$  MHz;  $\sigma = 2.129$  S/m;  $\epsilon_r = 53.487$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.9 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.13, 7.13, 7.13); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20850/Area Scan (41x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 1.54 W/kg

**Ch20850/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 25.69 V/m; Power Drift = 0.18 dB  
Peak SAR (extrapolated) = 2.06 W/kg  
**SAR(1 g) = 1.060 W/kg; SAR(10 g) = 0.537 W/kg**  
Maximum value of SAR (measured) = 1.55 W/kg



0 dB = 1.55 W/kg = 1.90 dBW/kg

### 14\_LTE Band 41\_20M\_QPSK\_1RB\_49Offset\_\_Front\_10mm\_Ch41140

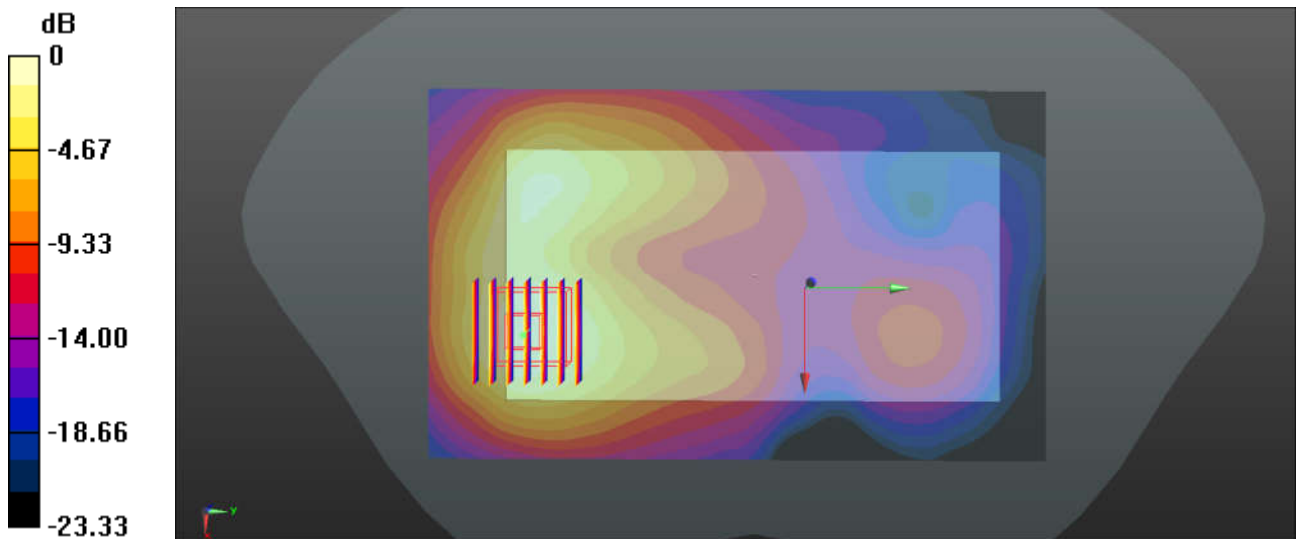
Communication System: UID 0, TDD\_LTE (0); Frequency: 2645 MHz; Duty Cycle: 1:1.59  
Medium: MSL\_2600 Medium parameters used:  $f = 2645$  MHz;  $\sigma = 2.328$  S/m;  $\epsilon_r = 52.997$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.9 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.13, 7.13, 7.13); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch41140/Area Scan (91x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 1.36 W/kg

**Ch41140/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 5.796 V/m; Power Drift = 0.02 dB  
Peak SAR (extrapolated) = 1.73 W/kg  
**SAR(1 g) = 0.875 W/kg; SAR(10 g) = 0.451 W/kg**  
Maximum value of SAR (measured) = 1.28 W/kg



0 dB = 1.28 W/kg = 1.07 dBW/kg

**15\_GSM 850\_GSM 1 Tx slot\_Front\_10mm\_Ch189**

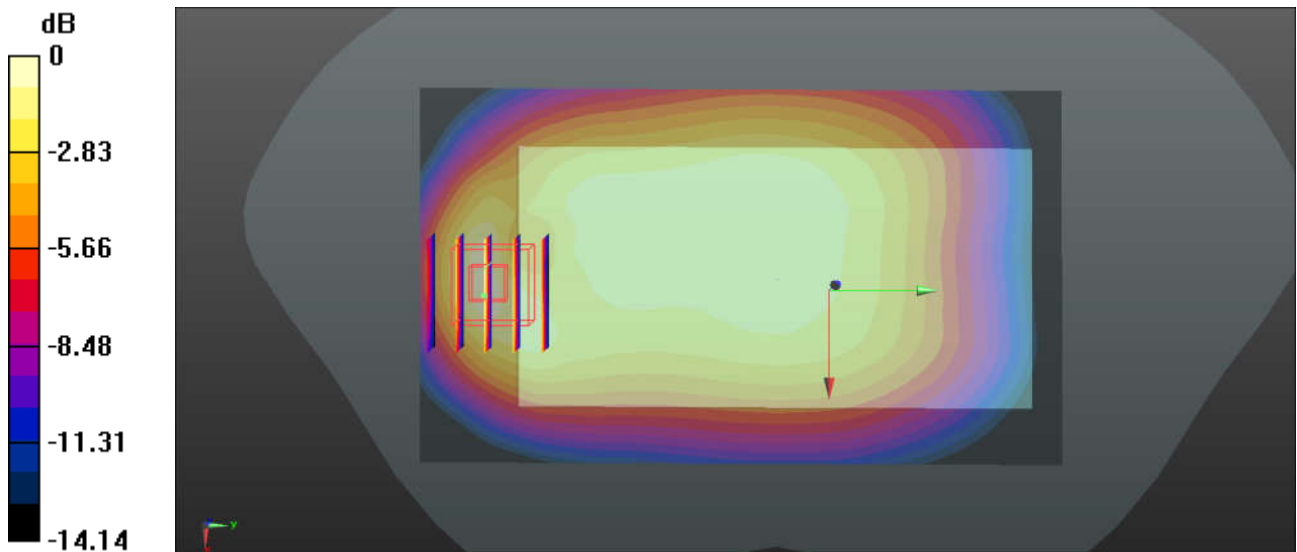
Communication System: UID 0, General GSM (0); Frequency: 836.4 MHz; Duty Cycle: 1:8.3  
 Medium: MSL\_850 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 55.697$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch189/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.349 W/kg

**Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
 Reference Value = 17.31 V/m; Power Drift = -0.01 dB  
 Peak SAR (extrapolated) = 0.476 W/kg  
**SAR(1 g) = 0.272 W/kg; SAR(10 g) = 0.155 W/kg**  
 Maximum value of SAR (measured) = 0.377 W/kg



0 dB = 0.377 W/kg = -4.24 dBW/kg

### 16\_GSM 1900\_GSM 1 Tx slot\_Front\_10mm\_Ch810

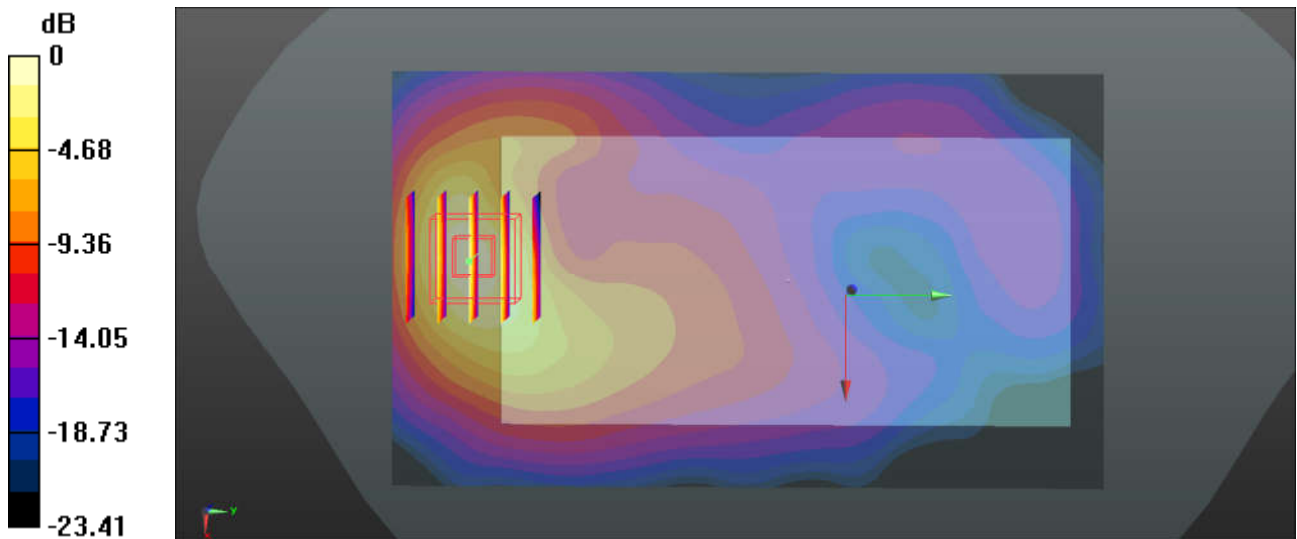
Communication System: UID 0, General GSM (0); Frequency: 1909.8 MHz; Duty Cycle: 1:8.3  
Medium: MSL\_1900 Medium parameters used:  $f = 1909.8$  MHz;  $\sigma = 1.579$  S/m;  $\epsilon_r = 55.036$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch810/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.482 W/kg

**Ch810/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.085 V/m; Power Drift = -0.05 dB  
Peak SAR (extrapolated) = 0.671 W/kg  
**SAR(1 g) = 0.369 W/kg; SAR(10 g) = 0.185 W/kg**  
Maximum value of SAR (measured) = 0.523 W/kg



0 dB = 0.523 W/kg = -2.81 dBW/kg

### 17\_WCDMA Band V\_RMC 12.2Kbps\_Back\_10mm\_Ch4132

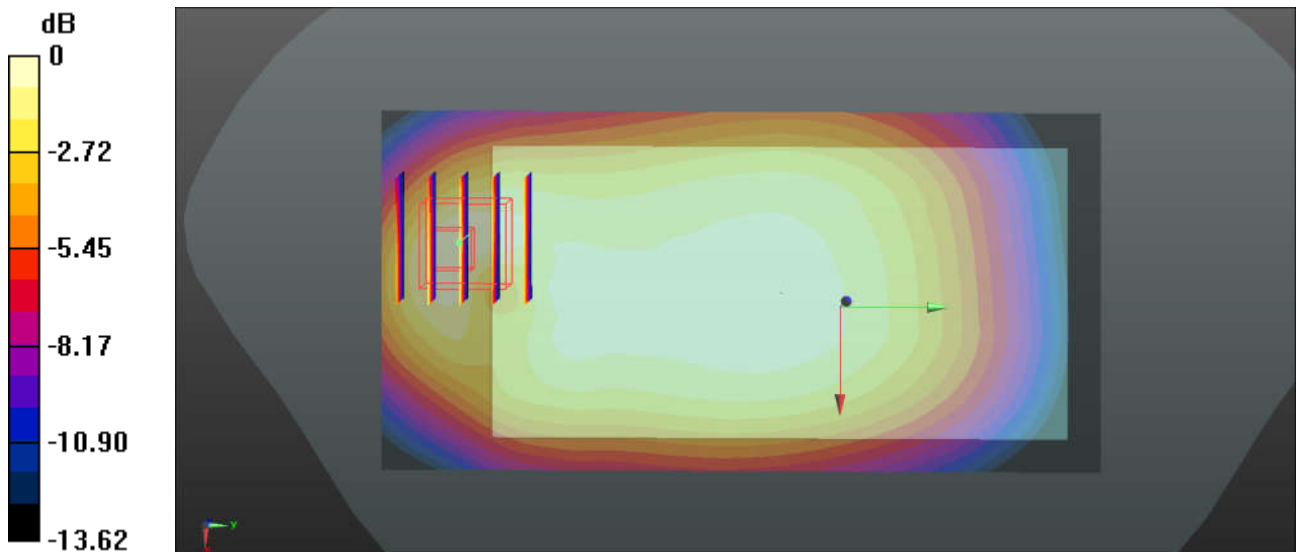
Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz; Duty Cycle: 1:1  
Medium: MSL\_850 Medium parameters used:  $f = 826.4$  MHz;  $\sigma = 0.963$  S/m;  $\epsilon_r = 55.796$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (61x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.418 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 20.48 V/m; Power Drift = -0.05 dB  
Peak SAR (extrapolated) = 0.541 W/kg  
**SAR(1 g) = 0.301 W/kg; SAR(10 g) = 0.175 W/kg**  
Maximum value of SAR (measured) = 0.424 W/kg



0 dB = 0.424 W/kg = -3.73 dBW/kg

### 18\_WCDMA Band II\_RMC 12.2Kbps\_Front\_10mm\_Ch9400

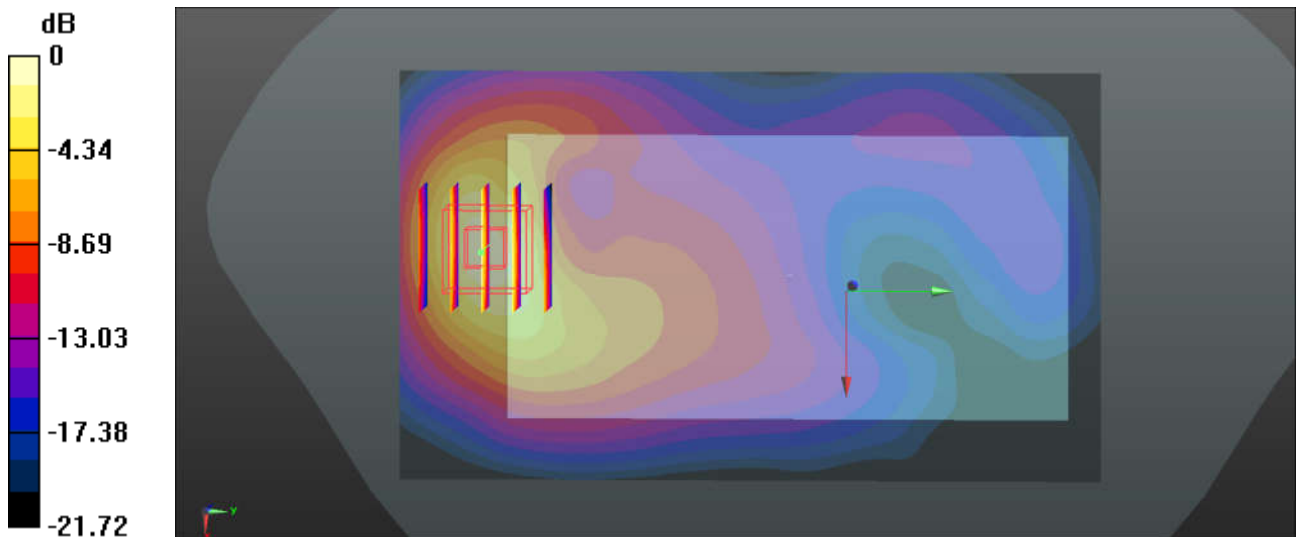
Communication System: UID 0, UMTS (0); Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.544$  S/m;  $\epsilon_r = 55.13$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9400/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.565 W/kg

**Ch9400/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.484 V/m; Power Drift = -0.09 dB  
Peak SAR (extrapolated) = 0.804 W/kg  
**SAR(1 g) = 0.448 W/kg; SAR(10 g) = 0.227 W/kg**  
Maximum value of SAR (measured) = 0.630 W/kg



0 dB = 0.630 W/kg = -2.01 dBW/kg

### 19\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_Front\_10mm\_Ch20525

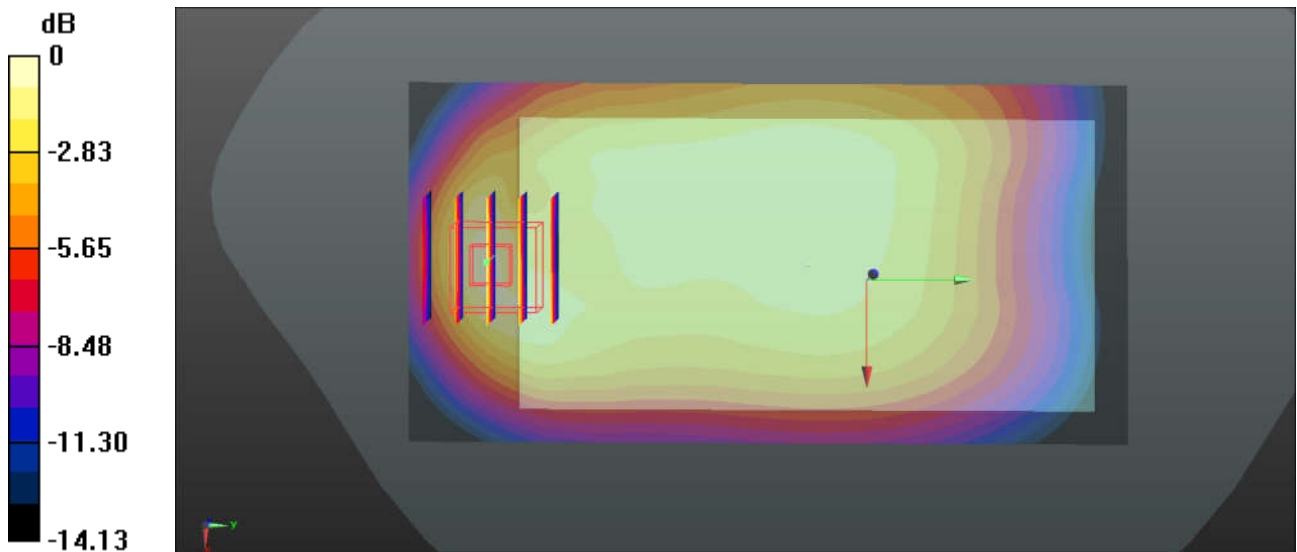
Communication System: UID 0, FDD\_LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1  
Medium: MSL\_850 Medium parameters used:  $f = 836.5$  MHz;  $\sigma = 0.974$  S/m;  $\epsilon_r = 55.697$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(9.25, 9.25, 9.25); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (61x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.347 W/kg

**Ch20525/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 16.80 V/m; Power Drift = -0.06 dB  
Peak SAR (extrapolated) = 0.463 W/kg  
**SAR(1 g) = 0.265 W/kg; SAR(10 g) = 0.151 W/kg**  
Maximum value of SAR (measured) = 0.369 W/kg



0 dB = 0.369 W/kg = -4.33 dBW/kg

### 20\_LTE Band 7\_20M\_QPSK\_1RB\_49Offset\_\_Front\_10mm\_Ch21350

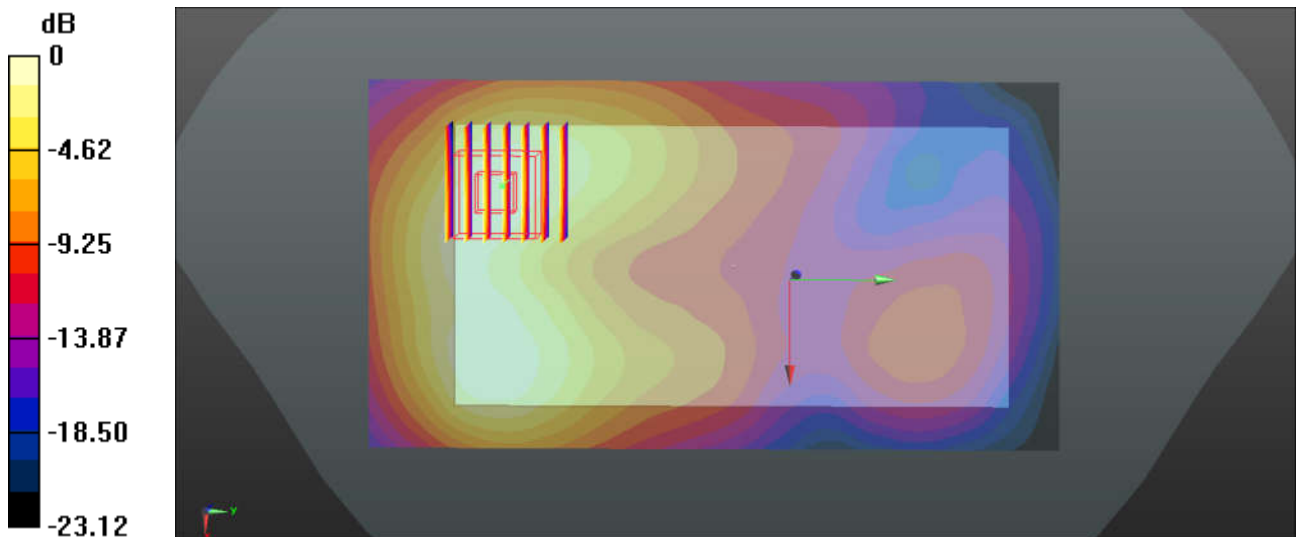
Communication System: UID 0, FDD\_LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1  
Medium: MSL\_2600 Medium parameters used:  $f = 2560$  MHz;  $\sigma = 2.204$  S/m;  $\epsilon_r = 53.334$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.9 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(7.13, 7.13, 7.13); Calibrated: 2016.5.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2016.5.18
- Phantom: SAM2; Type: SAM; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch21350/Area Scan (81x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.984 W/kg

**Ch21350/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 6.146 V/m; Power Drift = -0.06 dB  
Peak SAR (extrapolated) = 1.33 W/kg  
**SAR(1 g) = 0.710 W/kg; SAR(10 g) = 0.384 W/kg**  
Maximum value of SAR (measured) = 1.01 W/kg



0 dB = 1.01 W/kg = 0.04 dBW/kg



## **Appendix C. DASYS Calibration Certificate**

The DASYS calibration certificates are shown as follows



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton-CN (Auden)**

Certificate No: **D835V2-4d151\_Mar16**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d151**

Calibration procedure(s) **QA CAL-05.v9  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **March 16, 2016**


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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by: **Jeton Kastrati** (Name) **Laboratory Technician** (Function)  (Signature)

Approved by: **Katja Pokovic** (Name) **Technical Manager** (Function)  (Signature)

Issued: March 16, 2016

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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
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 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "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%.

## Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.7 $\pm$ 6 %	0.93 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °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	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.26 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.05 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.5 $\pm$ 6 %	1.01 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °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 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.52 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.28 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.2 $\Omega$ - 3.3 $j\Omega$
Return Loss	- 28.3 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.9 $\Omega$ - 4.5 $j\Omega$
Return Loss	- 25.9 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.390 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
Manufactured on	March 27, 2012

## DASY5 Validation Report for Head TSL

Date: 16.03.2016

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d151**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.93$  S/m;  $\epsilon_r = 41.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.83, 9.83, 9.83); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom Type: QD000P49AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

### Dipole Calibration for Head Tissue EX-Probe/Pin=250 mW, d=15mm/Zoom Scan

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

Reference Value = 61.40 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.57 W/kg

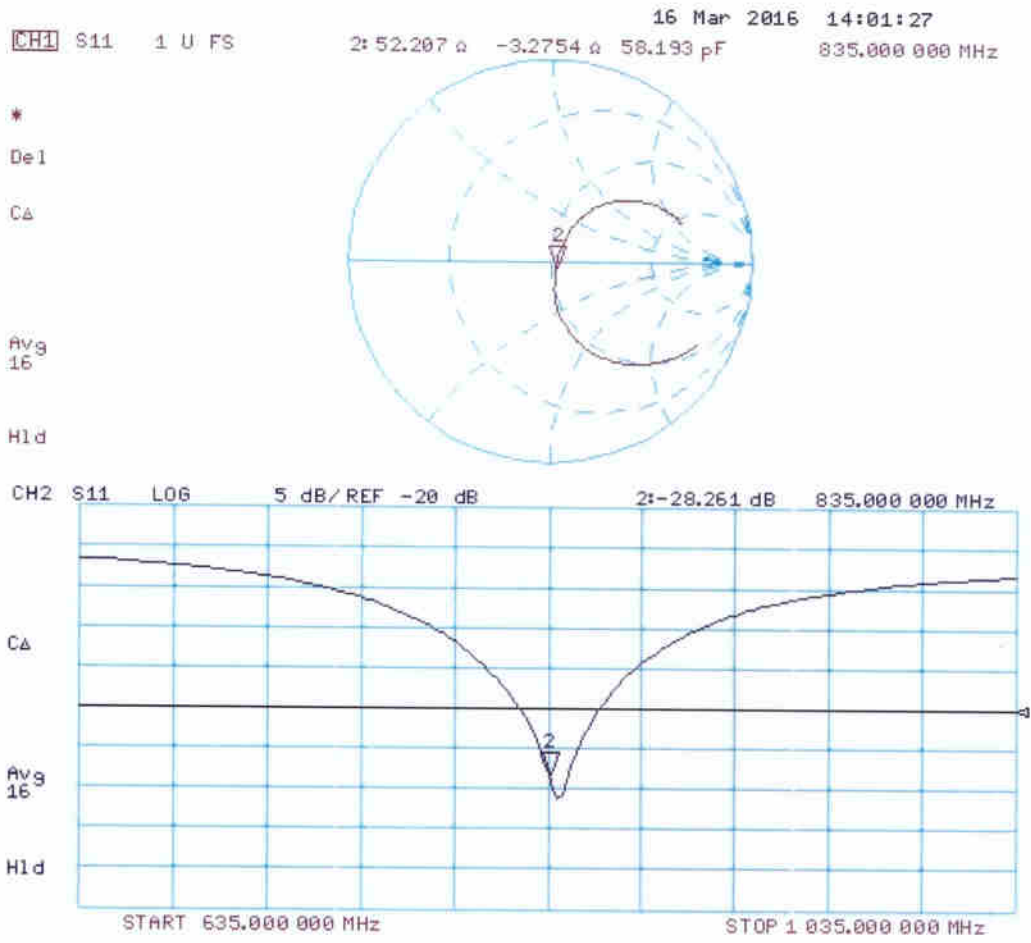
**SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg**

Maximum value of SAR (measured) = 3.18 W/kg



0 dB = 3.18 W/kg = 5.02 dBW/kg

# Impedance Measurement Plot for Head TSL



# DASY5 Validation Report for Body TSL

Date: 16.03.2016

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d151**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1.01$  S/m;  $\epsilon_r = 54.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

## Dipole Calibration for Body Tissue EX-Probe/Pin=250 mW, d=15mm/Zoom Scan

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

Reference Value = 60.04 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.65 W/kg

**SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.61 W/kg**

Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

# Impedance Measurement Plot for Body TSL

