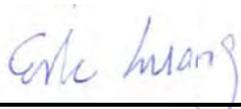


# Variant FCC SAR Test Report

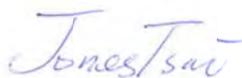
APPLICANT : ZTE CORPORATION  
EQUIPMENT : LTE uFi  
BRAND NAME : ZTE  
MODEL NAME : MF923  
FCC ID : SRQ-MF923  
STANDARD : FCC 47 CFR Part 2 (2.1093)  
ANSI/IEEE C95.1-1992  
IEEE 1528-2013

This is a variant report which is only valid together with the original test report. We, SPORTON INTERNATIONAL (XI'AN) 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 (XI'AN) INC., the test report shall not be reproduced except in full.



Reviewed by: Eric Huang / Deputy Manager



Approved by: Jones Tsai / Manager



**SPORTON INTERNATIONAL (XI'AN) INC.**

1F, Building A3, No. 39 Chuangye Rd., Xi'an Hi-tech Zone, Shanxi Province, P. R. China



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### 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION, LTE uFi, MF923**, are as follows.

Equipment Class	Frequency Band	Operating Mode	Highest SAR Summary	
			Body 1g SAR (W/kg) Gap(1cm)	Simultaneous Transmission SAR (W/kg)
PCB	WCDMA Band V	Data	0.79	1.43
	WCDMA Band II	Data	1.03	
	LTE Band 17	Data	0.62	
	LTE Band 5	Data	0.90	
	LTE Band 4	Data	0.93	
	LTE Band 2	Data	<b>1.04</b>	
DTS	WLAN 2.4GHz Band	Data	<0.10	1.11
NII	WLAN 5.2GHz Band	Data	0.43	1.43
	WLAN 5.8GHz Band	Data	0.33	
Date of Testing:			2015.8.15~2015.8.26	

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

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL (XI'AN) INC.
Test Site Location	1F, Building A3, No. 39 Chuangye Rd., Xi'an Hi-tech Zone, Shanxi Province, P. R. China TEL: +86-029-8860-8767 FAX: +86-029-8860-8791

Applicant	
Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P. R. China

Manufacturer	
Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P. R. China

## 3. Guidance Standard

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 v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r01
- FCC KDB 941225 D01 3G SAR Procedures v03
- FCC KDB 941225 D05 SAR for LTE Devices v02r03
- FCC KDB 941225 D05A Rel.10 LTE SAR Test Guidance v01r01
- FCC KDB 941225 D06 Hotspot Mode SAR v02



### 4. Equipment Under Test (EUT)

#### 4.1 General Information

Product Feature & Specification	
Equipment Name	LTE uFi
Brand Name	ZTE
Model Name	MF923
FCC ID	SRQ-MF923
IMEI Code	865135021190515
Wireless Technology and Frequency Range	WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz
Mode	<ul style="list-style-type: none"> <li>•RMC 12.2Kbps</li> <li>•HSDPA</li> <li>•HSUPA</li> <li>•DC-HSDPA</li> <li>•HSPA+ (Downlink Only)</li> <li>•LTE: QPSK, 16QAM</li> <li>•LTE Carrier Aggregation (Downlink only)</li> <li>•802.11a/b/g/n HT20/HT40</li> </ul>
HW Version	xx4A
SW Version	MF923V1.6
EUT Stage	Identical Prototype
<b>Remark:</b>	
<ol style="list-style-type: none"> <li>1. This device 2.4GHz WLAN supports hotspot operation and 5.2GHz/5.8GHz WLAN supports WiFi Direct (GC/GO),</li> <li>2. This device has no voice function.</li> </ol>	



**4.2 Maximum Tune-up Limit**

Mode	Average power(dBm)	
	WCDMA Band V	WCDMA Band II
RMC 12.2Kbps	24.0	23.5
HSDPA Subtest-1	22.0	22.0
HSDPA Subtest-2	22.0	22.0
HSDPA Subtest-3	22.0	22.0
HSDPA Subtest-4	22.0	22.0
DC-HSDPA Subtest-1	22.0	22.0
DC-HSDPA Subtest-2	22.0	22.0
DC-HSDPA Subtest-3	22.0	22.0
DC-HSDPA Subtest-4	22.0	22.0
HSUPA Subtest-1	22.0	21.5
HSUPA Subtest-2	21.0	21.0
HSUPA Subtest-3	20.5	21.0
HSUPA Subtest-4	22.0	21.5
HSUPA Subtest-5	21.0	21.0



LTE Band 17				
Average Power (dBm)				
Modulation	BW (MHz)	RB size	MPR	Target Power
QPSK	10	≤ 12	0	23.5
QPSK	10	> 12	1	22.5
16QAM	10	≤ 12	1	22.5
16QAM	10	> 12	2	21.5
QPSK	5	≤ 8	0	23.5
QPSK	5	> 8	1	22.5
16QAM	5	≤ 8	1	22.5
16QAM	5	> 8	2	21.5

LTE Band 4				
Average Power (dBm)				
Modulation	BW (MHz)	RB size	MPR	Target Power
QPSK	20	≤ 18	0	23.5
QPSK	20	> 18	1	22.5
16QAM	20	≤ 18	1	22.5
16QAM	20	> 18	2	21.5
QPSK	15	≤ 16	0	23.5
QPSK	15	> 16	1	22.5
16QAM	15	≤ 16	1	22.5
16QAM	15	> 16	2	21.5
QPSK	10	≤ 12	0	23.5
QPSK	10	> 12	1	22.5
16QAM	10	≤ 12	1	22.5
16QAM	10	> 12	2	21.5
QPSK	5	≤ 8	0	23.5
QPSK	5	> 8	1	22.5
16QAM	5	≤ 8	1	22.5
16QAM	5	> 8	2	21.5
QPSK	3	≤ 4	0	23.5
QPSK	3	> 4	1	22.5
16QAM	3	≤ 4	1	22.5
16QAM	3	> 4	2	21.5
QPSK	1.4	≤ 5	0	23.5
QPSK	1.4	> 5	1	22.5
16QAM	1.4	≤ 5	1	22.5
16QAM	1.4	> 5	2	21.5



LTE Band 5				
Average Power (dBm)				
Modulation	BW (MHz)	RB size	MPR	Target Power
QPSK	10	≤ 12	0	24.0
QPSK	10	> 12	1	23.0
16QAM	10	≤ 12	1	23.0
16QAM	10	> 12	2	22.0
QPSK	5	≤ 8	0	24.0
QPSK	5	> 8	1	23.0
16QAM	5	≤ 8	1	23.0
16QAM	5	> 8	2	22.0
QPSK	3	≤ 4	0	24.0
QPSK	3	> 4	1	23.0
16QAM	3	≤ 4	1	23.0
16QAM	3	> 4	2	22.0
QPSK	1.4	≤ 5	0	24.0
QPSK	1.4	> 5	1	23.0
16QAM	1.4	≤ 5	1	23.0
16QAM	1.4	> 5	2	22.0

LTE Band 2				
Average Power (dBm)				
Modulation	BW (MHz)	RB size	MPR	Target Power
QPSK	20	≤ 18	0	23.5
QPSK	20	> 18	1	22.5
16QAM	20	≤ 18	1	22.5
16QAM	20	> 18	2	21.5
QPSK	15	≤ 16	0	23.5
QPSK	15	> 16	1	22.5
16QAM	15	≤ 16	1	22.5
16QAM	15	> 16	2	21.5
QPSK	10	≤ 12	0	23.5
QPSK	10	> 12	1	22.5
16QAM	10	≤ 12	1	22.5
16QAM	10	> 12	2	21.5
QPSK	5	≤ 8	0	23.5
QPSK	5	> 8	1	22.5
16QAM	5	≤ 8	1	22.5
16QAM	5	> 8	2	21.5
QPSK	3	≤ 4	0	23.5
QPSK	3	> 4	1	22.5
16QAM	3	≤ 4	1	22.5
16QAM	3	> 4	2	21.5
QPSK	1.4	≤ 5	0	23.5
QPSK	1.4	> 5	1	22.5
16QAM	1.4	≤ 5	1	22.5
16QAM	1.4	> 5	2	21.5



Mode			Maximum Average Power (dBm)	
2.4GHz	802.11b	Chain Port 0	14.5	
		Chain Port 1	15.0	
	802.11g	Chain Port 0	CH 01	11.0
			CH 06	13.0
			CH 11	11.0
		Chain Port 1	CH 01	11.0
			CH 06	14.0
			CH 11	12.0
	802.11n HT20	Chain Port 0		12.5
		Chain Port 1	CH 01	12.0
			CH 06	12.0
			CH 11	12.5
	Chain Port 0+1		13.0	
	802.11n HT40	Chain Port 0		12.5
Chain Port 1		12.0		
Chain Port 0+1		12.5		
5.2GHz	802.11a	Chain Port 0	11.0	
		Chain Port 1	11.0	
	802.11n HT20	Chain Port 0	10.5	
		Chain Port 1	11.0	
		Chain Port 0+1	14.0	
	802.11n HT40	Chain Port 0	10.5	
		Chain Port 1	11.0	
		Chain Port 0+1	14.5	
	5.8GHz	802.11a	Chain Port 0	10.0
Chain Port 1			12.0	
802.11n HT20		Chain Port 0	10.0	
		Chain Port 1	11.0	
		Chain Port 0+1	14.0	
802.11n HT40		Chain Port 0	10.0	
		Chain Port 1	12.0	
		Chain Port 0+1	12.0	



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

Summarized necessary items addressed in KDB 941225 D05 v02r03																																							
FCC ID	SRQ-MF923																																						
Equipment Name	LTE uFi																																						
Operating Frequency Range of each LTE transmission band	LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz																																						
Channel Bandwidth	1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz(LTE Band 2/4) 1.4MHz, 3MHz, 5MHz, 10MHz(LTE Band 5) 3MHz, 5MHz, 10MHz, (LTE Band 17)																																						
uplink modulations used	QPSK, and 16QAM																																						
LTE Voice / Data requirements	Data only																																						
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)																																
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz																																	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1																																
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1																																
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2																																
LTE 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.																																						
LTE Release	R10																																						
LTE Carrier Aggregation Combinations	Inter-Band possible combinations as below page and the detail power verification please referred to page 36.																																						
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.																																						



LTE Band 17												
Bandwidth 5 MHz						Bandwidth 10 MHz						
	Channel #		Freq.(MHz)			Channel #		Freq. (MHz)				
L	23755		706.5			23780		709				
M	23790		710			23790		710				
H	23825		713.5			23800		711				

LTE Band 5											
Bandwidth 1.4 MHz			Bandwidth 3 MHz			Bandwidth 5 MHz			Bandwidth 10 MHz		
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	
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 4												
Bandwidth 1.4 MHz			Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 2												
Bandwidth 1.4 MHz			Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Carrier Aggregation Combinations											
Inter-Band Combinations											
(PCC) B2	(SCC) B17	(PCC) B17	(SCC) B2	(PCC) B4	(SCC) B17	(PCC) B4	(SCC) B29	(PCC) B2	(SCC) B29	(PCC) B12	(SCC) B4
10M + 10M		10M + 10M		10M + 10M		10M + 10M		10M + 10M		10M + 10M	
10M + 5M		10M + 5M		10M + 5M		10M + 5M		10M + 5M		10M + 5M	
5M + 10M		5M + 10M		5M + 10M		5M + 10M		5M + 10M		5M + 10M	
5M + 5M		5M + 5M		5M + 5M		5M + 5M		5M + 5M		5M + 5M	

**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:

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

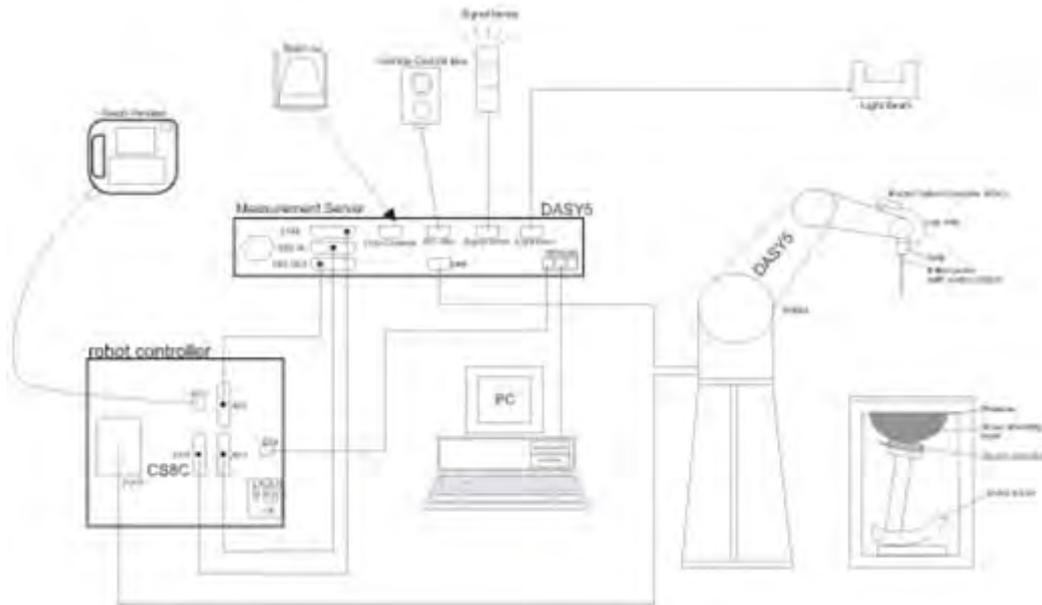
SAR is expressed in units of Watts per kilogram (W/kg)

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

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.



## **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 power measurement, use engineering software to configure EUT WLAN 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 output power

### <SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN 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.

		≤ 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	750MHz System Validation Kit	D750V3	1065	Nov. 19, 2014	Nov. 18, 2015
SPEAG	835MHz System Validation Kit	D835V2	4d091	Nov. 21, 2014	Nov. 20, 2015
SPEAG	1750MHz System Validation Kit	D1750V2	1069	Nov. 21, 2014	Nov. 20, 2015
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	Nov. 21, 2014	Nov. 20, 2015
SPEAG	2450MHz System Validation Kit	D2450V2	840	Nov. 19, 2014	Nov. 18, 2015
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	Nov. 24, 2014	Nov. 23, 2015
SPEAG	Data Acquisition Electronics	DAE4	679	Apr. 13, 2015	Apr. 12, 2016
SPEAG	Data Acquisition Electronics	DAE4	1210	May 21, 2015	May 20, 2016
SPEAG	Dosimetric E-Field Probe	EX3DV4	3911	Oct. 02, 2014	Oct. 01, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	May 28, 2015	May 27, 2016
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1479	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1753	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1754	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	MY52102600	Dec. 09, 2014	Dec. 08, 2015
Anritsu	Radio communication analyzer	MT8820C	6201091028	Dec. 09, 2014	Dec. 08, 2015
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	Dec. 09, 2014	Dec. 08, 2015
Agilent	Dielectric Probe Kit	85070E	MY44300751	NCR	NCR
Agilent	Dielectric Probe Kit	85070E	MY44300475	NCR	NCR
Anritsu	Power Sensor	MA2411B	0917070	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Meter	ML2495A	1005002	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Sensor	MA2411B	1207253	Jan. 28, 2015	Jan. 27, 2016
Anritsu	Power Meter	ML2495A	1218010	Jan. 28, 2015	Jan. 27, 2016
Anritsu	Power Sensor	MA2411B	0917070	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Meter	ML2495A	1005002	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Sensor	MA2411B	1339163	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Meter	ML2495A	1435004	Jan. 23, 2015	Jan. 22, 2016
ARRA	Power Divider	A3200-2	N/A	NA	NA
R&S	Spectrum Analyzer	FSP7	101045	Dec. 09, 2014	Dec. 08, 2015
R&S	Spectrum Analyzer	FSP40	100319	Oct. 28, 2014	Oct. 27, 2015
R&S	Signal Generator	SMBV100A	258305	Jan. 23, 2015	Jan. 22, 2016
Agilent	Dual Directional Coupler	778D	50422	Note	
Woken	Attenuator	WK0602-XX	N/A	Note	
PE	Attenuator	PE7005-10	N/A	Note	
PE	Attenuator	PE7005- 3	N/A	Note	
AR	Power Amplifier	5S1G4M2	0328767	Note	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	Note	

**General 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 Verification**

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

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

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

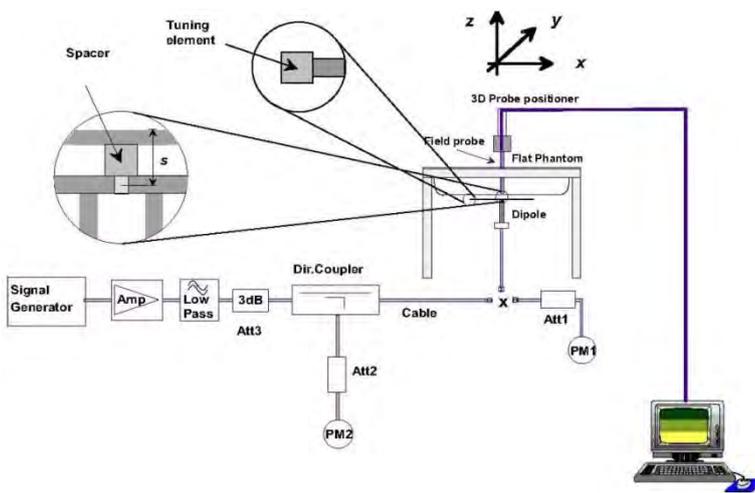
#### **<Tissue Dielectric Parameter Check Results>**

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Conductivity Target ( $\sigma$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\sigma$ ) (%)	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
750	Body	22.5	0.961	53.931	0.96	55.5	0.10	-2.83	±5	2015.08.16
835	Body	22.5	0.970	53.680	0.97	55.2	0.00	-2.75	±5	2015.08.15
1750	Body	22.4	1.528	52.031	1.49	53.4	2.55	-2.56	±5	2015.08.18
1900	Body	22.6	1.542	55.338	1.52	53.3	1.45	3.82	±5	2015.08.15
2450	Body	22.5	1.949	53.894	1.95	52.70	-0.05	2.27	±5	2015.08.19
5200	Body	22.8	5.295	49.183	5.30	49.00	-0.09	0.37	±5	2015.08.26
5800	Body	22.8	6.129	47.785	6.00	48.20	2.15	-0.86	±5	2015.08.26

**10.2 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 (%)
2015.08.16	750	Body	250	D750V3-1065	3911	679	2.17	8.64	8.68	0.46
2015.08.15	835	Body	250	D835V2-4d091	3911	679	2.30	9.60	9.2	-4.17
2015.08.18	1750	Body	250	D1750V2-1069	3911	679	8.95	38.10	35.8	-6.04
2015.08.15	1900	Body	250	D1900V2-5d118	3911	679	9.95	40.00	39.8	-0.50
2015.08.19	2450	Body	250	D2450V2-840	3911	679	12.40	51.00	49.6	-2.75
2015.08.26	5200	Body	100	D5GHzV2-1113	3857	1210	7.19	74.90	71.9	-4.01
2015.08.26	5800	Body	100	D5GHzV2-1113	3857	1210	7.39	75.40	73.9	-1.99



**Fig 8.3.1 System Performance Check Setup**



**Fig 8.3.2 Setup Photo**



## **11. RF Exposure Positions**

### **11.1 Body Position**

- (a) To position the device parallel to the phantom surface with all sides and either keypad up or down.
- (b) To adjust the device parallel to the flat phantom.
- (c) To adjust the distance between the device and the flat phantom to 1 cm.

#### **<EUT Setup Photos>**

Please refer to Appendix D for the test setup photos.

### **11.2 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 HDB Publication 941225 D06 v02 where SAR test considerations for handsets (L x W  $\geq$  9 cm x 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 D01v05r02 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)

### <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 D01 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 DPDCCH, DPCCH 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:**

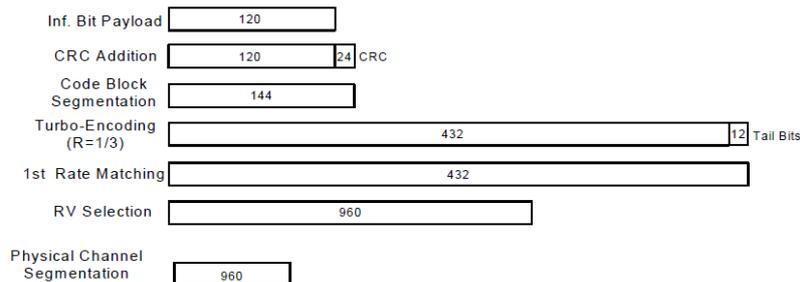
- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
  - i. Set RMC 12.2Kbps + HSDPA mode.
  - ii. Set Cell Power = -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>**

Band			WCDMA Band V			WCDMA Band II		
TX Channel			4132	4182	4233	9262	9400	9538
Rx Channel			4357	4407	4458	9662	9800	9938
Frequency (MHz)			826.4	836.4	846.6	1852.4	1880	1907.6
	3GPP Rel 99	RMC 12.2Kbps	23.06	23.13	<b>23.20</b>	<b>22.72</b>	22.63	22.55
0	3GPP Rel 6	HSDPA Subtest-1	21.55	21.60	21.65	21.46	21.40	21.35
0	3GPP Rel 6	HSDPA Subtest-2	21.51	21.59	21.64	21.43	21.38	21.32
0.5	3GPP Rel 6	HSDPA Subtest-3	21.62	21.65	21.70	21.45	21.40	21.34
0.5	3GPP Rel 6	HSDPA Subtest-4	21.68	21.70	21.72	21.43	21.40	21.32
0	3GPP Rel 8	DC-HSDPA Subtest-1	21.50	21.62	21.63	21.60	21.56	21.58
0	3GPP Rel 8	DC-HSDPA Subtest-2	21.48	21.59	21.62	21.57	21.58	21.63
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	21.60	21.62	21.68	21.54	21.60	21.58
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	21.66	21.67	21.66	21.53	21.58	21.56
0	3GPP Rel 6	HSUPA Subtest-1	21.58	21.60	21.64	21.35	21.32	21.30
2	3GPP Rel 6	HSUPA Subtest-2	20.68	20.70	20.73	20.70	20.64	20.60
1	3GPP Rel 6	HSUPA Subtest-3	20.28	20.30	20.34	20.59	20.55	20.51
2	3GPP Rel 6	HSUPA Subtest-4	21.38	21.40	21.46	20.90	20.82	20.80
0	3GPP Rel 6	HSUPA Subtest-5	20.68	20.70	20.71	20.70	20.67	20.62



**<LTE Band 17>**

Channel			Channel	23780	23790	23800	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)			Frequency (MHz)	709	710	711		
10	QPSK	1	0	22.61	22.61	22.67	23.5	0
10	QPSK	1	24	22.65	22.84	22.84		
10	QPSK	1	49	22.79	23.05	22.95		
10	QPSK	25	0	21.77	21.82	21.70	22.5	1
10	QPSK	25	12	21.74	21.78	21.64		
10	QPSK	25	24	21.85	21.83	21.73		
10	QPSK	50	0	21.79	21.88	21.69		
10	16QAM	1	0	21.79	21.42	21.82	22.5	1
10	16QAM	1	24	21.61	21.48	21.74		
10	16QAM	1	49	21.85	21.70	21.91		
10	16QAM	25	0	20.83	20.74	20.79	21.5	2
10	16QAM	25	12	20.62	20.74	20.73		
10	16QAM	25	24	20.73	20.84	20.76		
10	16QAM	50	0	20.71	20.69	20.65		
Channel			Channel	23755	23790	23825	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)			Frequency (MHz)	706.5	710	713.5		
5	QPSK	1	0	22.51	22.50	22.45	23.5	0
5	QPSK	1	12	22.52	22.52	22.53		
5	QPSK	1	24	22.56	22.81	22.61		
5	QPSK	12	0	21.76	21.65	21.67	22.5	1
5	QPSK	12	6	21.74	21.70	21.71		
5	QPSK	12	11	21.83	21.64	21.78		
5	QPSK	25	0	21.74	21.66	21.70		
5	16QAM	1	0	21.67	21.50	21.24	22.5	1
5	16QAM	1	12	21.70	21.69	21.47		
5	16QAM	1	24	21.72	21.77	21.66		
5	16QAM	12	0	20.79	20.74	20.64	21.5	2
5	16QAM	12	6	20.66	20.69	20.80		
5	16QAM	12	11	20.82	20.73	20.70		
5	16QAM	25	0	20.81	20.67	20.69		



**<LTE Band 5>**

Channel				20450	20525	20600	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	<b>22.84</b>	22.74	22.81	24.0	0
10	QPSK	1	24	22.75	22.70	22.75		
10	QPSK	1	49	22.76	22.61	22.70		
10	QPSK	25	0	21.84	21.84	21.73	23.0	1
10	QPSK	25	12	21.82	21.82	21.73		
10	QPSK	25	24	21.71	21.68	21.67		
10	QPSK	50	0	21.72	21.66	21.71	23.0	1
10	16QAM	1	0	22.07	21.65	21.82		
10	16QAM	1	24	21.58	21.44	21.58		
10	16QAM	1	49	21.84	21.37	21.60	22.0	2
10	16QAM	25	0	20.89	21.47	21.55		
10	16QAM	25	12	20.76	21.51	21.53		
10	16QAM	25	24	20.73	21.52	21.57	22.0	2
10	16QAM	50	0	20.71	20.85	20.85		
Channel				20425	20525	20625	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.76	22.79	22.57	24.0	0
5	QPSK	1	12	22.75	22.74	22.56		
5	QPSK	1	24	22.68	22.70	22.47		
5	QPSK	12	0	21.86	21.71	21.73	23.0	1
5	QPSK	12	6	21.81	21.73	21.78		
5	QPSK	12	11	21.90	21.76	21.72		
5	QPSK	25	0	21.69	21.69	21.71	23.0	1
5	16QAM	1	0	21.90	21.69	21.54		
5	16QAM	1	12	21.77	21.68	21.35		
5	16QAM	1	24	21.38	21.58	21.36	22.0	2
5	16QAM	12	0	21.00	21.52	21.39		
5	16QAM	12	6	20.74	21.62	21.43		
5	16QAM	12	11	20.69	21.65	21.45	22.0	2
5	16QAM	25	0	20.62	20.82	20.66		



Channel				20415	20525	20635	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.76	22.74	22.74	24.0	0
3	QPSK	1	7	22.68	22.68	22.67		
3	QPSK	1	14	22.66	22.70	22.70		
3	QPSK	8	0	21.77	21.74	21.58	23.0	1
3	QPSK	8	4	21.75	21.70	21.52		
3	QPSK	8	7	21.70	21.74	21.58		
3	QPSK	15	0	21.74	21.76	21.78	23.0	1
3	16QAM	1	0	21.59	21.83	21.85		
3	16QAM	1	7	21.54	21.83	21.56		
3	16QAM	1	14	21.49	21.36	21.77	22.0	2
3	16QAM	8	0	20.83	21.58	21.72		
3	16QAM	8	4	20.76	21.61	21.62		
3	16QAM	8	7	20.73	21.59	21.69	20.70	20.59
3	16QAM	15	0	20.70	20.59	20.77		
Channel				20407	20525	20643	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.75	22.76	22.76	24.0	0
1.4	QPSK	1	2	22.71	22.74	22.70		
1.4	QPSK	1	5	22.69	22.75	22.70		
1.4	QPSK	3	0	22.66	22.70	22.67		
1.4	QPSK	3	1	22.74	22.70	22.71		
1.4	QPSK	3	2	22.70	22.71	22.68	23.0	1
1.4	QPSK	6	0	21.87	21.89	21.73		
1.4	16QAM	1	0	21.88	21.68	21.58	23.0	1
1.4	16QAM	1	2	21.61	21.63	21.26		
1.4	16QAM	1	5	21.42	21.54	21.47		
1.4	16QAM	3	0	21.76	21.58	21.51		
1.4	16QAM	3	1	21.68	21.57	21.49		
1.4	16QAM	3	2	21.66	21.50	21.42		
1.4	16QAM	6	0	20.64	20.53	20.47	22.0	2



**<LTE Band 4>**

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				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	22.67	22.71	<b>22.72</b>	23.5	0
20	QPSK	1	49	22.57	22.54	22.57		
20	QPSK	1	99	22.51	22.48	22.52		
20	QPSK	50	0	21.65	21.66	21.67	22.5	1
20	QPSK	50	24	21.65	21.60	21.63		
20	QPSK	50	49	21.58	21.63	21.57		
20	QPSK	100	0	21.62	21.60	21.65	22.5	1
20	16QAM	1	0	21.63	21.62	21.56		
20	16QAM	1	49	21.46	21.50	21.49		
20	16QAM	1	99	21.41	21.43	21.49	21.5	2
20	16QAM	50	0	20.64	20.67	20.62		
20	16QAM	50	24	20.64	20.59	20.63		
20	16QAM	50	49	20.56	20.57	20.58	21.5	2
20	16QAM	100	0	20.61	20.61	20.66		
Channel				20025	20175	20325		
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	22.70	22.64	22.62	23.5	0
15	QPSK	1	37	22.59	22.58	22.56		
15	QPSK	1	74	22.57	22.53	22.59		
15	QPSK	36	0	21.65	21.61	21.61	22.5	1
15	QPSK	36	18	21.59	21.56	21.58		
15	QPSK	36	37	21.59	21.55	21.57		
15	QPSK	75	0	21.63	21.57	21.64	22.5	1
15	16QAM	1	0	21.61	21.58	21.52		
15	16QAM	1	37	21.58	21.55	21.48		
15	16QAM	1	74	21.48	21.48	21.47	21.5	2
15	16QAM	36	0	20.65	20.66	20.57		
15	16QAM	36	18	20.64	20.61	20.58		
15	16QAM	36	37	20.61	20.61	20.59	21.5	2
15	16QAM	75	0	20.67	20.62	20.60		



Channel				20000	20175	20350	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	22.65	22.62	22.59	23.5	0
10	QPSK	1	24	22.59	22.53	22.56		
10	QPSK	1	49	22.58	22.53	22.58		
10	QPSK	25	0	21.64	21.65	21.60	22.5	1
10	QPSK	25	12	21.67	21.55	21.55		
10	QPSK	25	24	21.61	21.57	21.55		
10	QPSK	50	0	21.71	21.60	21.61	22.5	1
10	16QAM	1	0	21.59	21.50	21.52		
10	16QAM	1	24	21.51	21.48	21.41		
10	16QAM	1	49	21.47	21.46	21.50	21.5	2
10	16QAM	25	0	20.73	20.67	20.69		
10	16QAM	25	12	20.67	20.60	20.64		
10	16QAM	25	24	20.69	20.60	20.68	21.5	2
10	16QAM	50	0	20.71	20.58	20.60		
10	16QAM	50	0	20.71	20.58	20.60		
Channel				19975	20175	20375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	22.63	22.57	22.54	23.5	0
5	QPSK	1	12	22.60	22.55	22.50		
5	QPSK	1	24	22.58	22.51	22.51		
5	QPSK	12	0	21.67	21.63	21.57	22.5	1
5	QPSK	12	6	21.69	21.62	21.58		
5	QPSK	12	11	21.62	21.71	21.62		
5	QPSK	25	0	21.61	21.62	21.58	22.5	1
5	16QAM	1	0	21.58	21.49	21.51		
5	16QAM	1	12	21.54	21.38	21.46		
5	16QAM	1	24	21.49	21.46	21.50	21.5	2
5	16QAM	12	0	20.72	20.67	20.66		
5	16QAM	12	6	20.70	20.66	20.63		
5	16QAM	12	11	20.70	20.74	20.65	21.5	2
5	16QAM	25	0	20.72	20.68	20.63		



Channel				19965	20175	20385	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	22.68	22.56	22.56	23.5	0
3	QPSK	1	7	22.61	22.53	22.52		
3	QPSK	1	14	22.63	22.51	22.51		
3	QPSK	8	0	21.67	21.60	21.63	22.5	1
3	QPSK	8	4	21.61	21.62	21.59		
3	QPSK	8	7	21.60	21.71	21.56		
3	QPSK	15	0	21.67	21.61	21.60	22.5	1
3	16QAM	1	0	21.62	21.54	21.55		
3	16QAM	1	7	21.60	21.51	21.51		
3	16QAM	1	14	21.57	21.49	21.48	21.5	2
3	16QAM	8	0	20.73	20.61	20.62		
3	16QAM	8	4	20.73	20.63	20.66		
3	16QAM	8	7	20.70	20.70	20.64	20.69	20.58
3	16QAM	15	0	20.69	20.58	20.63		
Channel				19957	20175	20393	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	22.70	22.64	22.64	23.5	0
1.4	QPSK	1	2	22.65	22.58	22.61		
1.4	QPSK	1	5	22.68	22.61	22.60		
1.4	QPSK	3	0	22.65	22.63	22.62		
1.4	QPSK	3	1	22.66	22.54	22.60		
1.4	QPSK	3	2	22.68	22.61	22.55	22.5	1
1.4	QPSK	6	0	21.66	21.60	21.53		
1.4	16QAM	1	0	21.55	21.54	21.54	22.5	1
1.4	16QAM	1	2	21.51	21.53	21.51		
1.4	16QAM	1	5	21.50	21.49	21.52		
1.4	16QAM	3	0	21.52	21.46	21.50		
1.4	16QAM	3	1	21.50	21.50	21.48		
1.4	16QAM	3	2	21.53	21.50	21.45	21.5	2
1.4	16QAM	6	0	20.61	20.54	20.55		



**<LTE Band 2>**

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				18700	18900	19100		
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	0	22.62	22.65	22.81	23.5	0
20	QPSK	1	49	22.59	22.56	22.80		
20	QPSK	1	99	22.54	22.58	22.80		
20	QPSK	50	0	21.36	21.70	21.77	22.5	1
20	QPSK	50	24	21.53	21.72	21.73		
20	QPSK	50	49	21.50	21.69	21.79		
20	QPSK	100	0	21.44	21.67	21.71	22.5	1
20	16QAM	1	0	21.40	21.54	21.61		
20	16QAM	1	49	21.37	21.45	21.53		
20	16QAM	1	99	21.31	21.47	21.56	21.5	2
20	16QAM	50	0	20.43	20.67	20.80		
20	16QAM	50	24	20.58	20.74	20.77		
20	16QAM	50	49	20.53	20.71	20.86	21.5	2
20	16QAM	100	0	20.48	20.77	20.83		
Channel				18675	18900	19125		
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	0	22.55	22.77	22.78	23.5	0
15	QPSK	1	37	22.54	22.73	22.68		
15	QPSK	1	74	22.46	22.70	22.76		
15	QPSK	36	0	21.31	21.68	21.68	22.5	1
15	QPSK	36	18	21.46	21.64	21.72		
15	QPSK	36	37	21.52	21.67	21.77		
15	QPSK	75	0	21.47	21.74	21.83	22.5	1
15	16QAM	1	0	21.39	21.59	21.67		
15	16QAM	1	37	21.38	21.54	21.62		
15	16QAM	1	74	21.35	21.51	21.61	21.5	2
15	16QAM	36	0	20.47	20.65	20.74		
15	16QAM	36	18	20.51	20.67	20.76		
15	16QAM	36	37	20.56	20.70	20.79	21.5	2
15	16QAM	75	0	20.52	20.76	20.86		



Channel				18650	18900	19150	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	0	22.49	22.71	22.76	23.5	0
10	QPSK	1	24	22.47	22.63	22.73		
10	QPSK	1	49	22.39	22.68	22.72		
10	QPSK	25	0	21.35	21.67	21.68	22.5	1
10	QPSK	25	12	21.33	21.65	21.81		
10	QPSK	25	24	21.32	21.70	21.77		
10	QPSK	50	0	21.35	21.74	21.80	22.5	1
10	16QAM	1	0	21.35	21.59	21.64		
10	16QAM	1	24	21.31	21.55	21.62		
10	16QAM	1	49	21.26	21.49	21.59	21.5	2
10	16QAM	25	0	20.52	20.73	20.79		
10	16QAM	25	12	20.50	20.72	20.89		
10	16QAM	25	24	20.48	20.73	20.84	21.5	2
10	16QAM	50	0	20.43	20.69	20.82		
10	16QAM	50	0	20.43	20.69	20.82		
Channel				18625	18900	19175	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	0	22.54	22.75	22.74	23.5	0
5	QPSK	1	12	22.46	22.74	22.73		
5	QPSK	1	24	22.43	22.72	22.70		
5	QPSK	12	0	21.37	21.60	21.83	22.5	1
5	QPSK	12	6	21.35	21.69	21.75		
5	QPSK	12	11	21.33	21.62	21.74		
5	QPSK	25	0	21.37	21.68	21.82	22.5	1
5	16QAM	1	0	21.32	21.61	21.60		
5	16QAM	1	12	21.26	21.53	21.57		
5	16QAM	1	24	21.28	21.57	21.55	21.5	2
5	16QAM	12	0	20.51	20.72	20.86		
5	16QAM	12	6	20.48	20.75	20.82		
5	16QAM	12	11	20.49	20.73	20.82	21.5	2
5	16QAM	25	0	20.44	20.73	20.83		



Channel				18615	18900	19185	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1851.5	1880	1908.5		
3	QPSK	1	0	22.53	22.76	22.81	23.5	0
3	QPSK	1	7	22.45	22.70	22.76		
3	QPSK	1	14	22.48	22.69	22.73		
3	QPSK	8	0	21.34	21.70	21.73	22.5	1
3	QPSK	8	4	21.38	21.67	21.70		
3	QPSK	8	7	21.38	21.70	21.72		
3	QPSK	15	0	21.36	21.64	21.71	22.5	1
3	16QAM	1	0	21.33	21.59	21.69		
3	16QAM	1	7	21.31	21.49	21.67		
3	16QAM	1	14	21.31	21.54	21.66	21.5	2
3	16QAM	8	0	20.56	20.72	20.80		
3	16QAM	8	4	20.51	20.69	20.85		
3	16QAM	8	7	20.51	20.69	20.80	21.5	2
3	16QAM	15	0	20.44	20.70	20.78		
Channel				18607	18900	19193	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1850.7	1880	1909.3		
1.4	QPSK	1	0	22.56	22.80	<b>22.86</b>	23.5	0
1.4	QPSK	1	2	22.54	22.76	22.81		
1.4	QPSK	1	5	22.46	22.79	22.83		
1.4	QPSK	3	0	22.51	22.78	22.76		
1.4	QPSK	3	1	22.55	22.77	22.84		
1.4	QPSK	3	2	22.46	22.76	22.83	22.5	1
1.4	QPSK	6	0	21.41	21.70	21.77		
1.4	16QAM	1	0	21.42	21.59	21.67	22.5	1
1.4	16QAM	1	2	21.36	21.57	21.66		
1.4	16QAM	1	5	21.37	21.51	21.57		
1.4	16QAM	3	0	21.36	21.56	21.57		
1.4	16QAM	3	1	21.36	21.56	21.57		
1.4	16QAM	3	2	21.37	21.49	21.66	21.5	2
1.4	16QAM	6	0	20.45	20.61	20.69		



**LTE Carrier Aggregation Conducted Power**

**General Note:**

- i. According to KDB941225 D05A v01, 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 only supports downlink carrier aggregation. Uplink carrier aggregation is not supported. Power measurements were performed with two DL carriers for the Release 8 configuration that had the highest output power across all bandwidths, channels and RB configuration for each band.
- iv. During the carrier aggregation conducted power measurements we have attention to throughput traffic to make sure all the power measurement is corrected.

Configure	PCC						SCC				Measured 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 2	10M	1855	18650	1	0	Band 17	10M	710	23790	22.52	22.49
	Band 2	10M	1880	18900	1	0	Band 17	10M	710	23790	22.65	22.71
	Band 2	10M	1905	19150	1	0	Band 17	10M	710	23790	22.77	22.76
	Band 17	10M	709	23780	1	49	Band 2	10M	1905	19150	22.72	22.79
	Band 17	10M	710	23790	1	49	Band 2	10M	1905	19150	22.99	23.05
	Band 17	10M	711	23800	1	49	Band 2	10M	1905	19150	22.92	22.95
	Band 4	10M	1715	20000	1	0	Band 17	10M	710	23790	22.61	22.65
	Band 4	10M	1732.5	20175	1	0	Band 17	10M	710	23790	22.68	22.62
	Band 4	10M	1750	20350	1	0	Band 17	10M	710	23790	22.63	22.59
	Band 4	10M	1715	20000	1	0	Band 29	10M	722.5	9715	22.62	22.65
	Band 4	10M	1732.5	20175	1	0	Band 29	10M	722.5	9715	22.63	22.62
	Band 4	10M	1750	20350	1	0	Band 29	10M	722.5	9715	22.71	22.59
	Band 2	10M	1855	18650	1	0	Band 29	10M	722.5	9715	22.51	22.49
	Band 2	10M	1880	18900	1	0	Band 29	10M	722.5	9715	22.67	22.71
Band 2	10M	1905	19150	1	0	Band 29	10M	722.5	9715	22.73	22.76	

**<2.4GHz WLAN Antenna 0>**

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Duty Cycle %
2.4GHz WLAN	802.11b	CH 1	2412	1Mbps	13.47	100
		CH 6	2437		<b>14.15</b>	
		CH 11	2462		13.74	
	802.11g	CH 1	2412	6Mbps	10.43	95.32
		CH 6	2437		<b>12.85</b>	
		CH 11	2462		10.86	
	802.11n-HT20	CH 1	2412	MCS0	11.57	95.05
		CH 6	2437		12.09	
		CH 11	2462		<b>12.16</b>	
	802.11n-HT40	CH 3	2422	MCS0	11.42	91.24
		CH 6	2437		11.75	
		CH 9	2452		<b>12.19</b>	

**<2.4GHz WLAN Antenna 1>**

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Duty Cycle %
2.4GHz WLAN	802.11b	CH 1	2412	1Mbps	13.56	100
		CH 6	2437		<b>14.67</b>	
		CH 11	2462		14.28	
	802.11g	CH 1	2412	6Mbps	10.76	95.64
		CH 6	2437		<b>13.51</b>	
		CH 11	2462		11.46	
	802.11n-HT20	CH 1	2412	MCS0	10.95	95.32
		CH 6	2437		11.66	
		CH 11	2462		<b>12.19</b>	
	802.11n-HT40	CH 3	2422	MCS0	11.12	90.54
		CH 6	2437		11.32	
		CH 9	2452		<b>11.75</b>	

**<2.4GHz WLAN Antenna 0+1>**

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Duty Cycle %
2.4GHz WLAN	802.11n-HT20	CH 1	2412	MCS0	11.84	90.90
		CH 6	2437		12.22	
		CH 11	2462		<b>12.51</b>	
	802.11n-HT40	CH 3	2422	MCS0	11.38	83.62
		CH 6	2437		12.12	
		CH 9	2452		<b>12.33</b>	

**<5GHz WLAN Antenna 0>**

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Duty Cycle %	
5.2GHz WLAN	802.11a	CH 36	5180	6Mbps	10.48	95.32	
		CH 40	5200		10.45		
		CH 44	5220		10.49		
		CH 48	5240		<b>10.53</b>		
	802.11n-HT20	CH 36	5180	MCS0	<b>10.40</b>	95.11	
		CH 40	5200		10.22		
		CH 44	5220		10.26		
		CH 48	5240		10.34		
	802.11n-HT40	CH 38	5190	MCS0	<b>10.18</b>	90.58	
		CH 46	5230		9.85		
	5.8GHz WLAN	802.11a	CH 149	5745	MCS0	9.39	95.32
			CH 157	5785		9.50	
CH 165			5825	<b>9.64</b>			
802.11n-HT20		CH 149	5745	MCS0	9.41	95.11	
		CH 157	5785		9.56		
		CH 165	5825		<b>9.57</b>		
802.11n-HT40		CH 151	5755	MCS0	<b>9.39</b>	90.58	
		CH 159	5795		9.04		

**<5GHz WLAN Antenna 1>**

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Duty Cycle %	
5.2GHz WLAN	802.11a	CH 36	5180	6Mbps	<b>10.69</b>	95.12	
		CH 40	5200		10.49		
		CH 44	5220		10.27		
		CH 48	5240		10.01		
	802.11n-HT20	CH 36	5180	MCS0	<b>10.69</b>	94.77	
		CH 40	5200		10.56		
		CH 44	5220		10.32		
		CH 48	5240		10.21		
	802.11n-HT40	CH 38	5190	MCS0	<b>10.64</b>	90.29	
		CH 46	5230		10.44		
	5.8GHz WLAN	802.11a	CH 149	5745	MCS0	11.06	95.12
			CH 157	5785		11.35	
CH 165			5825	<b>11.46</b>			
802.11n-HT20		CH 149	5745	MCS0	10.12	94.77	
		CH 157	5785		10.36		
		CH 165	5825		<b>10.61</b>		
802.11n-HT40		CH 151	5755	MCS0	11.34	90.29	
		CH 159	5795		<b>11.39</b>		

**<5GHz WLAN Antenna 0+1>**

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Duty Cycle %
5.2GHz WLAN	802.11n-HT20	CH 36	5180	MCS0	<b>13.88</b>	90.60
		CH 40	5200		13.50	
		CH 44	5220		13.52	
		CH 48	5240		13.39	
	802.11n-HT40	CH 38	5190	MCS0	14.05	83.41
		CH 46	5230		<b>14.20</b>	
5.8GHz WLAN	802.11n-HT20	CH 149	5745	MCS0	13.21	90.60
		CH 157	5785		13.16	
		CH 165	5825		<b>13.50</b>	
	802.11n-HT40	CH 151	5755	MCS0	<b>11.44</b>	83.41
		CH 159	5795		11.29	

### **13. WLAN Exclusions Applied**

Mode Band	Average power(dBm)	
	5.2GHz WLAN(antenna 0/1)	5.8G WLAN(antenna 0)
WLAN	11	10

**Note:**

1. Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR}$$

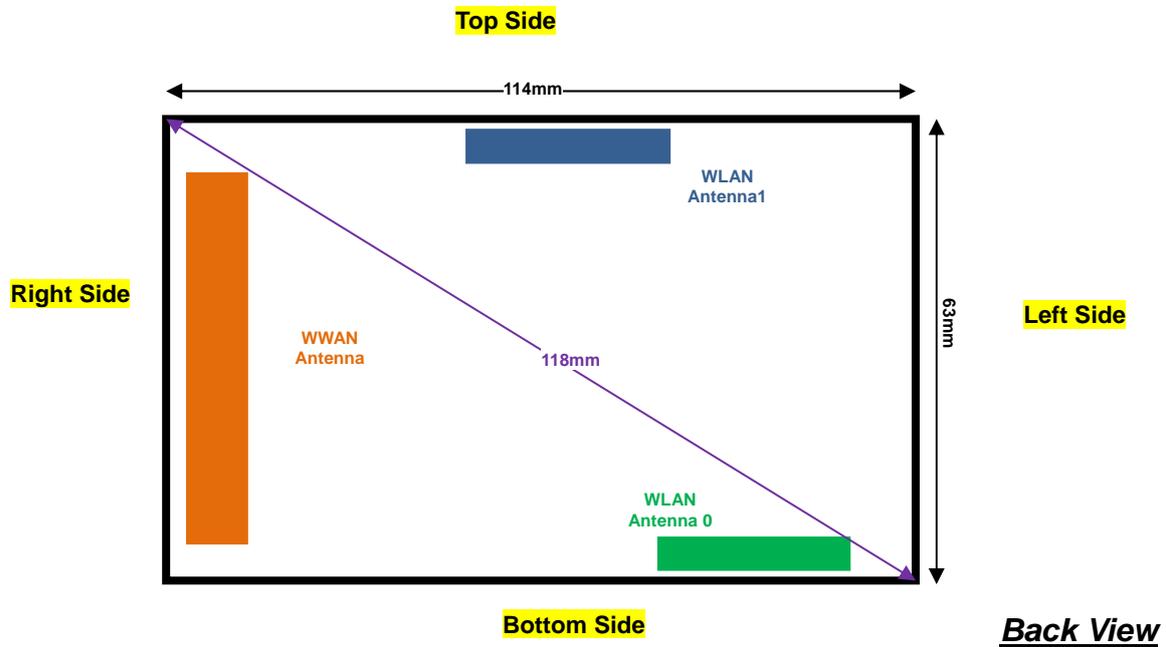
- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

WLAN Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	Exclusion Thresholds
11	10	5.25	3.0
10	10	5.85	2.4

**Note:**

Per KDB 447498 D01v05r02, for WLAN 5.2GHz, the test exclusion threshold is 3.0 which is ≤ 3, SAR testing is not required. For WLAN 5.8GHz, the test exclusion threshold is 2.4 which is ≤ 3, So SAR test for 5.8GHz antenna 0 can be excluded.

### 14. Antenna Location



Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN	≤ 25mm	≤ 25mm	≤ 25mm	≤ 25mm	≤ 25mm	97mm
WLAN(0)	≤ 25mm	≤ 25mm	55mm	≤ 25mm	74mm	≤ 25mm
WLAN(1)	≤ 25mm	≤ 25mm	≤ 25mm	55mm	55mm	39mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN	Yes	Yes	Yes	Yes	Yes	No
WLAN(0)	Yes	Yes	No	Yes	No	Yes
WLAN(1)	Yes	Yes	Yes	No	No	No

**General Note:**

Referring to KDB 941225 D06 v02, when the overall device length and width are ≥ 9cm\*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge



## 15. SAR Test Results

### 15.1 Body SAR

#### <WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	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	WCDMA Band V	RMC 12.2Kbps	Back	1	4233	846.6	23.20	24.00	1.202	0.11	0.656	<b>0.789</b>
	WCDMA Band II	RMC 12.2Kbps	Front	1	9400	1880	22.63	23.50	1.222	-0.03	0.834	1.019
#02	WCDMA Band II	RMC 12.2Kbps	Front	1	9262	1852.4	22.72	23.50	1.197	-0.09	0.864	<b>1.034</b>
	WCDMA Band II	RMC 12.2Kbps	Front	1	9538	1907.6	22.55	23.50	1.245	-0.03	0.813	1.012

#### <LTE SAR>

Plot No.	Band	BW (MHz)	RB Size	RB offset	Modulation	Test Position	Gap (cm)	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	LTE Band 17	10	1	49	QPSK	Front	1	23800	711	22.95	23.50	1.135	-0.03	0.546	<b>0.620</b>
#04	LTE Band 5	10	1	0	QPSK	Back	1	20450	829	22.84	24.00	1.306	-0.08	0.686	<b>0.896</b>
	LTE Band 5	10	1	0	QPSK	Back	1	20525	836.5	22.74	24.00	1.337	-0.08	0.652	0.871
	LTE Band 5	10	1	0	QPSK	Back	1	20600	844	22.81	24.00	1.315	-0.07	0.629	0.827
#05	LTE Band 4	20	1	0	QPSK	Front	1	20300	1745	22.72	23.50	1.197	-0.03	0.775	<b>0.927</b>
	LTE Band 4	20	1	0	QPSK	Front	1	20050	1720	22.67	23.50	1.211	-0.03	0.724	0.876
	LTE Band 4	20	1	0	QPSK	Front	1	20175	1732.5	22.71	23.50	1.199	-0.06	0.754	0.904
#06	LTE Band 2	20	1	0	QPSK	Back	1	18700	1860	22.62	23.50	1.225	-0.04	0.846	<b>1.036</b>
	LTE Band 2	20	1	0	QPSK	Back	1	18900	1880	22.65	23.50	1.216	-0.03	0.815	0.991
	LTE Band 2	20	1	0	QPSK	Back	1	19100	1900	22.81	23.50	1.172	-0.04	0.813	0.953

#### <DTS WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	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)
	WLAN 2.4GHz	802.11b 1Mbps	Bottom side	1	0	6	2437	14.15	14.50	1.084	100	1.000	-0.06	0.051	0.055
#07	WLAN 2.4GHz	802.11b 1Mbps	Top side	1	1	6	2437	14.67	15.00	1.079	100	1.000	0.1	0.081	<b>0.087</b>
	WLAN 2.4GHz	802.11n-HT20 MCS0	Top side	1	0+1	11	2462	12.51	13.00	1.119	90.90	1.100	-0.04	0.029	0.036

#### <UNII WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	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)
#8	WLAN 5.2GHz	802.11n-HT20, MCS0	Bottom side	1	0+1	44	5220	13.52	14.00	1.117	90.6	1.104	0.07	0.347	<b>0.428</b>
	WLAN 5.8GHz	802.11a, MCS0	Front	1	1	165	5825	11.46	12.00	1.132	95.12	1.051	-0.04	0.077	0.092
#9	WLAN 5.8GHz	802.11n-HT20 MCS0	Bottom side	1	0+1	165	5825	13.50	14.00	1.122	90.6	1.104	-0.10	0.263	<b>0.326</b>

**15.2 Repeated SAR Measurement**

No.	Band	Mode	Test Position	Gap (cm)	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	WCDMA Band II	RMC 12.2Kbps	Front	1	9262	1852.4	22.72	23.50	1.197	-0.09	0.864	1	1.034
2nd	WCDMA Band II	RMC 12.2Kbps	Front	1	9262	1852.4	22.72	23.50	1.197	-0.09	0.832	1.039	0.996

**General Note:**

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$ W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is  $\leq 1.2$  and the measured SAR  $< 1.45$ W/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.

**16. Simultaneous Transmission Analysis**

NO.	Simultaneous Transmission Configurations	LTE uFi	Note
		Body	
1.	WCDMA(Data) + WLAN2.4GHz SISO(data)	Yes	2.4GHz Hotspot
2.	WCDMA(Data) + WLAN2.4GHz MIMO(data)	Yes	2.4GHz Hotspot
3.	WCDMA(Data) + WLAN5 GHz SISO(data)	Yes	WiFi Direct
4.	WCDMA(Data) + WLAN5 GHz MIMO(data)	Yes	WiFi Direct
5.	LTE (Data) + WLAN2.4GHz SISO(data)	Yes	2.4GHz Hotspot
6.	LTE (Data) + WLAN2.4GHz MIMO(data)	Yes	2.4GHz Hotspot
7.	LTE (Data) + WLAN5 GHz SISO(data)	Yes	WiFi Direct
8.	LTE (Data) + WLAN5 GHz MIMO(data)	Yes	WiFi Direct
9.	WLAN Antenna 0 + WLAN Antenna 1	Yes	-

**General Note:**

1. This device has no voice function.
2. This device 2.4GHz WLAN supports hotspot operation, 5.2GHz/5.8GHz WLAN supports hotspot /WiFi Direct (GC/GO).
3. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, they will not transmit simultaneously.
4. EUT will choose either WCDMA or LTE according to the network signal condition; therefore, they will not transmit simultaneously.
5. The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WiFi Direct(GC/GO). Therefore, the following summations represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.
6. For simultaneously transmission SAR analysis, SAR values only considered the worst position which we did perform SAR testing on FA460508, and other test results were leverage from the parent model which referred to the test report number FA460508.
7. The reported SAR summation is calculated based on the same configuration and test position.
8. Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
  - i) Scalar SAR summation < 1.6W/kg.
  - ii)  $SPLSR = (SAR_1 + SAR_2)^{1.5} / (min. separation distance, mm)$ , and the peak separation distance is determined from the square root of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$ , where  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the coordinates of the extrapolated peak SAR locations in the zoom scan
  - 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.
9. For simultaneous transmission analysis, WLAN 5GHz SAR is estimated per KDB 447498 D01v05r01 based on the formula below.
  - i)  $(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm) \cdot [\sqrt{f(GHz)/x}] W/kg$  for test separation distances  $\leq 50 mm$ ; where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.
  - ii) When the minimum test separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
  - iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

WLAN 5.2G Maximum Power	Exposure Position	Body
	Test separation	10 mm
11 dBm	Estimated SAR (W/kg)	0.397W/kg

**16.1 Body Exposure Conditions**

**<WWAN PCB + WLAN DTS>**

WWAN Band	Exposure Position	WWAN PCB	WLAN DTS			Summed WWAN+ WLAN Ant. 0 SAR (W/kg)	Summed WWAN+ WLAN Ant. 1 SAR (W/kg)	Summed WWAN+ WLAN Ant. 0+1 SAR (W/kg)	SPLSR	Case No	
		Max. WWAN SAR (W/kg)	Max. WLAN Ant. 0 SAR (W/kg)	Max. WLAN Ant. 1 SAR (W/kg)	Max. WLAN Ant. 0+1 SAR (W/kg)						
WCMDA	Band V	Front	0.639	0.066	0.077	0.026	0.71	0.72	0.67		
		Back	0.789	0.056	0.054	0.023	0.85	0.84	0.81		
		Top side	0.378		0.087	0.036	0.38	0.47	0.41		
		Bottom side	0.389	0.055		0.025	0.44	0.39	0.41		
	Band II	Front	1.034	0.066	0.077	0.026	1.10	<b>1.11</b>	1.06		
		Back	0.926	0.056	0.054	0.023	0.98	0.98	0.95		
		Top side	0.247		0.087	0.036	0.25	0.33	0.28		
		Bottom side	0.302	0.055		0.025	0.36	0.30	0.33		
LTE	Band 17	Front	0.620	0.066	0.077	0.026	0.69	0.70	0.65		
		Back	0.344	0.056	0.054	0.023	0.40	0.40	0.37		
		Top side	0.146		0.087	0.036	0.15	0.23	0.18		
		Bottom side	0.142	0.055		0.025	0.20	0.14	0.17		
	Band 5	Front	0.669	0.066	0.077	0.026	0.74	0.75	0.70		
		Back	0.896	0.056	0.054	0.023	0.95	0.95	0.92		
		Top side	0.424		0.087	0.036	0.42	0.51	0.46		
		Bottom side	0.413	0.055		0.025	0.47	0.41	0.44		
	Band 4	Front	0.927	0.066	0.077	0.026	0.99	1.00	0.95		
		Back	0.924	0.056	0.054	0.023	0.98	0.98	0.95		
		Top side	0.319		0.087	0.036	0.32	0.41	0.36		
		Bottom side	0.442	0.055		0.025	0.50	0.44	0.47		
	Band 2	Front	0.920	0.066	0.077	0.026	0.99	1.00	0.95		
		Back	1.036	0.056	0.054	0.023	1.09	1.09	1.06		
		Top side	0.312		0.087	0.036	0.31	0.40	0.35		
		Bottom side	0.283	0.055		0.025	0.34	0.28	0.31		



<WWAN PCB + WLAN NII>

WWAN Band	Exposure Position	WWAN PCB	WLAN NII			Summed WWAN+ WLAN Ant. 0 SAR (W/kg)	Summed WWAN+ WLAN Ant. 1 SAR (W/kg)	Summed WWAN+ WLAN Ant. 0+1 SAR (W/kg)	SPLSR	Case No	
		Max. WWAN SAR (W/kg)	Max. WLAN Ant. 0 SAR (W/kg)	Max. WLAN Ant. 1 SAR (W/kg)	Max. WLAN Ant. 0+1 SAR (W/kg)						
WCMDA	Band V	Front	0.639	0.397	0.092	0.213	1.04	0.73	0.85		
		Back	0.789	0.397	0.062	0.095	1.19	0.85	0.88		
		Top side	0.378		0.169	0.140	0.38	0.55	0.52		
		Bottom side	0.389	0.397		0.428	0.79	0.39	0.82		
	Band II	Front	1.034	0.397	0.092	0.213	1.43	1.13	1.25		
		Back	0.926	0.397	0.062	0.095	1.32	0.99	1.02		
		Top side	0.247		0.169	0.140	0.25	0.42	0.39		
		Bottom side	0.302	0.397		0.428	0.70	0.30	0.73		
LTE	Band 17	Front	0.620	0.397	0.092	0.213	1.02	0.71	0.83		
		Back	0.344	0.397	0.062	0.095	0.74	0.41	0.44		
		Top side	0.146		0.169	0.140	0.15	0.32	0.29		
		Bottom side	0.142	0.397		0.428	0.54	0.14	0.57		
	Band 5	Front	0.669	0.397	0.092	0.213	1.07	0.76	0.88		
		Back	0.896	0.397	0.062	0.095	1.29	0.96	0.99		
		Top side	0.424		0.169	0.140	0.42	0.59	0.56		
		Bottom side	0.413	0.397		0.428	0.81	0.41	0.84		
	Band 4	Front	0.927	0.397	0.092	0.213	1.32	1.02	1.14		
		Back	0.924	0.397	0.062	0.095	1.32	0.99	1.02		
		Top side	0.319		0.169	0.140	0.32	0.49	0.46		
		Bottom side	0.442	0.397		0.428	0.84	0.44	0.87		
	Band 2	Front	0.920	0.397	0.092	0.213	1.32	1.01	1.13		
		Back	1.036	0.397	0.062	0.095	1.43	1.10	1.13		
		Top side	0.312		0.169	0.140	0.31	0.48	0.45		
		Bottom side	0.283	0.397		0.428	0.68	0.28	0.71		

Test Engineer : Kat Yin

## **17. 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/k <sup>(b)</sup>	1/√3	1/√6	1/√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 17.1. 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 17.2. 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>						<b>12.5%</b>	<b>12.5%</b>
<b>Coverage Factor for 95 %</b>						<b>K=2</b>	<b>K=2</b>
<b>Expanded STD Uncertainty</b>						<b>25.0%</b>	<b>24.9%</b>

**Table 17.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz**

## **18. 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 v02r01, "SAR Guidance for IEEE 802.11 (WiFi) Transmitters", Jun 2015.
- [6] FCC KDB 447498 D01 v05r02, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Feb 2014
- [7] FCC KDB 941225 D01 v03, "3G SAR MEAUREMENT PROCEDURES", Oct 2014
- [8] FCC KDB 941225 D05 v02r03, "SAR Evaluation Considerations for LTE Devices", Dec 2013
- [9] FCC KDB 941225 D05A v01r01, "Rel. 10 LTE SAR Test Guidance and KDB Inquiries", Aug 2014
- [10] FCC KDB 941225 D06 v02, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2014.
- [11] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [12] FCC KDB 865664 D02 v01r01, "RF Exposure Compliance Reporting and Documentation Considerations" May 2013.



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

The plots are shown as follows.

### System Check\_Body\_750MHz\_150816

#### DUT: D750V3-1065

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

Medium: MSL\_750\_150816 Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.961$  S/m;  $\epsilon_r = 53.931$ ;  $\rho = 1000$  kg/m<sup>3</sup>

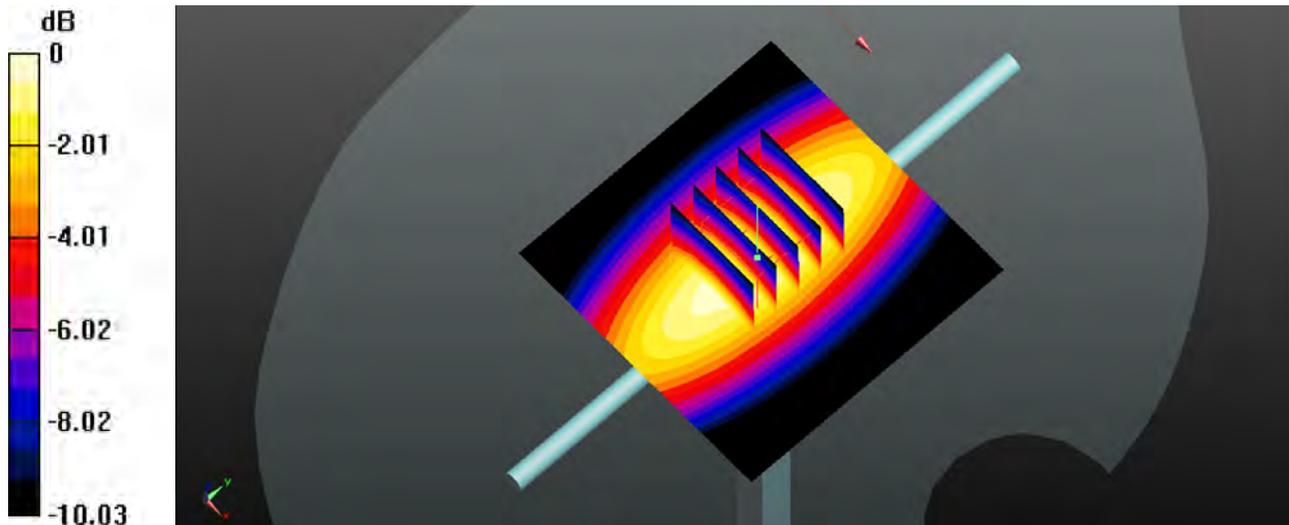
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.5 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.61, 9.61, 9.61); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 2.71 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 49.30 V/m; Power Drift = -0.01 dB  
Peak SAR (extrapolated) = 3.14 W/kg  
**SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.44 W/kg**  
Maximum value of SAR (measured) = 2.72 W/kg



0 dB = 2.72 W/kg

### System Check\_Body\_835MHz\_150815

#### DUT: D835V2-4d091

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

Medium: MSL\_835\_150815 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.97 \text{ S/m}$ ;  $\epsilon_r = 53.68$ ;  $\rho = 1000 \text{ kg/m}^3$

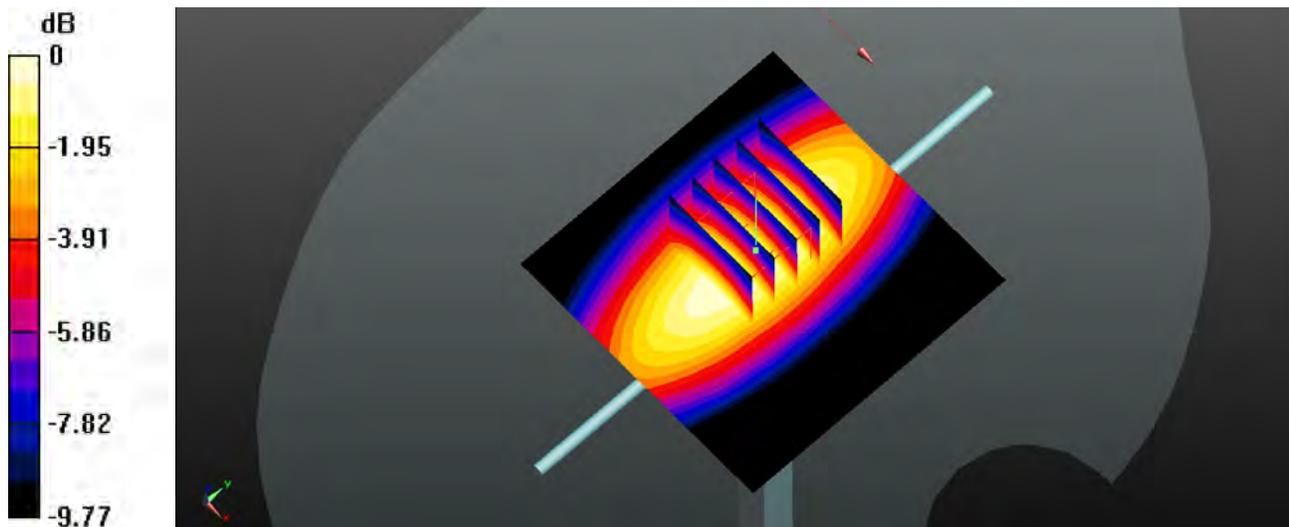
Ambient Temperature :  $23.5 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.5 \text{ }^\circ\text{C}$

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.66, 9.66, 9.66); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (interpolated) =  $2.89 \text{ W/kg}$

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value =  $48.45 \text{ V/m}$ ; Power Drift =  $-0.02 \text{ dB}$   
Peak SAR (extrapolated) =  $3.29 \text{ W/kg}$   
**SAR(1 g) =  $2.3 \text{ W/kg}$ ; SAR(10 g) =  $1.55 \text{ W/kg}$**   
Maximum value of SAR (measured) =  $2.84 \text{ W/kg}$



0 dB =  $2.84 \text{ W/kg}$

### System Check\_Body\_1750MHz\_150818

#### DUT: D1750V2-1069

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

Medium: MSL\_1750\_150818 Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.528$  S/m;  $\epsilon_r = 52.031$ ;  $\rho = 1000$  kg/m<sup>3</sup>

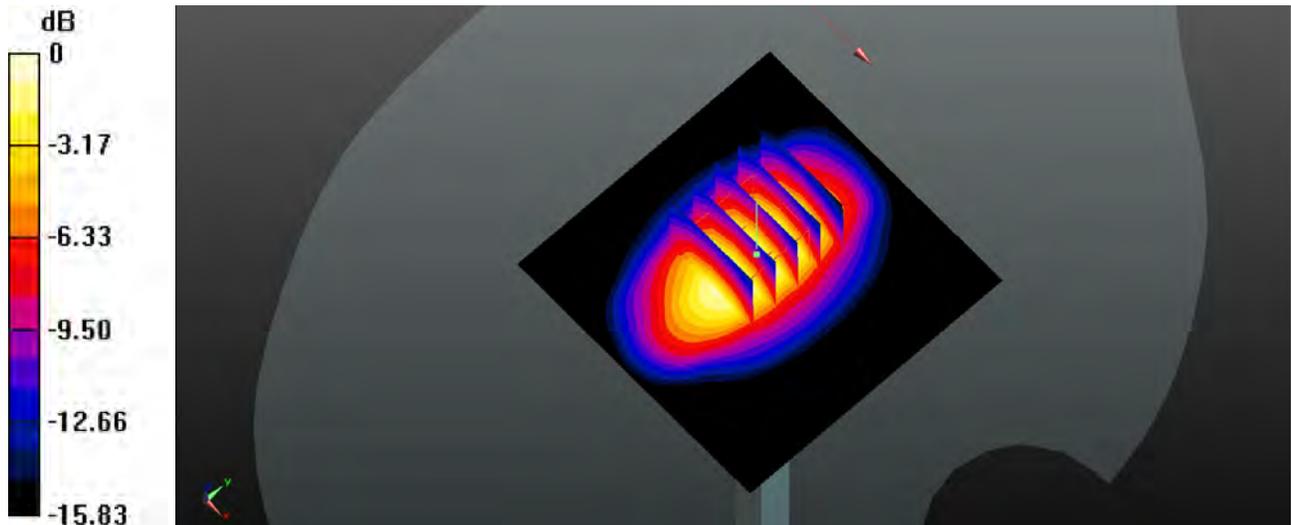
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.4 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.93, 7.93, 7.93); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 12.3 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 84.27 V/m; Power Drift = 0.05 dB  
Peak SAR (extrapolated) = 14.9 W/kg  
**SAR(1 g) = 8.95 W/kg; SAR(10 g) = 4.94 W/kg**  
Maximum value of SAR (measured) = 12.1 W/kg



0 dB = 12.1 W/kg

### System Check\_Body\_1900MHz\_150815

#### DUT: D1900V2-5d118

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

Medium: MSL\_1900\_150815 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.542$  S/m;  $\epsilon_r = 55.338$ ;  $\rho = 1000$  kg/m<sup>3</sup>

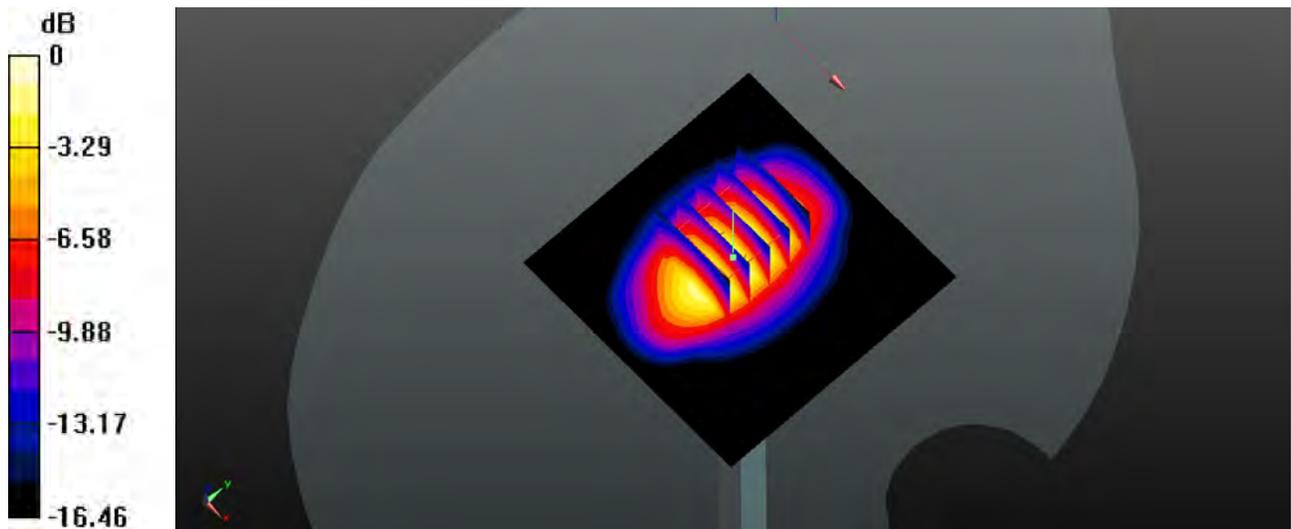
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.57, 7.57, 7.57); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 13.9 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 79.03 V/m; Power Drift = -0.01 dB  
Peak SAR (extrapolated) = 16.9 W/kg  
**SAR(1 g) = 9.95 W/kg; SAR(10 g) = 5.34 W/kg**  
Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg

### System Check\_Body\_2450MHz\_150819

#### DUT: D2450V2-840

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

Medium: MSL\_2450\_150819 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.949$  S/m;  $\epsilon_r = 53.894$ ;  $\rho = 1000$  kg/m<sup>3</sup>

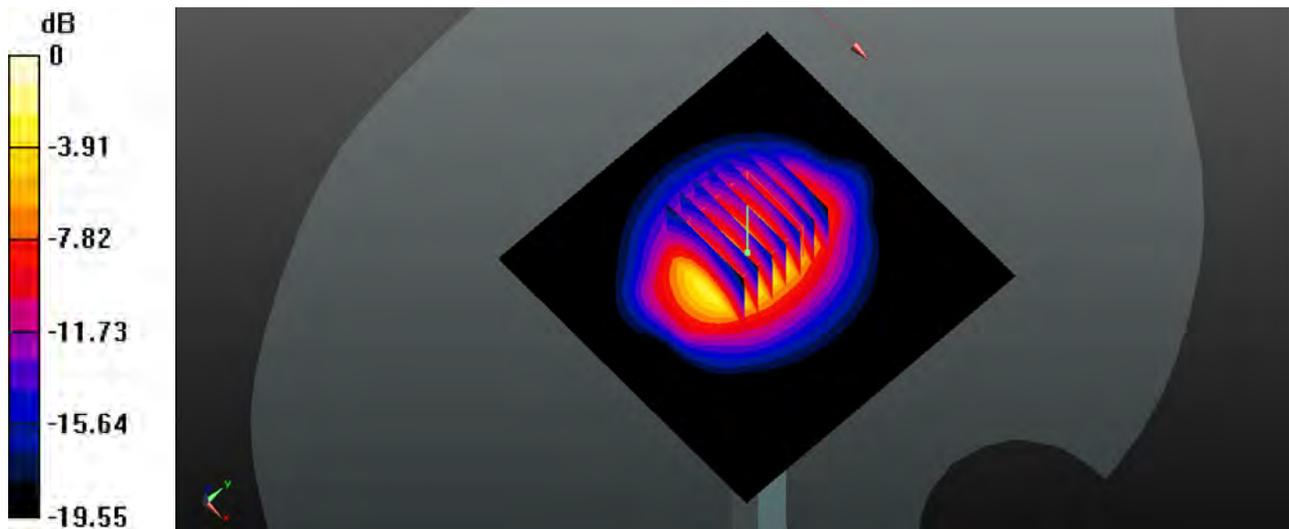
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.5 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.18, 7.18, 7.18); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (81x81x1):** Interpolated grid: dx=12mm, dy=12mm  
Maximum value of SAR (interpolated) = 18.0 W/kg

**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 76.97 V/m; Power Drift = 0.07 dB  
Peak SAR (extrapolated) = 23.6 W/kg  
**SAR(1 g) = 12.4 W/kg; SAR(10 g) = 6 W/kg**  
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg

### System Check\_Body\_5200MHz\_150826

#### DUT: D5GHzV2-1113

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: MSL\_5000\_150826 Medium parameters used:  $f = 5200 \text{ MHz}$ ;  $\sigma = 5.295 \text{ mho/m}$ ;  $\epsilon_r =$

$49.183$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.5 \text{ }^\circ\text{C}$  ; Liquid Temperature :  $22.8 \text{ }^\circ\text{C}$

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(4.45, 4.45, 4.45); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

**Pin=100mW/Area Scan (71x71x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

Maximum value of SAR (interpolated) =  $16.820 \text{ mW/g}$

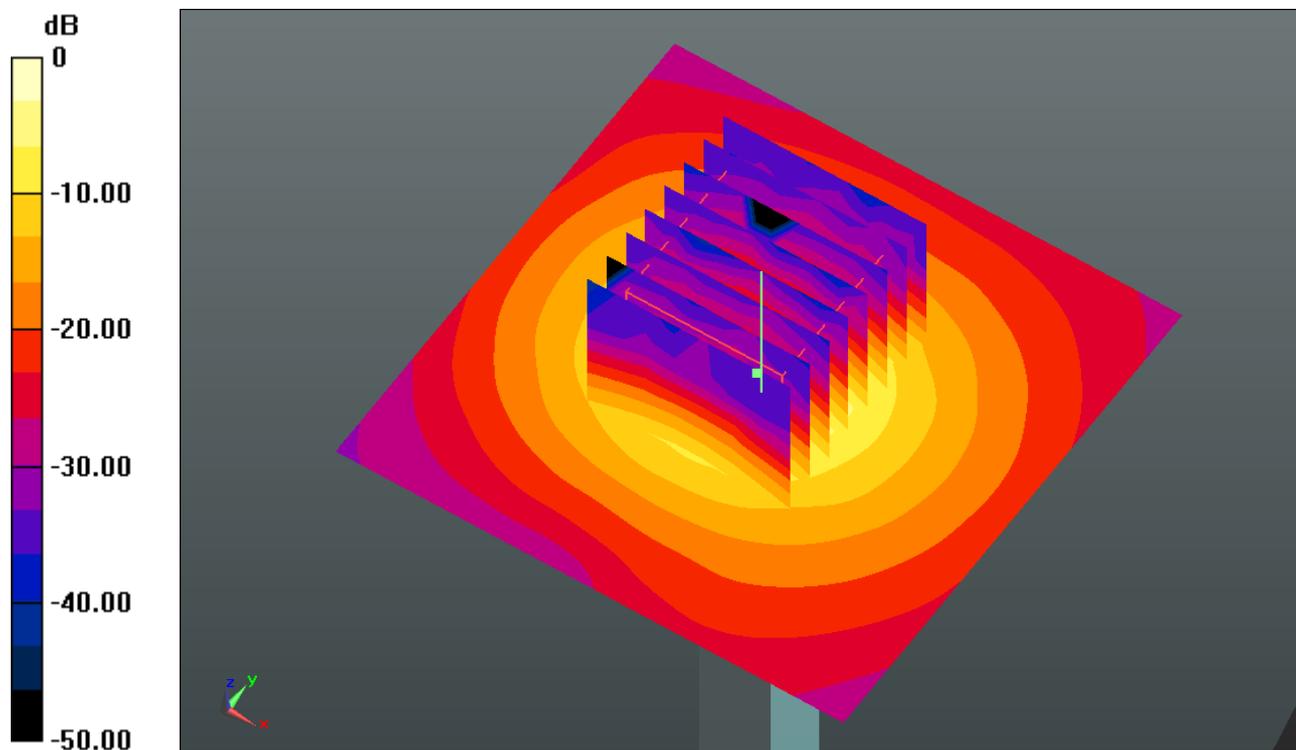
**Pin=100mW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $40.630 \text{ V/m}$ ; Power Drift =  $0.04 \text{ dB}$

Peak SAR (extrapolated) =  $28.783 \text{ W/kg}$

**SAR(1 g) =  $7.19 \text{ mW/g}$ ; SAR(10 g) =  $2.02 \text{ mW/g}$**

Maximum value of SAR (measured) =  $16.676 \text{ mW/g}$



0 dB =  $16.680\text{mW/g}$

### System Check\_Body\_5800MHz\_150826

#### DUT: D5GHzV2-1113

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: MSL\_5000\_150826 Medium parameters used:  $f = 5800 \text{ MHz}$ ;  $\sigma = 6.129 \text{ mho/m}$ ;  $\epsilon_r =$

$47.785$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.5 \text{ }^\circ\text{C}$  ; Liquid Temperature :  $22.8 \text{ }^\circ\text{C}$

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3857; ConvF(4.16, 4.16, 4.16); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

**Pin=100mW/Area Scan (71x71x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

Maximum value of SAR (interpolated) =  $18.076 \text{ mW/g}$

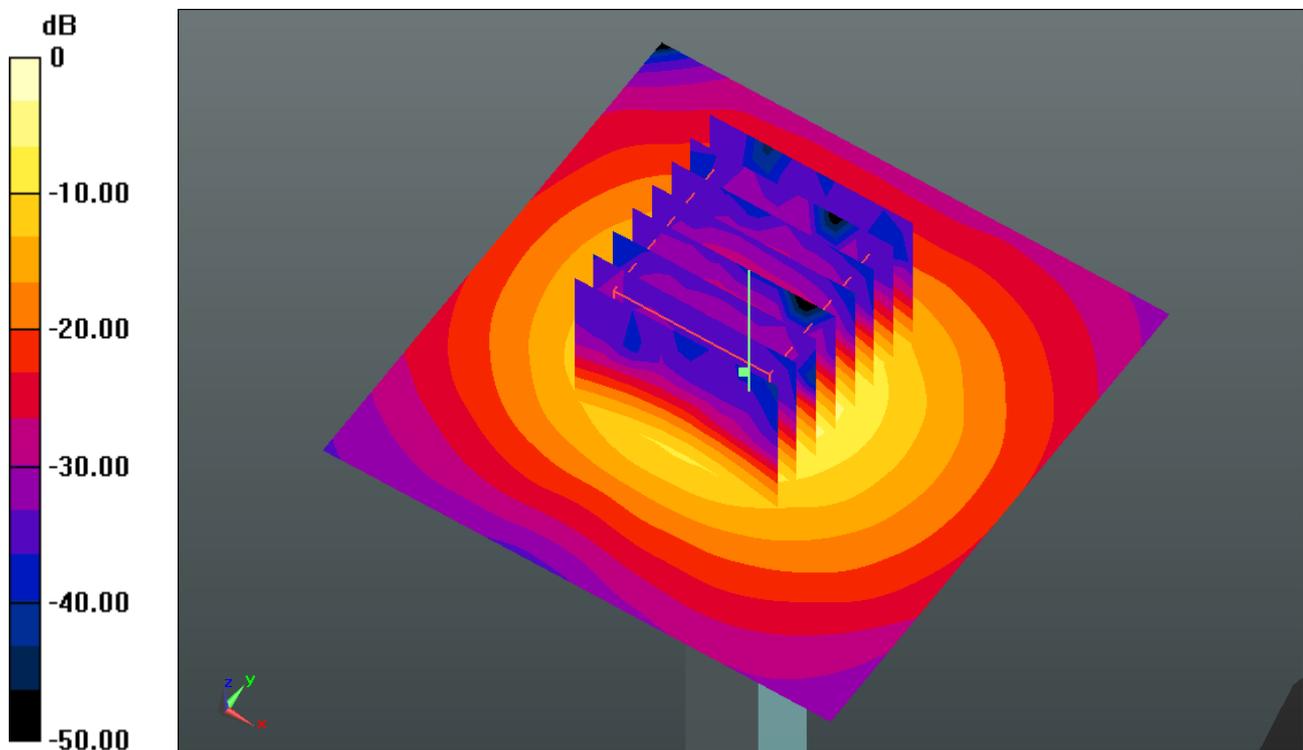
**Pin=100mW/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $37.500 \text{ V/m}$ ; Power Drift =  $0.0097 \text{ dB}$

Peak SAR (extrapolated) =  $33.500 \text{ W/kg}$

**SAR(1 g) =  $7.39 \text{ mW/g}$ ; SAR(10 g) =  $2.05 \text{ mW/g}$**

Maximum value of SAR (measured) =  $18.075 \text{ mW/g}$



0 dB =  $18.080\text{mW/g}$



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

The plots are shown as follows.

### #01 WCDMA Band V\_RMC 12.2Kbps\_Back\_1.0cm\_Ch4233

Communication System: UID 0, WCDMA (0); Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL\_835\_150815 Medium parameters used:  $f = 846.6$  MHz;  $\sigma = 0.982$  S/m;  $\epsilon_r = 53.561$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.66, 9.66, 9.66); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4233/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.756 W/kg

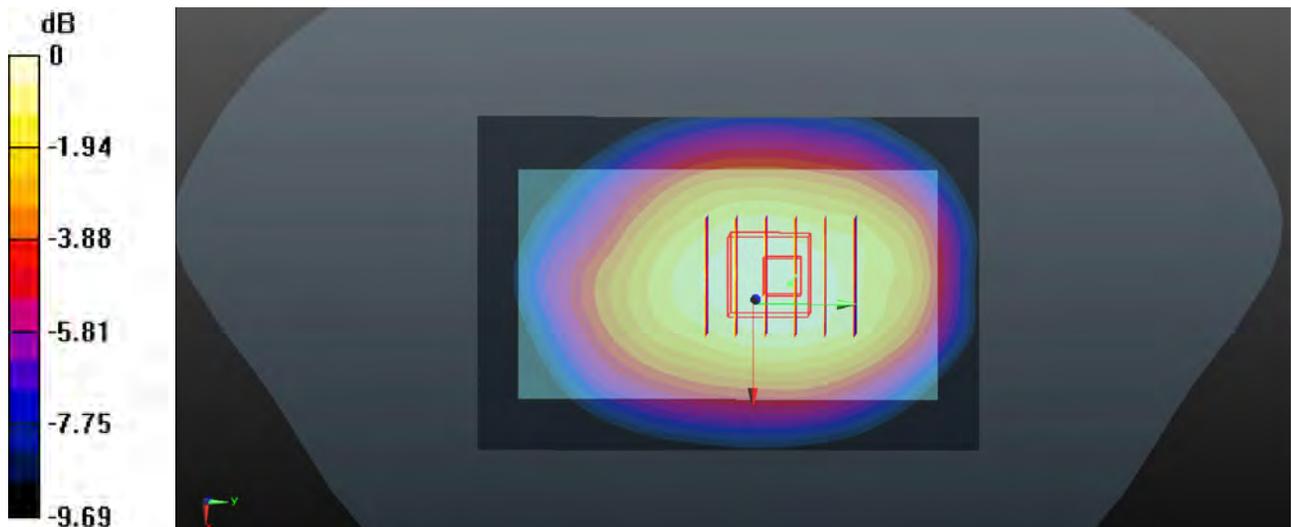
**Ch4233/Zoom Scan (5x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.98 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.828 W/kg

**SAR(1 g) = 0.656 W/kg; SAR(10 g) = 0.494 W/kg**

Maximum value of SAR (measured) = 0.758 W/kg



0 dB = 0.758 W/kg

### #02 WCDMA Band II\_RMC 12.2Kbps\_Front\_1.0cm\_Ch9262

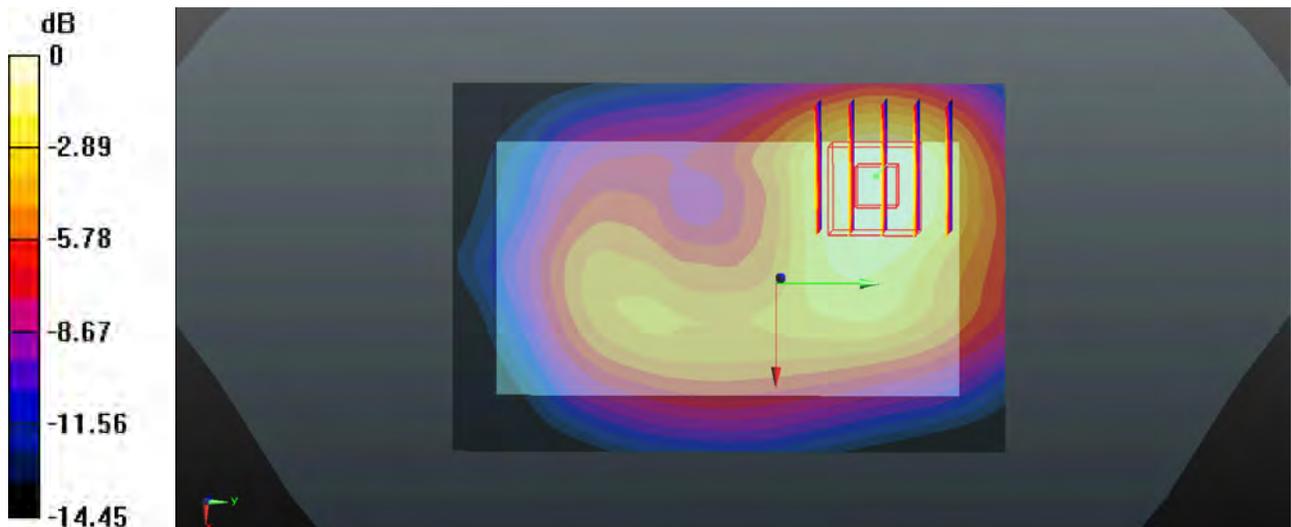
Communication System: UID 0, WCDMA (0); Frequency: 1852.4 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900\_150815 Medium parameters used:  $f = 1852.4$  MHz;  $\sigma = 1.496$  S/m;  $\epsilon_r = 55.471$ ;  
 $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.57, 7.57, 7.57); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9262/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 1.11 W/kg

**Ch9262/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 12.06 V/m; Power Drift = -0.09 dB  
Peak SAR (extrapolated) = 1.27 W/kg  
**SAR(1 g) = 0.864 W/kg; SAR(10 g) = 0.542 W/kg**  
Maximum value of SAR (measured) = 1.08 W/kg



0 dB = 1.08 W/kg

### #03 LTE Band 17\_QPSK\_10M(1,49)\_Front\_1.0cm\_Ch23800

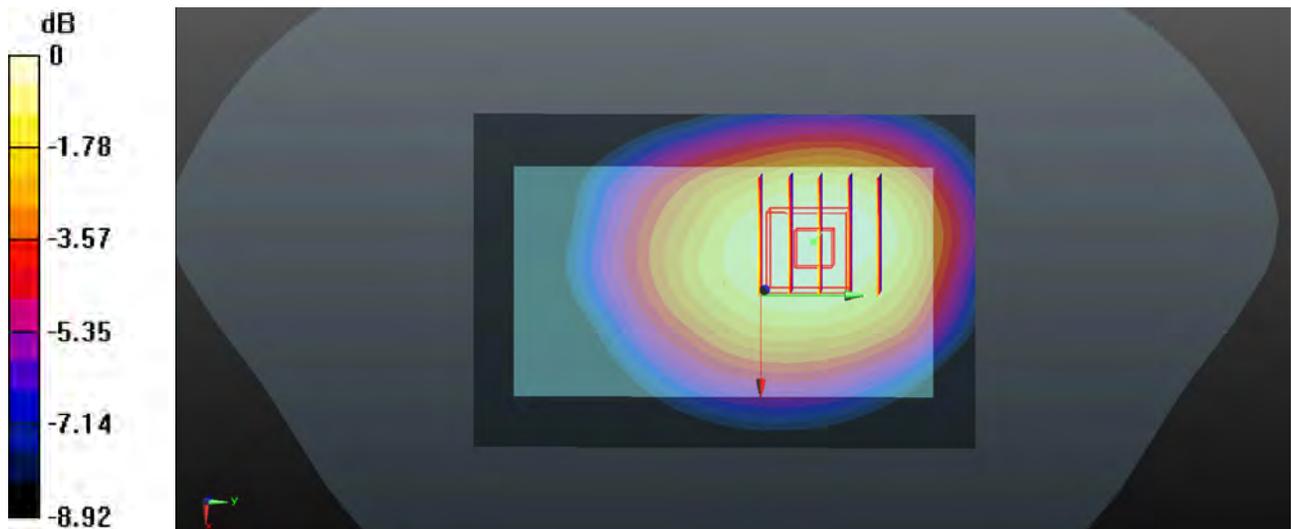
Communication System: UID 0, FDD-LTE (0); Frequency: 711 MHz; Duty Cycle: 1:1  
Medium: MSL\_750\_150816 Medium parameters used:  $f = 711$  MHz;  $\sigma = 0.935$  S/m;  $\epsilon_r = 54.86$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.5 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.61, 9.61, 9.61); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch23800/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.631 W/kg

**Ch23800/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 20.89 V/m; Power Drift = -0.03 dB  
Peak SAR (extrapolated) = 0.677 W/kg  
**SAR(1 g) = 0.546 W/kg; SAR(10 g) = 0.413 W/kg**  
Maximum value of SAR (measured) = 0.625 W/kg



0 dB = 0.625 W/kg

**#04 LTE Band 5\_QPSK\_10M(1,0)\_Back\_1.0cm\_Ch20450**

Communication System: UID 0, FDD-LTE (0); Frequency: 829 MHz; Duty Cycle: 1:1

Medium: MSL\_835\_150815 Medium parameters used:  $f = 829$  MHz;  $\sigma = 0.965$  S/m;  $\epsilon_r = 53.739$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.66, 9.66, 9.66); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20450/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.803 W/kg

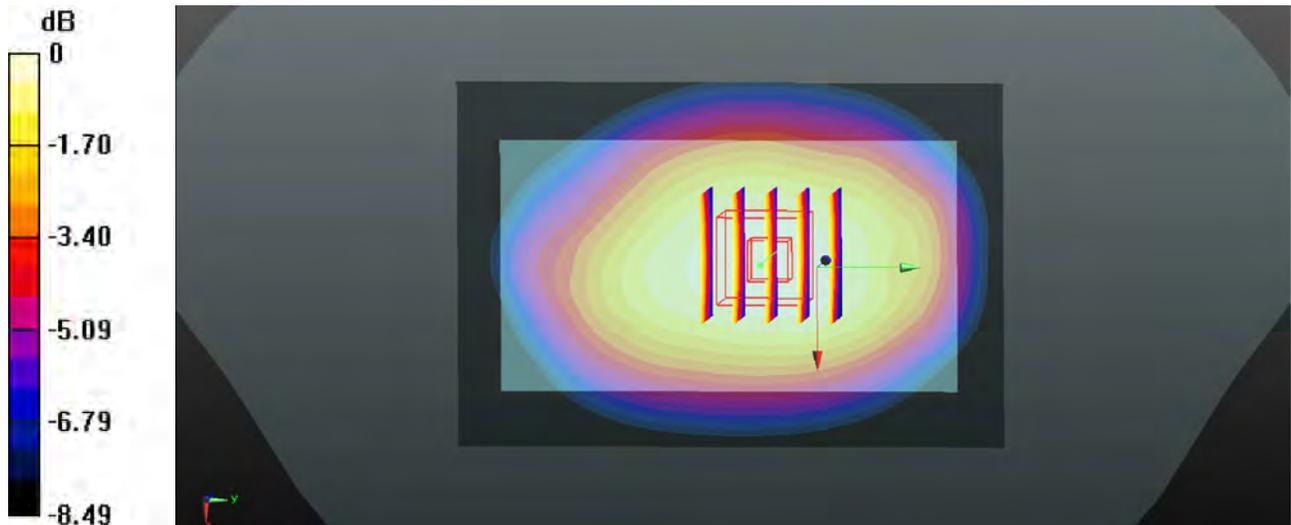
**Ch20450/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.37 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.849 W/kg

**SAR(1 g) = 0.686 W/kg; SAR(10 g) = 0.522 W/kg**

Maximum value of SAR (measured) = 0.783 W/kg



0 dB = 0.783 W/kg

### #05 LTE Band 4\_QPSK\_20M(1,0)\_Front\_1.0cm\_Ch20300

Communication System: UID 0, FDD-LTE (0); Frequency: 1745 MHz; Duty Cycle: 1:1

Medium: MSL\_1750\_150818 Medium parameters used:  $f = 1745$  MHz;  $\sigma = 1.523$  S/m;  $\epsilon_r = 52.051$ ;  $\rho = 1000$  kg/m<sup>3</sup>

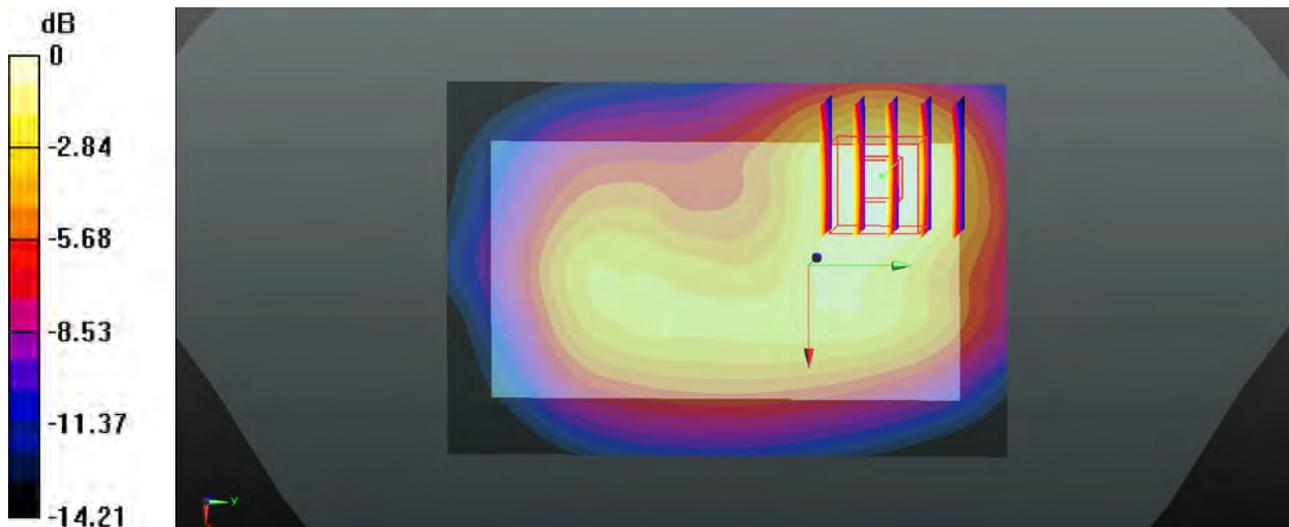
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.93, 7.93, 7.93); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20300/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.987 W/kg

**Ch20300/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 14.85 V/m; Power Drift = -0.03 dB  
Peak SAR (extrapolated) = 1.15 W/kg  
**SAR(1 g) = 0.775 W/kg; SAR(10 g) = 0.487 W/kg**  
Maximum value of SAR (measured) = 0.979 W/kg



0 dB = 0.979 W/kg

**#06 LTE Band 2\_QPSK\_20M(1,0)\_Back\_1.0cm\_Ch18700**

Communication System: UID 0, FDD-LTE (0); Frequency: 1860 MHz;Duty Cycle: 1:1

Medium: MSL\_1900\_150815 Medium parameters used:  $f = 1860$  MHz;  $\sigma = 1.505$  S/m;  $\epsilon_r = 55.474$ ;  $\rho = 1000$  kg/m<sup>3</sup>

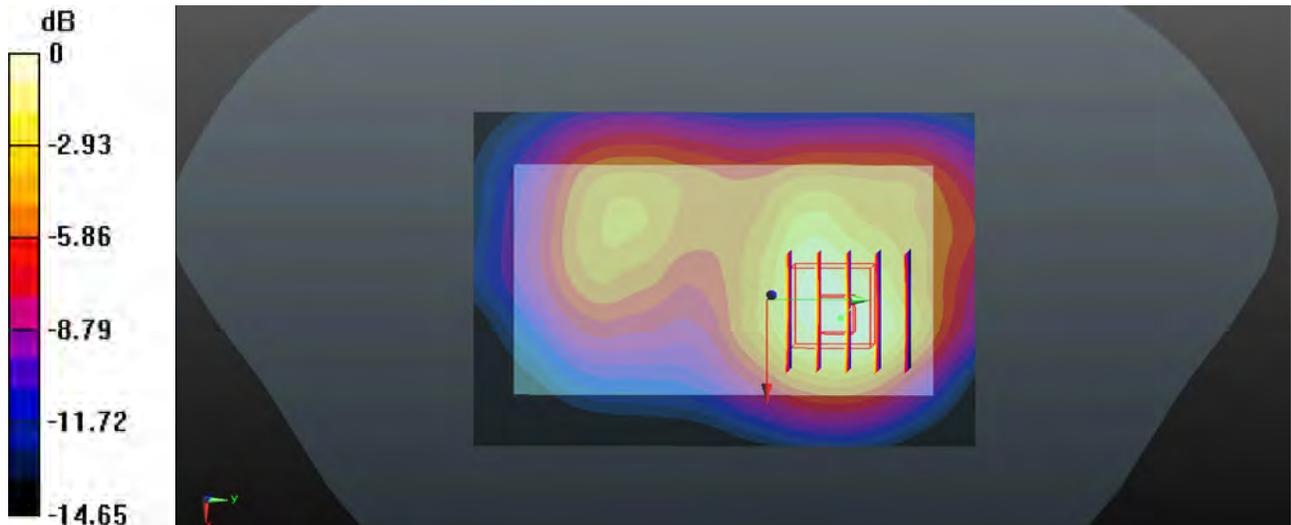
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.57, 7.57, 7.57); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch18700/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 1.10 W/kg

**Ch18700/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 11.72 V/m; Power Drift = -0.04 dB  
Peak SAR (extrapolated) = 1.28 W/kg  
**SAR(1 g) = 0.846 W/kg; SAR(10 g) = 0.522 W/kg**  
Maximum value of SAR (measured) = 1.08 W/kg



0 dB = 1.08 W/kg

**#07 WLAN2.4GHz\_802.11b, 1Mbps\_Top side side\_1.0cm\_Ch6\_Ant 1**

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

Medium: MSL\_2450\_150819 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.922$  S/m;  $\epsilon_r = 53.921$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.18, 7.18, 7.18); Calibrated: 2014/10/2;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2015/4/13
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch6/Area Scan (31x111x1):** Interpolated grid: dx=12mm, dy=12mm

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

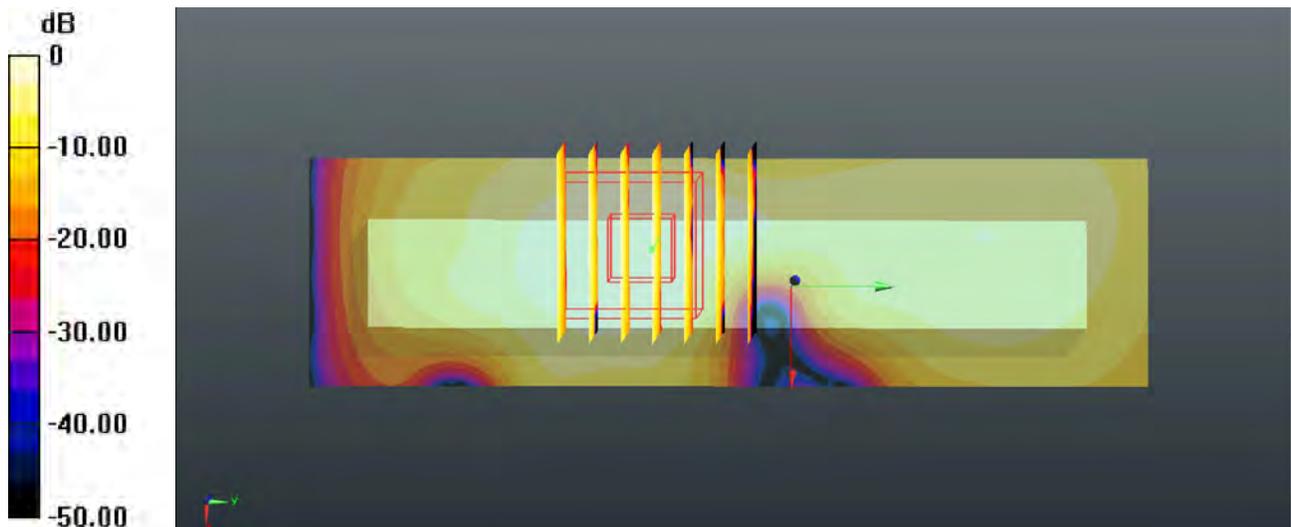
**Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.136 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.148 W/kg

**SAR(1 g) = 0.081 W/kg; SAR(10 g) = 0.041 W/kg**

Maximum value of SAR (measured) = 0.116 W/kg



0 dB = 0.116 W/kg

**#08\_WLAN 5.2GHz\_802.11n-HT20, MCS0\_Bottom Side 1cm\_Ch44\_Ant.0+1**

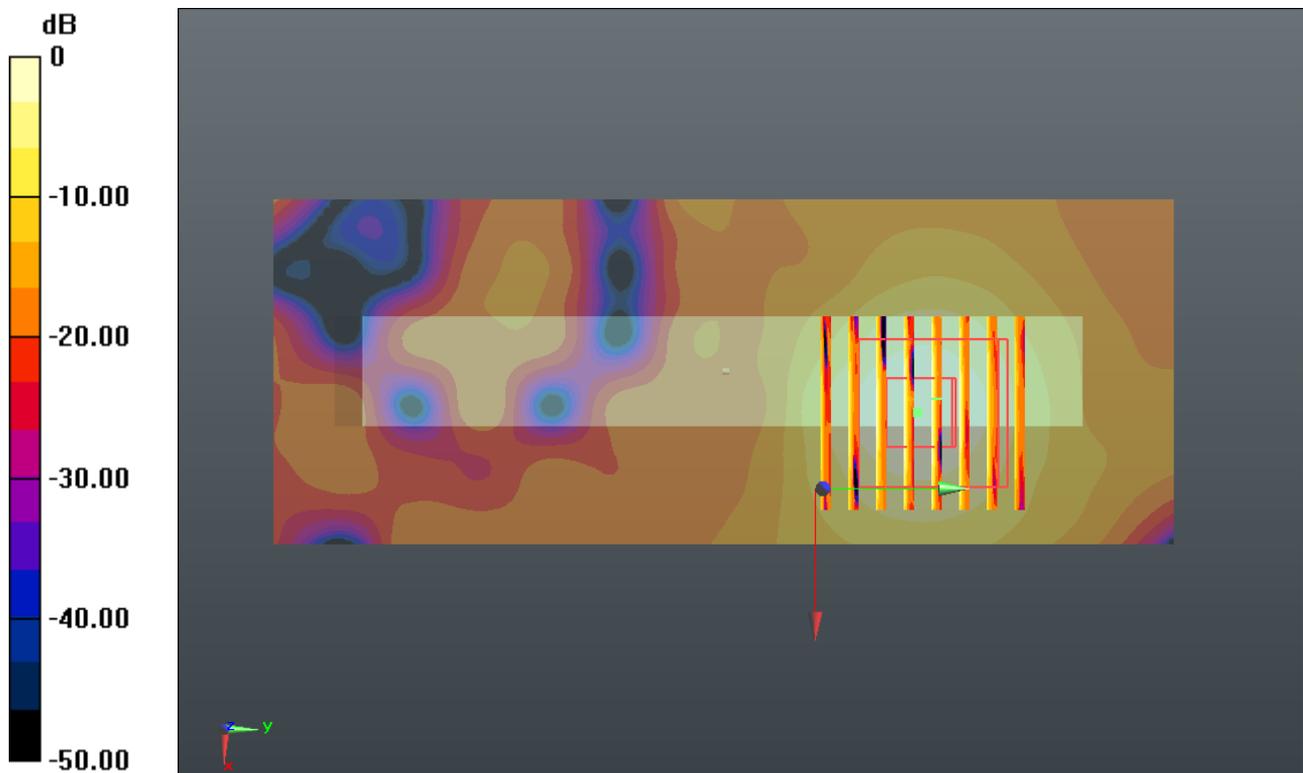
Communication System: WIFI (0); Frequency: 5220 MHz; Duty Cycle: 1:1.117  
 Medium: MSL\_5000\_150826 Medium parameters used:  $f = 5220 \text{ MHz}$ ;  $\sigma = 5.33 \text{ mho/m}$ ;  $\epsilon_r = 49.157$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Ambient Temperature :  $23.5 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.8 \text{ }^\circ\text{C}$

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.45, 4.45, 4.45); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

**Ch44/Area Scan (51x131x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$   
 Maximum value of SAR (interpolated) =  $0.876 \text{ mW/g}$

**Ch44/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value =  $0.636 \text{ V/m}$ ; Power Drift =  $0.07 \text{ dB}$   
 Peak SAR (extrapolated) =  $1.229 \text{ W/kg}$   
**SAR(1 g) =  $0.347 \text{ mW/g}$ ; SAR(10 g) =  $0.110 \text{ mW/g}$**   
 Maximum value of SAR (measured) =  $0.775 \text{ mW/g}$



0 dB =  $0.780\text{mW/g}$

**#09\_WLAN 5.8GHz\_802.11n-HT20, MCS0\_Bottom Side 1cm\_Ch165\_Ant.0+1**

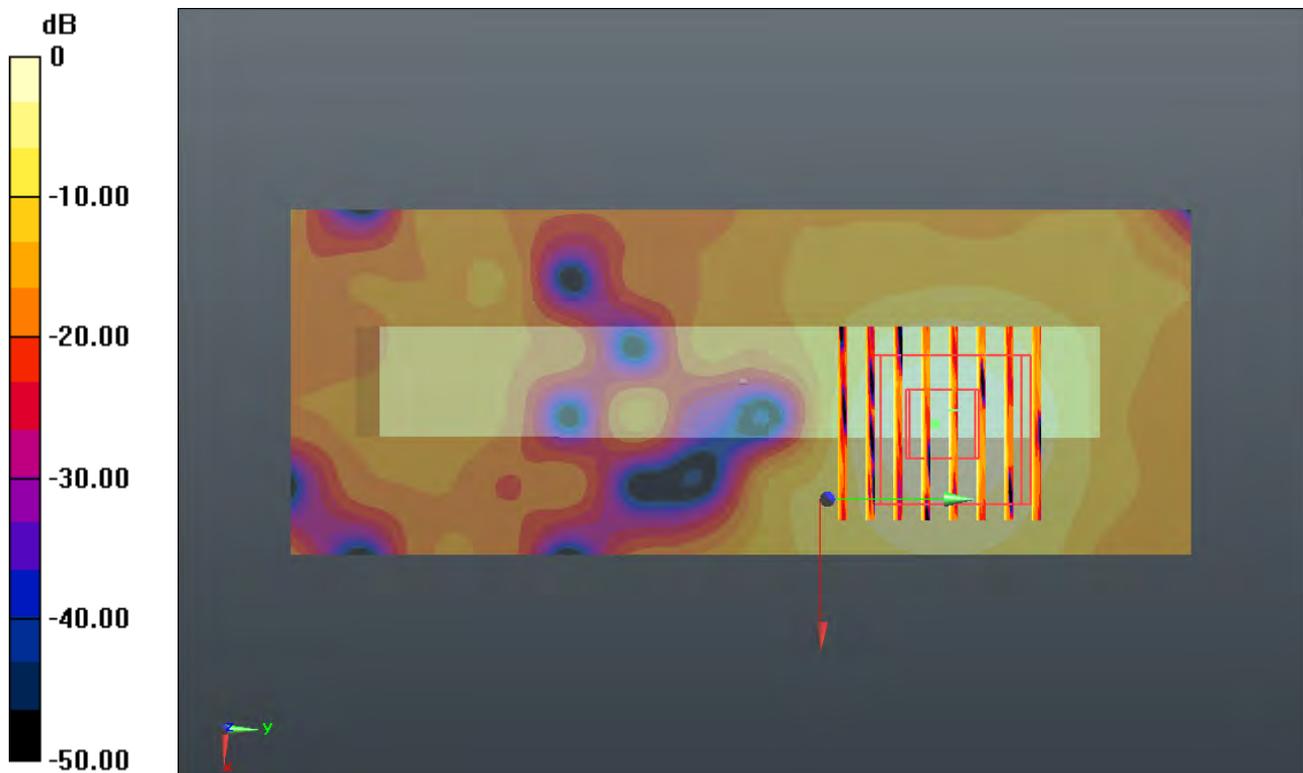
Communication System: WIFI (0); Frequency: 5825 MHz; Duty Cycle: 1:1.104  
 Medium: MSL\_5000\_150826 Medium parameters used:  $f = 5825 \text{ MHz}$ ;  $\sigma = 6.166 \text{ mho/m}$ ;  $\epsilon_r = 47.679$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Ambient Temperature :  $23.5 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.8 \text{ }^\circ\text{C}$

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3857; ConvF(4.16, 4.16, 4.16); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM1; Type: SAM; Serial: TP-1479
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

**Ch165/Area Scan (51x131x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$   
 Maximum value of SAR (interpolated) =  $0.703 \text{ mW/g}$

**Ch165/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value =  $1.154 \text{ V/m}$ ; Power Drift =  $-0.10 \text{ dB}$   
 Peak SAR (extrapolated) =  $1.086 \text{ W/kg}$   
**SAR(1 g) =  $0.263 \text{ mW/g}$ ; SAR(10 g) =  $0.082 \text{ mW/g}$**   
 Maximum value of SAR (measured) =  $0.624 \text{ mW/g}$



0 dB =  $0.620\text{mW/g}$



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**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 108**

Client **Sporton-CN (Auden)**

Certificate No: **D750V3-1065\_Nov14**

## CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1065**

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

Calibration date: **November 19, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name** Michael Weber **Function** Laboratory Technician

**Signature**

Approved by: **Name** Katja Pokovic **Function** Technical Manager

Issued: November 20, 2014

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 108**

### 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
- 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	750 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.4 $\pm$ 6 %	0.89 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	2.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>8.14 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	1.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>5.35 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	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.7 $\pm$ 6 %	0.98 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	2.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>8.64 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	1.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>5.71 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 $\Omega$ - 0.4 j $\Omega$
Return Loss	- 27.2 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.0 $\Omega$ - 3.0 j $\Omega$
Return Loss	- 29.8 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.032 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	May 10, 2012

## DASY5 Validation Report for Head TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.89$  S/m;  $\epsilon_r = 41.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

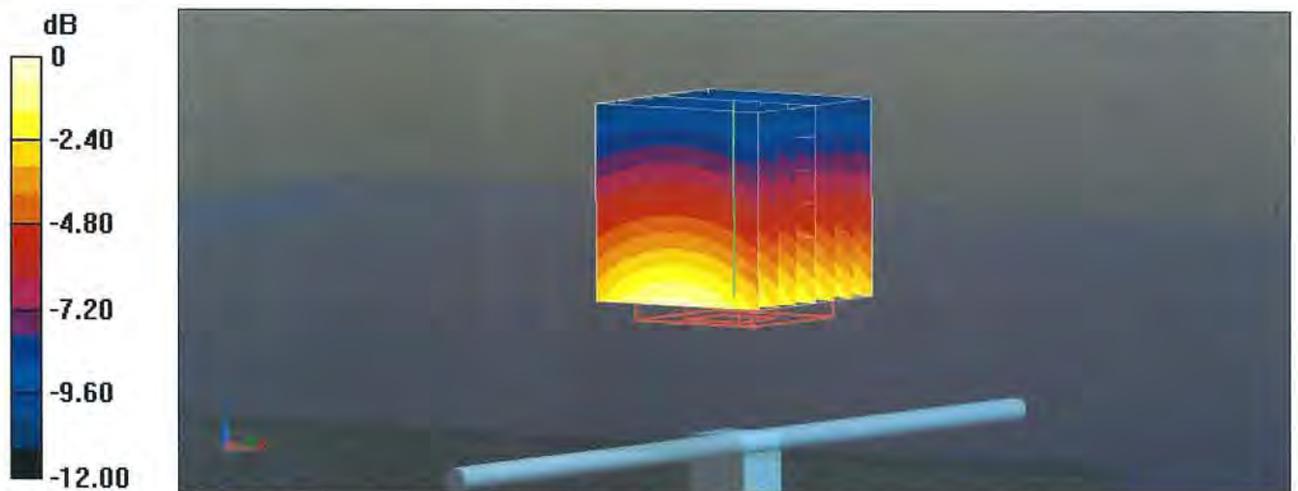
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.42 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.04 W/kg

**SAR(1 g) = 2.04 W/kg; SAR(10 g) = 1.34 W/kg**

Maximum value of SAR (measured) = 2.40 W/kg



# Impedance Measurement Plot for Head TSL

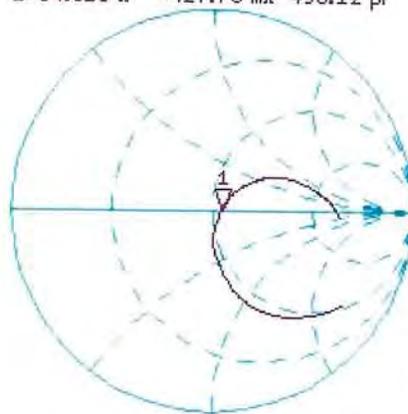
19 Nov 2014 13:21:52  
 [CH1] S11 1 U FS 1: 54.518  $\Omega$  -427.73 m $\Omega$  496.12 pF 750.000 000 MHz

\*  
 De1

CΔ

Avg  
 16

H1d

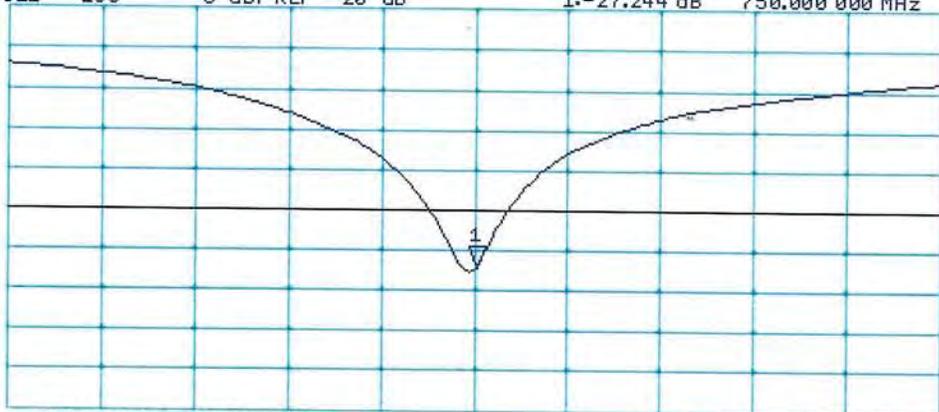


CH2 S11 LOG 5 dB/REF -20 dB 1: -27.244 dB 750.000 000 MHz

CΔ

Avg  
 16

H1d



START 550.000 000 MHz

STOP 950.000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 18.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.98$  S/m;  $\epsilon_r = 54.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.13, 6.13, 6.13); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

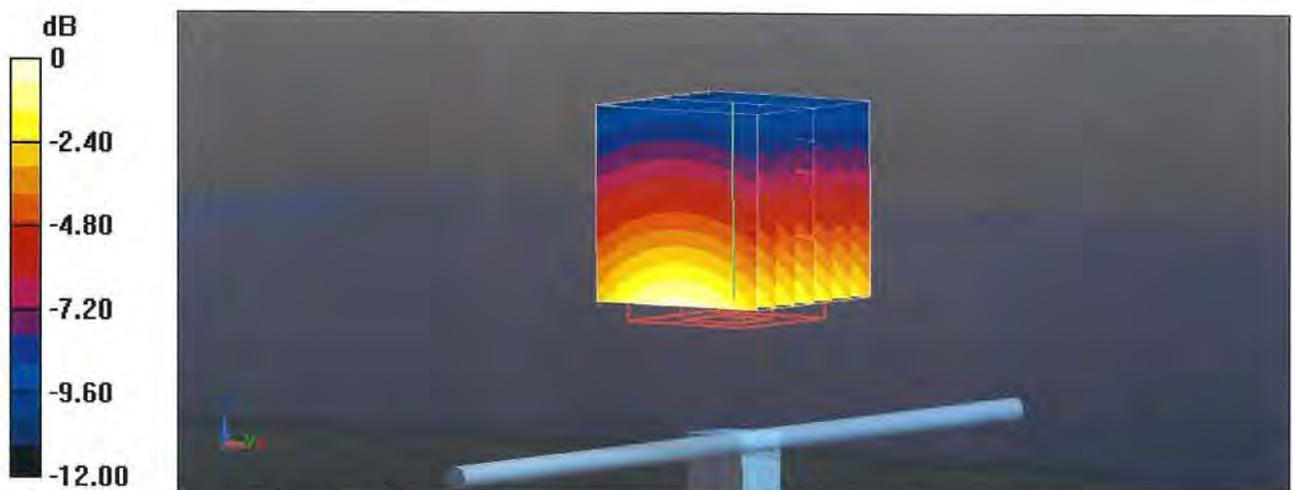
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.96 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.22 W/kg

**SAR(1 g) = 2.2 W/kg; SAR(10 g) = 1.45 W/kg**

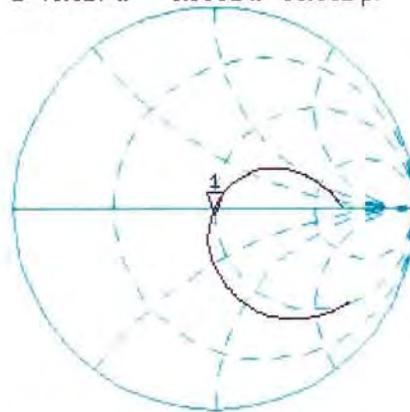
Maximum value of SAR (measured) = 2.57 W/kg



# Impedance Measurement Plot for Body TSL

18 Nov 2014 16:09:59  
[CH1] S11 1 U FS 1: 49.027  $\Omega$  -3.0332  $\Omega$  69.961 pF 750.000 000 MHz

\*  
De 1  
Ca



Avg  
16

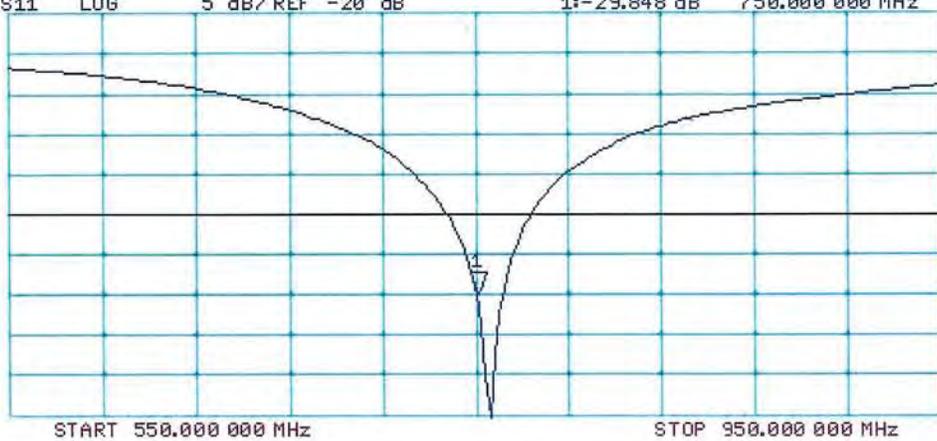
H1 d

CH2 S11 LOG 5 dB/REF -20 dB 1: -29.848 dB 750.000 000 MHz

Ca

Avg  
16

H1 d





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-CN (Auden)**

Certificate No: **D835V2-4d091\_Nov14**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d091**

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

Calibration date: **November 21, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Michael Weber**      Name: Michael Weber      Function: Laboratory Technician

Signature

Approved by: **Katja Pokovic**      Name: Katja Pokovic      Function: Technical Manager

Issued: November 21, 2014

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### 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
- 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	41.2 $\pm$ 6 %	0.91 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	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.11 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	1.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>5.95 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	2.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.60 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	1.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.31 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 $\Omega$ - 1.8 j $\Omega$
Return Loss	- 32.2 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 $\Omega$ - 4.2 j $\Omega$
Return Loss	- 25.2 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.394 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	September 15, 2009

## DASY5 Validation Report for Head TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.91$  S/m;  $\epsilon_r = 41.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

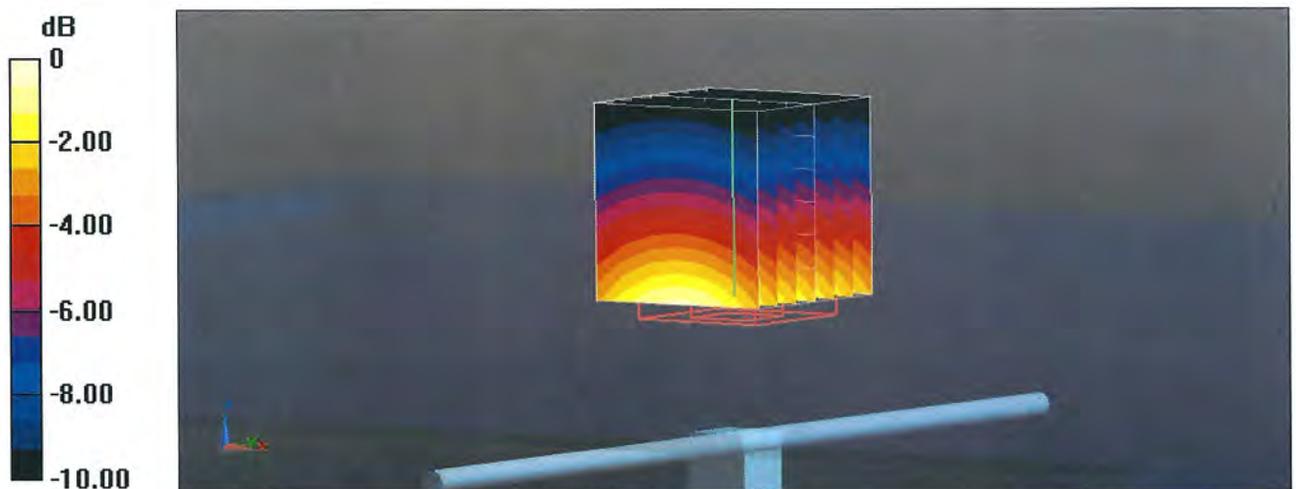
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.46 V/m; Power Drift = -0.04 dB

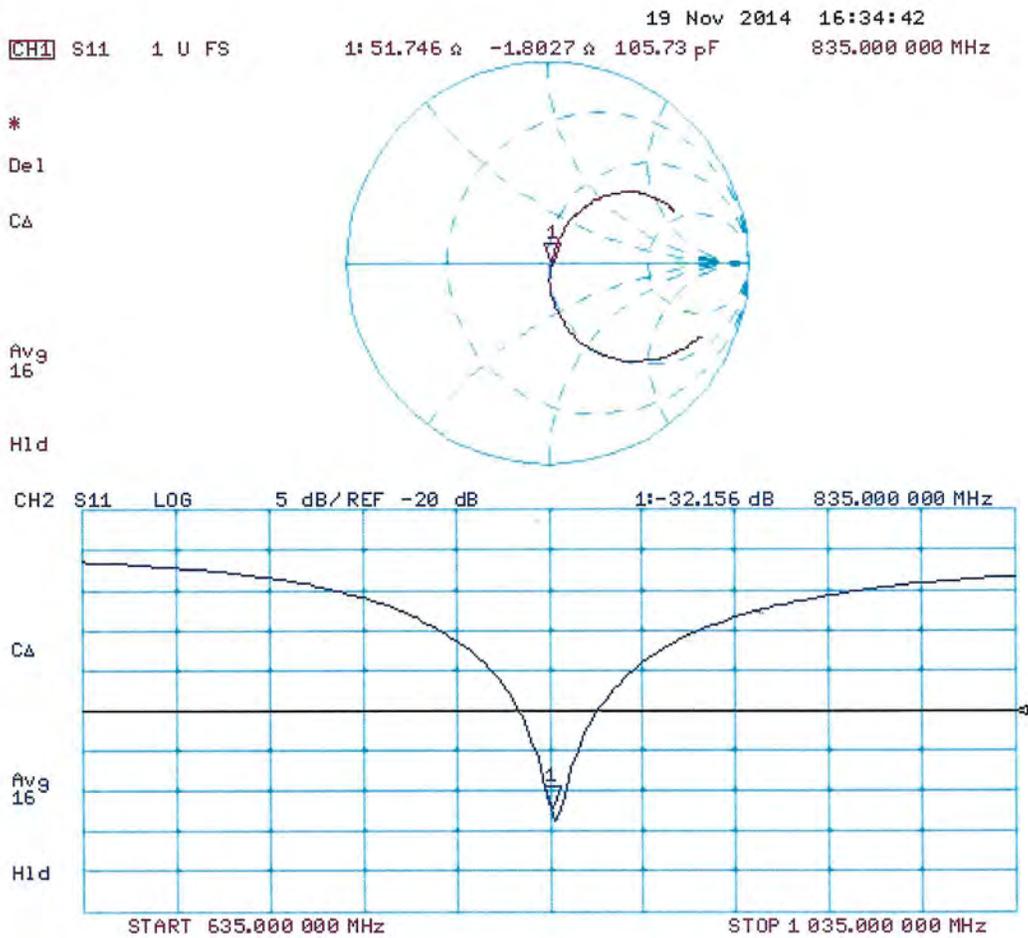
Peak SAR (extrapolated) = 3.43 W/kg

**SAR(1 g) = 2.3 W/kg; SAR(10 g) = 1.5 W/kg**

Maximum value of SAR (measured) = 2.69 W/kg



# Impedance Measurement Plot for Head TSL



# DASY5 Validation Report for Body TSL

Date: 21.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 1.01 \text{ S/m}$ ;  $\epsilon_r = 54.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

## Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

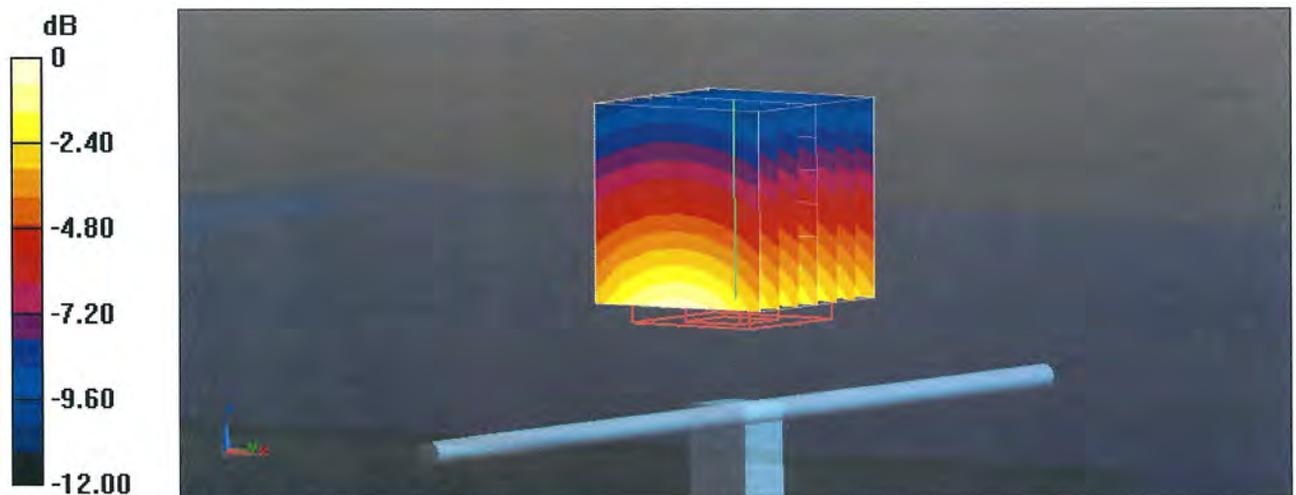
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 55.36 V/m; Power Drift = 0.00 dB

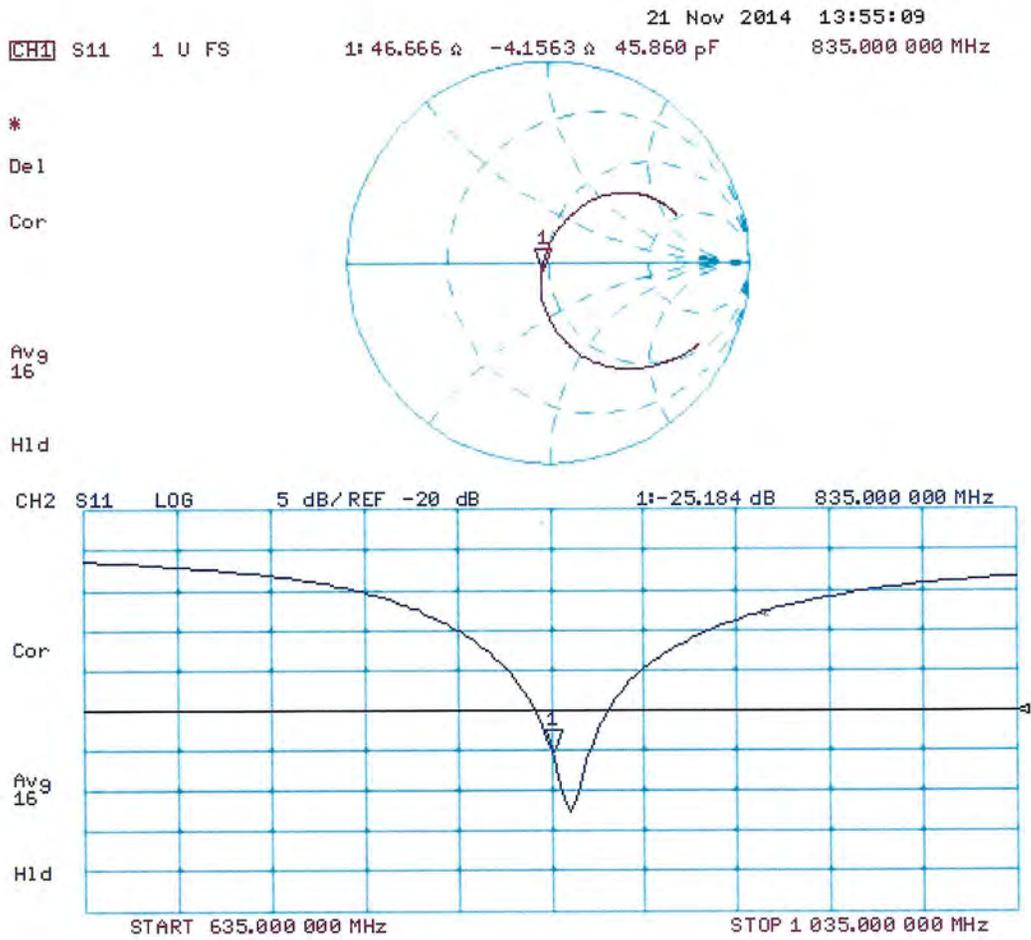
Peak SAR (extrapolated) = 3.64 W/kg

**SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.62 W/kg**

Maximum value of SAR (measured) = 2.89 W/kg



# Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **Sporton-CN (Auden)**

Certificate No: **D1750V2-1069\_Nov14**

## CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1069**

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

Calibration date: **November 21, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 21, 2014

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



Accredited by the Swiss Accreditation Service (SAS)  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

**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
- 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.4 $\pm$ 6 %	1.38 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	9.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>37.1 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	4.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>19.8 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.2 $\pm$ 6 %	1.50 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	9.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>38.1 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	5.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.5 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 $\Omega$ + 1.3 j $\Omega$
Return Loss	- 34.6 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 $\Omega$ + 1.7 j $\Omega$
Return Loss	- 28.6 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.217 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	June 15, 2010

## DASY5 Validation Report for Head TSL

Date: 21.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1069**

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.38$  S/m;  $\epsilon_r = 39.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.23, 5.23, 5.23); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

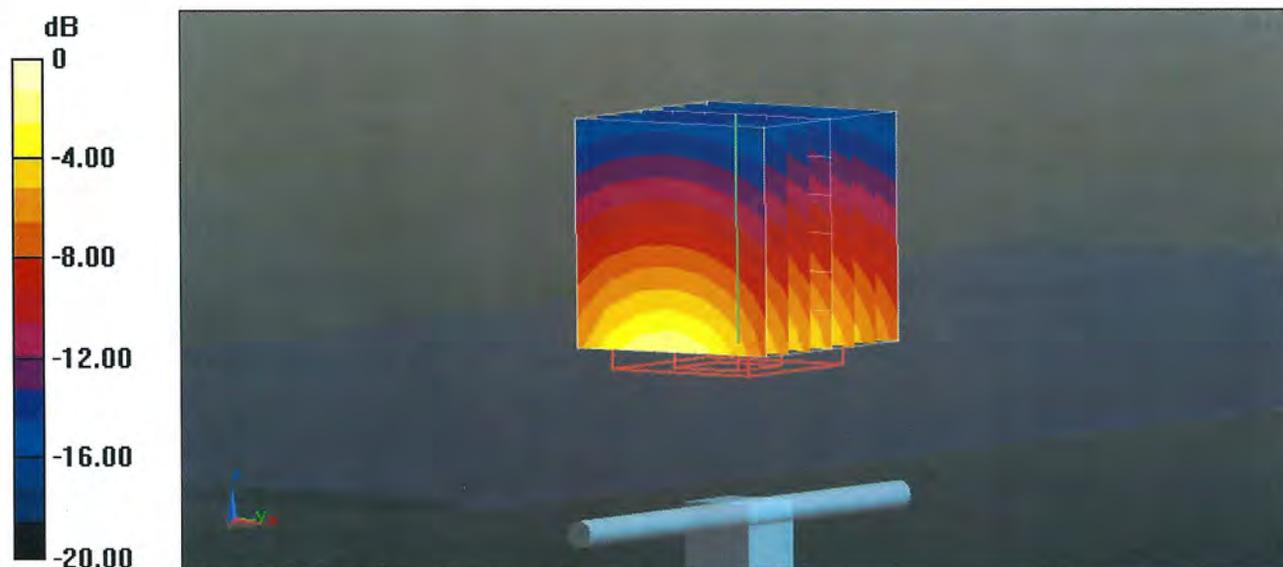
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.69 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.8 W/kg

**SAR(1 g) = 9.36 W/kg; SAR(10 g) = 4.97 W/kg**

Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

# Impedance Measurement Plot for Head TSL

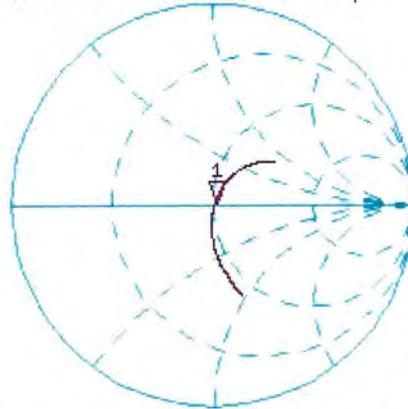
21 Nov 2014 12:05:18

CH1 S11 1 U FS

1: 51.398  $\Omega$  1.2637  $\Omega$  114.93 pF

1 750.000 000 MHz

\*  
De1  
CA



Avg  
16

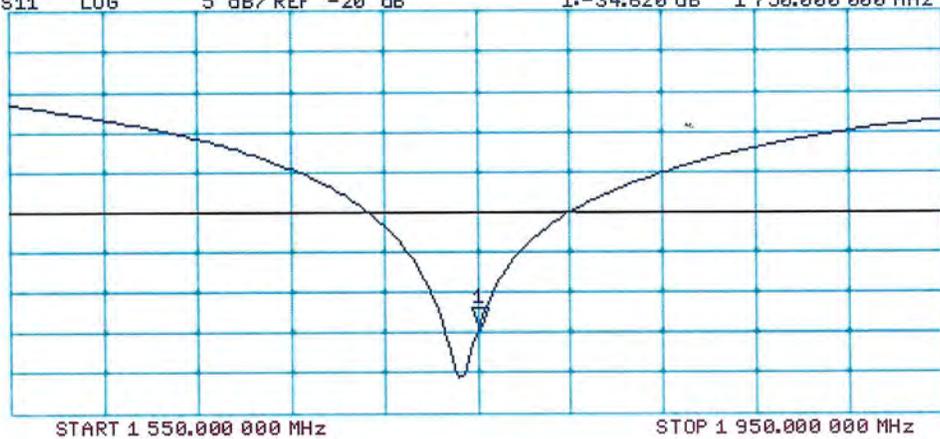
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -34.620 dB 1 750.000 000 MHz

CA

Avg  
16

H1d



## DASY5 Validation Report for Body TSL

Date: 21.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1069**

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.5$  S/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.89, 4.89, 4.89); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### **Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

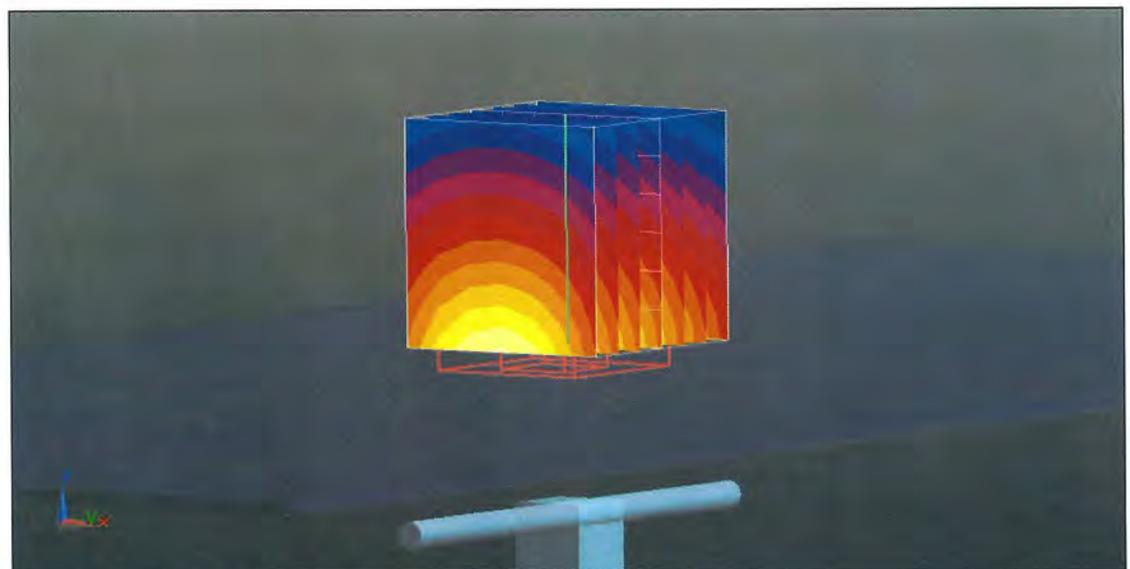
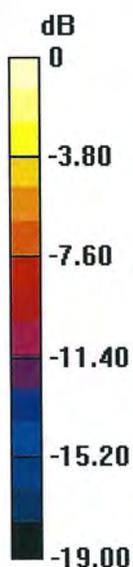
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.56 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 16.6 W/kg

**SAR(1 g) = 9.62 W/kg; SAR(10 g) = 5.16 W/kg**

Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

# Impedance Measurement Plot for Body TSL

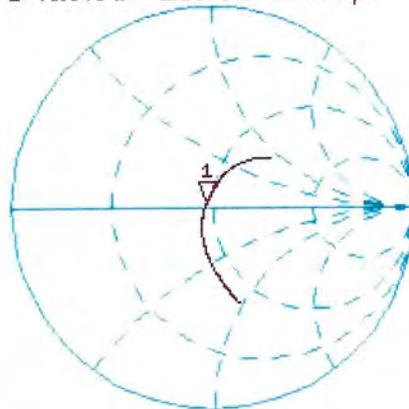
21 Nov 2014 12:04:48

CH1 S11 1 U FS

1: 46.846  $\Omega$  1.6973  $\Omega$  154.36  $\mu\text{H}$

1 750.000 000 MHz

\*  
De1  
CA



Avg  
16

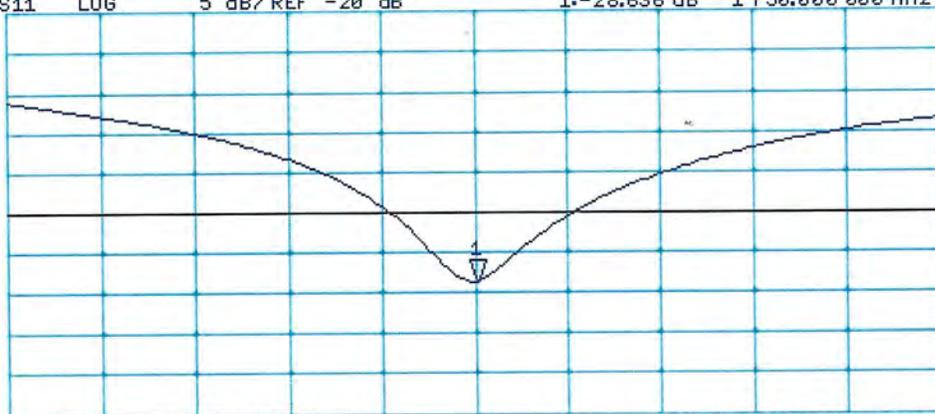
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-28.636 dB 1 750.000 000 MHz

CA

Avg  
16

H1d



START 1 550.000 000 MHz

STOP 1 950.000 000 MHz



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-CN (Auden)**

Certificate No: **D1900V2-5d118\_Nov14**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d118**

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

Calibration date: **November 21, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Michael Weber**      Name: Michael Weber      Function: Laboratory Technician

Approved by: **Katja Pokovic**      Name: Katja Pokovic      Function: Technical Manager

Signature

Issued: November 21, 2014

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



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Accreditation No.: **SCS 108**

**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:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "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
- c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- d) 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.1 $\pm$ 6 %	1.39 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	9.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>40.1 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	5.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.0 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.3 $\pm$ 6 %	1.52 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	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>40.0 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	5.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.4 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.3 $\Omega$ + 6.8 j $\Omega$
Return Loss	- 23.1 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 $\Omega$ + 7.1 j $\Omega$
Return Loss	- 22.3 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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	August 21, 2009

## DASY5 Validation Report for Head TSL

Date: 21.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d118**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.39$  S/m;  $\epsilon_r = 40.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

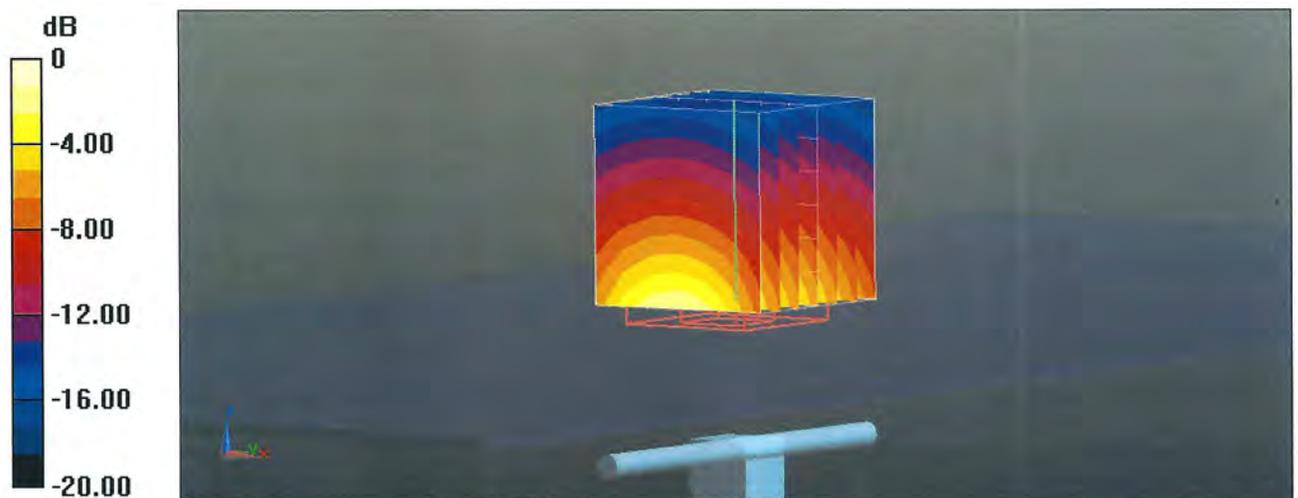
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.04 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.2 W/kg

**SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.24 W/kg**

Maximum value of SAR (measured) = 12.6 W/kg



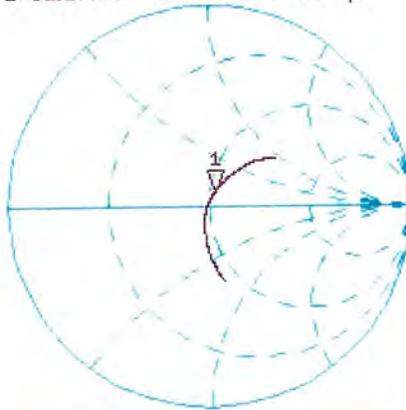
# Impedance Measurement Plot for Head TSL

21 Nov 2014 12:34:52

CH1 S11 1 U FS

1: 52.277  $\Omega$  6.8418  $\mu$ H 573.11 pF 1 900.000 000 MHz

\*  
De1  
CA



Avg  
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-23.051 dB 1 900.000 000 MHz

CA

Avg  
16

H1d



## DASY5 Validation Report for Body TSL

Date: 21.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d118**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.52$  S/m;  $\epsilon_r = 53.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

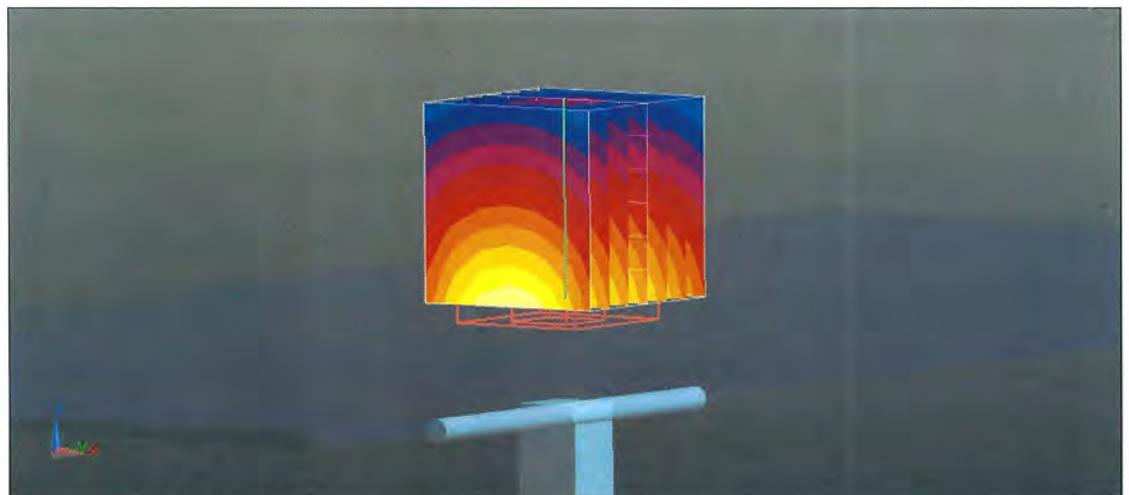
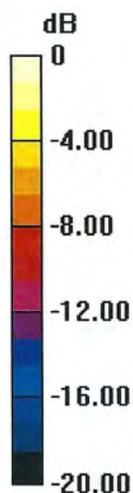
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.09 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.5 W/kg

**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.34 W/kg**

Maximum value of SAR (measured) = 12.7 W/kg



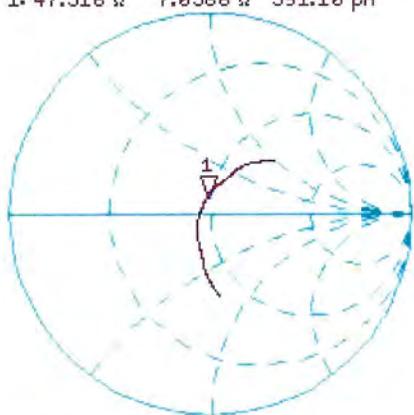
0 dB = 12.7 W/kg = 11.04 dBW/kg

# Impedance Measurement Plot for Body TSL

21 Nov 2014 12:34:24

CH1 S11 1 U FS 1: 47.516  $\Omega$  7.0566  $\Omega$  591.10 pF 1 900.000 000 MHz

\*  
De1  
CA



Avg  
16

H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -22.324 dB 1 900.000 000 MHz

CA

Avg  
16

H1d

