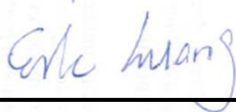


# FCC SAR Test Report

APPLICANT : HTC Corporation  
EQUIPMENT : Smartphone  
MODEL NAME : 0PKV100  
FCC ID : NM80PKV100  
STANDARD : FCC 47 CFR Part 2 (2.1093)  
ANSI/IEEE C95.1-1992  
IEEE 1528-2003

We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.



Reviewed by: Eric Huang / Deputy Manager



Approved by: Jones Tsai / Manager



## **SPORTON INTERNATIONAL INC.**

No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.)



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### Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA511222	Rev. 01	Initial issue of report	Mar. 17, 2015



**1. Statement of Compliance**

The maximum results of Specific Absorption Rate (SAR) found during testing for **HTC Corporation, Smartphone, 0PKV100**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)
		Head (Separation 0mm) 1g SAR (W/kg)	Body-worn (Separation 10mm) 1g SAR (W/kg)	Wireless Router (Separation 10mm) 1g SAR (W/kg)	
PCE	GSM850	<b>0.72</b>	<b>0.37</b>	<b>0.37</b>	0.80
	GSM1900	0.45	0.16	0.17	
	WCDMA Band V	0.32	0.16	0.16	
	WCDMA Band II	0.60	0.17	0.17	
	LTE Band 5	0.25	0.18	0.18	
	LTE Band 7	0.43	0.16	0.17	
DTS	2.4GHz WLAN	0.23	0.02	0.02	0.80
NII	5.2GHz WLAN	0.02	0.02		0.79
	5.3GHz WLAN	0.03	0.02		
	5.5GHz WLAN	0.06	0.02		
	5.8GHz WLAN	0.07	0.02		
Date of Testing:		2015/02/19 ~ 2015/03/13			

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 1528-2003.



## 2. Administration Data

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	HTC Corporation
Address	1F, 6-3 Baoqiang Road, Xindian District, New Taipei City, Taiwan 231

Manufacturer	
Company Name	HTC Corporation
Address	1F, 6-3 Baoqiang Road, Xindian District, New Taipei City, Taiwan 231

## 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 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- FCC KDB 941225 D01 3G SAR Procedures v03
- FCC KDB 941225 D05 SAR for LTE Devices v02r03
- FCC KDB 941225 D06 Hotspot Mode SAR v02



## 4. Equipment Under Test (EUT)

### 4.1 General Information

Product Feature & Specification	
Equipment Name	Smartphone
Model Name	0PKV100
FCC ID	NM80PKV100
IMEI Code	Sample for WWAN SAR testing: 358031060014613 Sample for WLAN SAR testing: 358031060014571
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	<ul style="list-style-type: none"> <li>• GSM/GPRS/EGPRS</li> <li>• RMC 12.2Kbps</li> <li>• HSDPA</li> <li>• HSUPA</li> <li>• DC-HSDPA</li> <li>• LTE: QPSK, 16QAM</li> <li>• 802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80</li> <li>• Bluetooth v3.0+EDR , Bluetooth v4.0-LE</li> <li>• NFC:ASK</li> </ul>
GSM / (E)GPRS Dual Transfer mode	Class A – EUT can support Packet Switched and Circuit Switched Network simultaneously.
EUT Stage	Identical Prototype
<b>Remark:</b>	
<ol style="list-style-type: none"> <li>1. This device 2.4GHz WLAN supports Hotspot and WiFi Direct (GC/GO) operation, and 5GHz WLAN supports WiFi Direct (GC only).</li> <li>2. This device supports dual SIM dual antenna single active, the WWAN radio cannot simultaneous transmission at the same time.</li> </ol>	



**4.2 Maximum Tune-up Limit**

Mode		Burst average power(dBm)	
		GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)		35.00	32.00
GPRS/EDGE (GMSK, 1 Tx slot)		35.00	32.00
GPRS/EDGE (GMSK, 2 Tx slots)		33.00	30.50
GPRS/EDGE (GMSK, 3 Tx slots)		31.50	30.00
GPRS/EDGE (GMSK, 4 Tx slots)		30.50	28.50
EDGE (8PSK, 1 Tx slot)		28.00	27.00
EDGE (8PSK, 2 Tx slots)		27.50	26.50
EDGE (8PSK, 3 Tx slots)		27.50	25.00
EDGE (8PSK, 4 Tx slots)		25.00	23.50
DTM 5	GSM (GMSK, 1 Tx slot)	33.00	30.50
	GPRS (GMSK, 1 Tx slot)	33.00	30.50
DTM 9	GSM (GMSK, 1 Tx slot)	33.00	30.50
	GPRS (GMSK, 1 Tx slot)	33.00	30.50
DTM 11	GSM (GMSK, 1 Tx slot)	31.50	30.00
	GPRS (GMSK, 2 Tx slots)	31.50	30.00
DTM 5	GSM (GMSK, 1 Tx slot)	33.00	30.50
	EDGE (8PSK, 1 Tx slot)	27.50	26.50
DTM 9	GSM (GMSK, 1 Tx slot)	33.00	30.50
	EDGE (8PSK, 1 Tx slot)	27.50	26.50
DTM 11	GSM (GMSK, 1 Tx slot)	31.50	30.00
	EDGE (8PSK, 2 Tx slots)	27.50	25.00

Mode / Band		Average Power (dBm)
WCDMA	Band V	23.50
	Band II	23.50
LTE	Band 5	23.00
	Band 7	23.00
2.4GHz WLAN	802.11b	17.00
	802.11g	15.00
	802.11n-HT20	12.00
5GHz WLAN	802.11a	12.00
	802.11n-HT20	12.00
	802.11n-HT40	12.00
	802.11ac-VHT20	10.00
	802.11ac-VHT40	10.00
	802.11ac-VHT80	10.00
Bluetooth v3.0+EDR	1Mbps	9.00
	2Mbps	7.00
	3Mbps	7.00
Bluetooth v4.0-LE		7.00



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

Summarized necessary items addressed in KDB 941225 D05 v02r03								
FCC ID	NM80PKV100							
Equipment Name	SMARTPHONE							
Operating Frequency Range of each LTE transmission band	LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz							
Channel Bandwidth	LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz							
Release and Category	Rel9, Cat4							
uplink modulations used	QPSK, and 16QAM							
LTE Voice / Data requirements	Data only							
LTE MPR permanently built-in by design	<b>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</b>							
	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.							
Transmission (H, M, L) channel numbers and frequencies in each LTE band								
LTE Band 5								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844
LTE Band 7								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560





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)

Table with 3 columns: Whole-Body, Partial-Body, Hands, Wrists, Feet and Ankles. Values: 0.4, 8.0, 20.0

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

Table with 3 columns: Whole-Body, Partial-Body, Hands, Wrists, Feet and Ankles. Values: 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 (ρ). The equation description is as below:

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

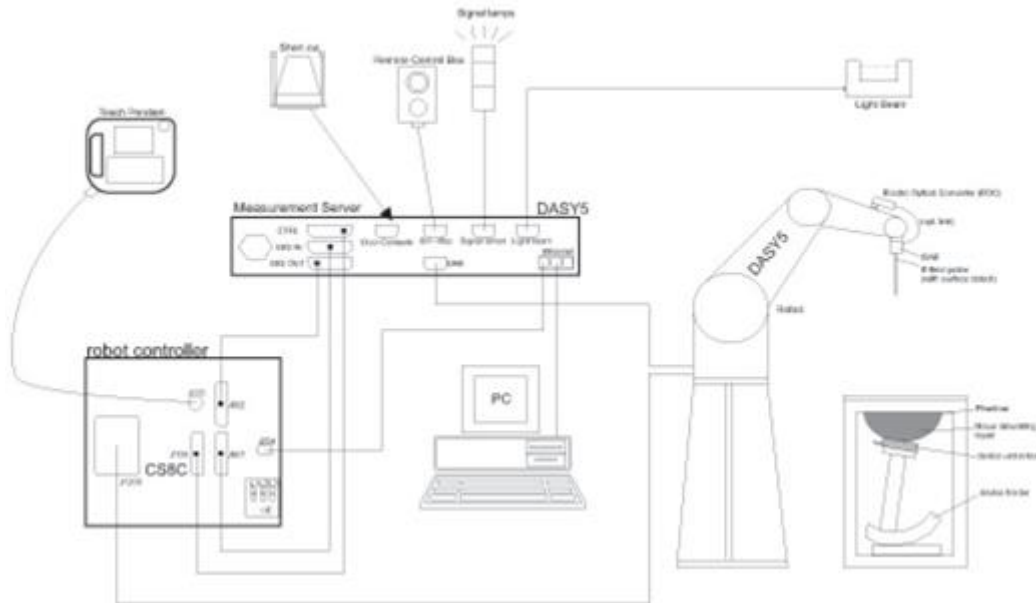
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where: σ is the conductivity of the tissue, ρ 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/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

### <SAR measurement>

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

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

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

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

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

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

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

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

**8.2 Power Reference Measurement**

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

**8.3 Area Scan**

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

Area scan parameters extracted from FCC KDB 865664 D01v01r03 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 D01v01r03 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	835MHz System Validation Kit	D835V2	4d162	Nov. 19, 2014	Nov. 18, 2015
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Nov. 14, 2014	Nov. 13, 2015
SPEAG	2450MHz System Validation Kit	D2450V2	924	Nov. 19, 2014	Nov. 18, 2015
SPEAG	2600MHz System Validation Kit	D2600V2	1070	Nov. 19, 2014	Nov. 18, 2015
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Sep. 25, 2014	Sep. 24, 2015
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 21, 2014	Aug. 20, 2015
SPEAG	Data Acquisition Electronics	DAE4	1388	Sep. 24, 2014	Sep. 23, 2015
SPEAG	Data Acquisition Electronics	DAE3	577	Oct. 06, 2014	Oct. 05, 2015
SPEAG	Data Acquisition Electronics	DAE4	1279	Jul. 23, 2014	Jul. 22, 2015
SPEAG	Data Acquisition Electronics	DAE4	1399	Nov. 13, 2014	Nov. 12, 2015
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 26, 2014	Sep. 25, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Sep. 29, 2014	Sep. 28, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3820	May. 15, 2014	May. 14, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 25, 2014	Sep. 24, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3954	Nov. 21, 2014	Nov. 20, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3955	Nov. 21, 2014	Nov. 20, 2015
Wisewind	Thermometer	ETP-101	TM560	Oct. 21, 2014	Oct. 20, 2015
Wisewind	Thermometer	ETP-101	TM685	Oct. 21, 2014	Oct. 20, 2015
Wisewind	Thermometer	HTC-1	TM642	Oct. 21, 2014	Oct. 20, 2015
Wisewind	Thermometer	HTC-1	TM281	Oct. 21, 2014	Oct. 20, 2015
H.M.IRIS	Thermometer	TH-08	TM658	Oct. 21, 2014	Oct. 20, 2015
Anritsu	Radio Communication Analyzer	MT8820C	6201381760	May. 28, 2014	May. 27, 2015
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 27, 2014	May. 26, 2015
SPEAG	Device Holder	N/A	N/A	NCR	NCR
R&S	Signal Generator	SMU200A	102502	Jul. 07, 2014	Jul. 06, 2015
SPEAG	Dielectric Probe Kit	DAK-3.5	1138	Nov. 18, 2014	Nov. 17, 2015
Agilent	ENA Network Analyzer	E5071C	MY46101588	May. 31, 2014	May. 30, 2015
Anritsu	Power Meter	ML2495A	1036004	Aug. 09, 2014	Aug. 08, 2015
Anritsu	Power Sensor	MA2411B	1027253	Aug. 11, 2014	Aug. 10, 2015
R&S	Spectrum Analyzer	FSP 7	101131	Jul. 10, 2014	Jul. 09, 2015
Agilent	Dual Directional Coupler	778D	50422	Note1	
Woken	Attenuator 1	WK0602-XX	N/A	Note1	
PE	Attenuator 2	PE7005-10	N/A	Note1	
PE	Attenuator 3	PE7005- 3	N/A	Note1	
AR	Power Amplifier	5S1G4M2	0328767	Note1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note1	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	Note1	

**General Note:**

1. 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 Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
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
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
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
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

#### 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%





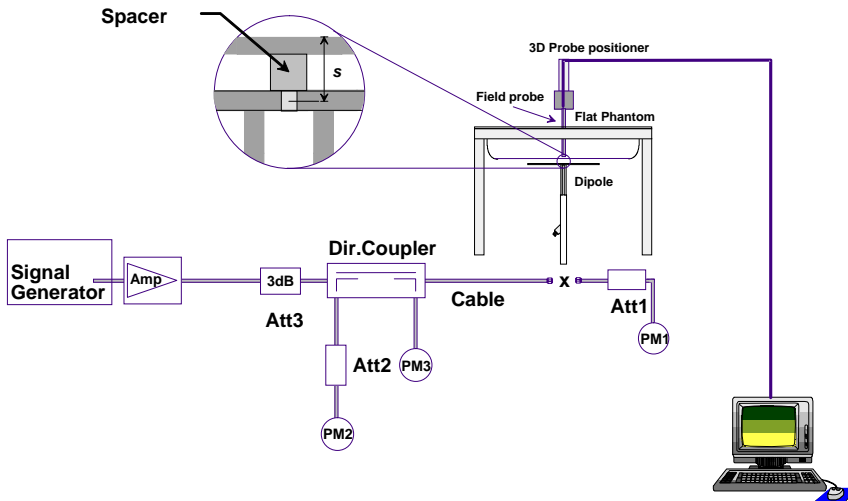
<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ε <sub>r</sub> )	Conductivity Target (σ)	Permittivity Target (ε <sub>r</sub> )	Delta (σ) (%)	Delta (ε <sub>r</sub> ) (%)	Limit (%)	Date
835	HSL	22.4	0.884	40.960	0.90	41.50	-1.78	-1.30	±5	2015/2/20
835	HSL	22.3	0.922	41.877	0.90	41.50	2.44	0.91	±5	2015/3/2
835	MSL	22.4	0.938	53.717	0.97	55.20	-3.30	-2.69	±5	2015/2/19
835	MSL	22.4	0.973	54.315	0.97	55.20	0.31	-1.60	±5	2015/3/3
835	MSL	22.4	0.973	54.315	0.97	55.20	0.31	-1.60	±5	2015/3/3
1900	HSL	22.5	1.429	40.060	1.40	40.00	2.07	0.15	±5	2015/2/20
1900	MSL	22.5	1.524	54.037	1.52	53.30	0.26	1.38	±5	2015/2/19
2450	HSL	22.4	1.861	39.392	1.80	39.20	3.39	0.49	±5	2015/2/20
2450	MSL	22.6	2.026	51.576	1.95	52.70	3.90	-2.13	±5	2015/2/20
2600	HSL	22.5	2.023	38.200	1.96	39.00	3.21	-2.05	±5	2015/2/21
2600	MSL	22.5	2.234	51.034	2.16	52.50	3.43	-2.79	±5	2015/2/20
5200	HSL	22.5	4.585	36.242	4.66	36.00	-1.61	0.67	±5	2015/2/21
5200	HSL	22.5	4.800	35.500	4.66	36.00	3.00	-1.39	±5	2015/3/13
5200	MSL	22.5	5.408	47.798	5.30	49.00	2.04	-2.45	±5	2015/2/21
5200	MSL	22.5	5.330	48.600	5.30	49.00	0.57	-0.82	±5	2015/3/13
5300	HSL	22.5	4.673	36.087	4.76	35.90	-1.83	0.52	±5	2015/2/21
5300	HSL	22.5	4.910	35.300	4.76	35.90	3.15	-1.67	±5	2015/3/13
5300	MSL	22.5	5.549	47.628	5.42	48.90	2.38	-2.60	±5	2015/2/21
5300	MSL	22.5	5.470	48.500	5.42	48.90	0.92	-0.82	±5	2015/3/13
5600	HSL	22.5	4.986	35.845	5.07	35.50	-1.66	0.97	±5	2015/2/21
5600	HSL	22.5	5.220	34.700	5.07	35.50	2.96	-2.25	±5	2015/3/13
5600	MSL	22.5	5.934	47.048	5.77	48.50	2.84	-2.99	±5	2015/2/21
5600	MSL	22.5	5.850	47.700	5.77	48.50	1.39	-1.65	±5	2015/3/13
5800	HSL	22.5	5.214	35.421	5.27	35.30	-1.06	0.34	±5	2015/2/21
5800	HSL	22.5	5.400	34.400	5.27	35.30	2.47	-2.55	±5	2015/3/13
5800	MSL	22.5	6.183	46.751	6.00	48.20	3.05	-3.01	±5	2015/2/21
5800	MSL	22.5	6.110	47.400	6.00	48.20	1.83	-1.66	±5	2015/3/13

**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) <sup>2</sup>	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 (%)
2015/2/20	835	HSL	250	D835V2-4d162	ES3DV3 - SN3270	DAE4 Sn778	2.14	9.15	8.56	-6.45
2015/3/2	835	HSL	250	D835V2-4d162	EX3DV4 - SN3697	DAE4 Sn1388	2.36	9.15	9.44	3.17
2015/2/19	835	MSL	250	D835V2-4d162	EX3DV4 - SN3931	DAE3 Sn577	2.36	9.56	9.44	-1.26
2015/3/3	835	MSL	250	D835V2-4d162	EX3DV4 - SN3697	DAE4 Sn1388	2.45	9.56	9.80	2.51
2015/3/3	835	MSL	250	D835V2-4d162	EX3DV4 - SN3820	DAE4 Sn1388	2.40	9.56	9.60	0.42
2015/2/20	1900	HSL	250	D1900V2-5d182	ES3DV3 - SN3270	DAE4 Sn778	9.81	39.80	39.24	-1.41
2015/2/19	1900	MSL	250	D1900V2-5d182	EX3DV4 - SN3931	DAE3 Sn577	9.89	40.00	39.56	-1.10
2015/2/20	2450	HSL	250	D2450V2-924	EX3DV4 - SN3954	DAE4 Sn1279	13.30	51.90	53.20	2.50
2015/2/20	2450	MSL	250	D2450V2-924	EX3DV4 - SN3955	DAE4 Sn1399	12.20	51.40	48.80	-5.06
2015/2/21	2600	HSL	250	D2600V2-1070	EX3DV4 - SN3931	DAE3 Sn577	14.30	56.90	57.20	0.53
2015/2/20	2600	MSL	250	D2600V2-1070	EX3DV4 - SN3931	DAE3 Sn577	14.40	55.30	57.60	4.16
2015/2/21	5200	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.72	81.10	87.20	7.52
2015/3/13	5200	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.95	81.10	79.50	-1.97
2015/2/21	5200	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.60	77.50	76.00	-1.94
2015/3/13	5200	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.57	77.50	75.70	-2.32
2015/2/21	5300	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	9.26	86.60	92.60	6.93
2015/3/13	5300	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.61	86.60	86.10	-0.58
2015/2/21	5300	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.05	80.00	80.50	0.63
2015/3/13	5300	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.60	80.00	76.00	-5.00
2015/2/21	5600	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.82	85.80	88.20	2.80
2015/3/13	5600	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.38	85.80	83.80	-2.33
2015/2/21	5600	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.26	85.20	82.60	-3.05
2015/3/13	5600	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.94	85.20	79.40	-6.81
2015/2/21	5800	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.19	82.90	81.90	-1.21
2015/3/13	5800	HSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	8.09	82.90	80.90	-2.41
2015/2/21	5800	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.58	78.40	75.80	-3.32
2015/3/13	5800	MSL	100	D5GHzV2-1006	EX3DV4 - SN3954	DAE4 Sn1279	7.91	78.40	79.10	0.89



**Fig 8.3.1 System Performance Check Setup**



**Fig 8.3.2 Setup Photo**

## 11. RF Exposure Positions

### 11.1 Ear and handset reference point

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

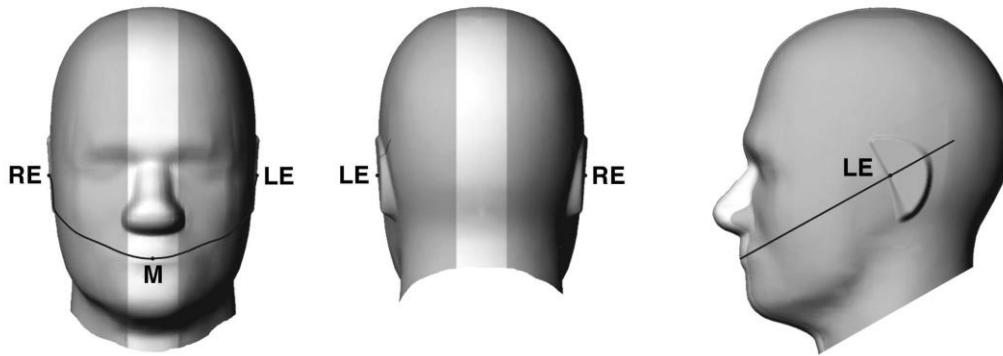


Fig 9.1.1 Front, back, and side views of SAM twin phantom

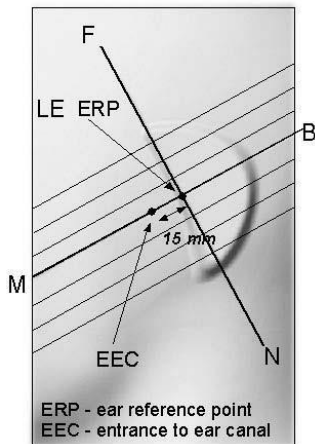


Fig 9.1.2 Close-up side view of phantom showing the ear region.

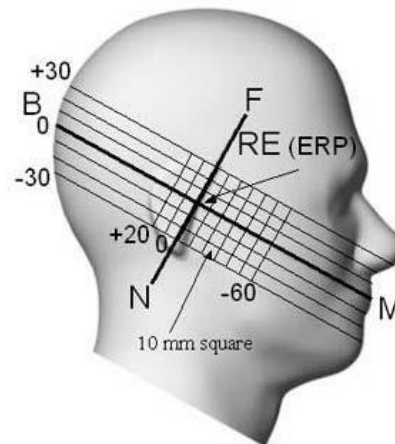
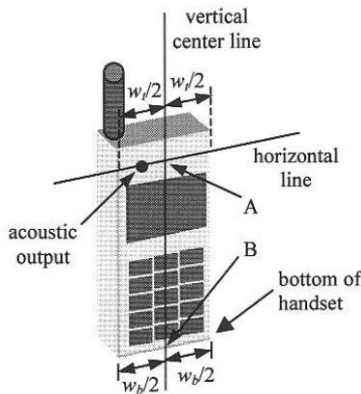


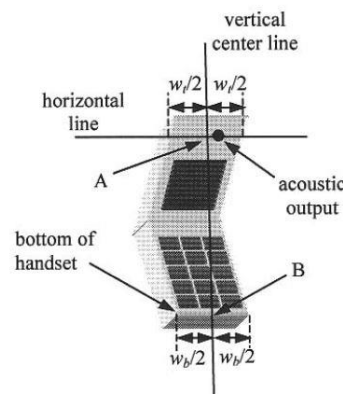
Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

**11.2 Definition of the cheek position**

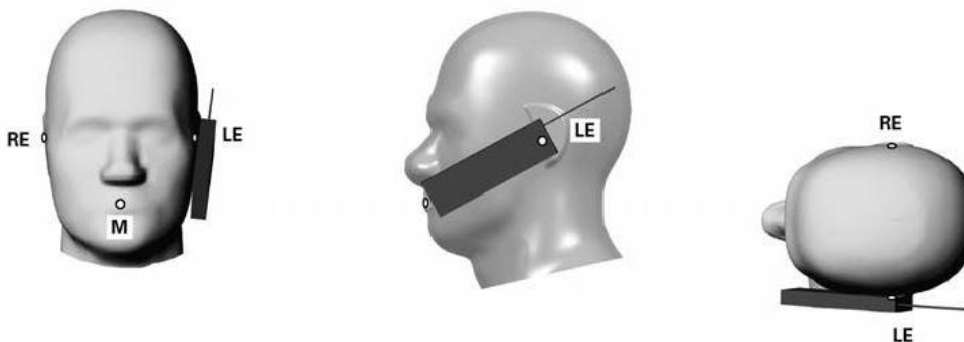
1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal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



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



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



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

### 11.3 Definition of the tilt position

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

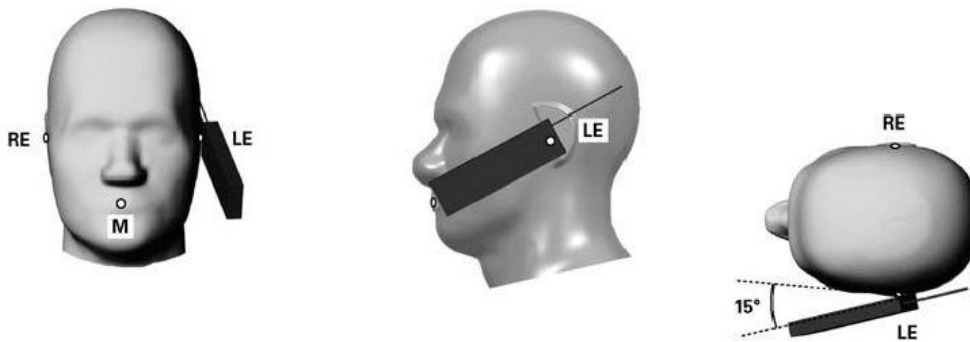
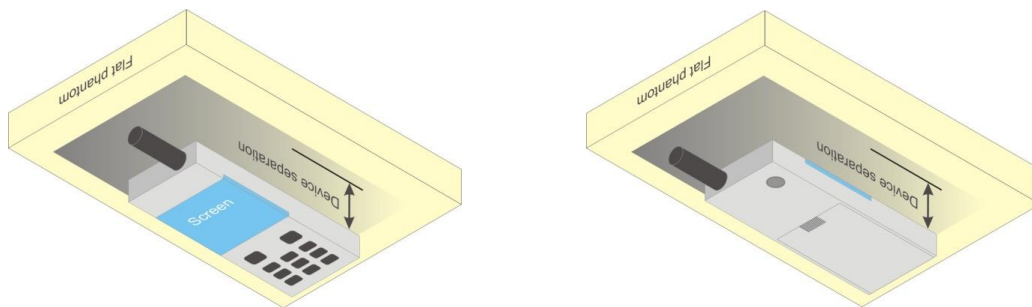


Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

**11.4 Body Worn Accessory**

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB 648474 D04v01r02, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v05r02 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is < 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

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



**Fig 9.4 Body Worn Position**

**11.5 Wireless Router**

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC HDB Publication 941225 D06 v02 where SAR test considerations for handsets (L x W ≥ 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)

### <GSM Conducted Power>

**General Note:**

- For DTM multi-slot class mode, the device was linked with base station simulator (Agilent E5515C) and transmit maximum power on maximum number of TX slots, i.e. one CS timeslot, and additional PS timeslots (1 for DTM class 5 and 9, 2 for DTM class 11) in one TDMA frame.
- Agilent E5515C was used to setup the device operated under DTM mode for power measurement and SAR testing. For conducted power, the power of the burst for voice and the power of the bursts for data was reported separately in the table above, and the frame-average power is derived below to determine SAR testing.  

$$DTM \text{ frame average power (dBm)} = 10 * \log [\sum (\text{power of each slot, in mW}) / 8]$$
- Per KDB 447498 D01v05r02, the maximum output power channel is used for SAR testing and for further SAR test reduction.
- Per KDB 941225 D01v03, considering the possibility of e.g. 3rd party VoIP operation for Head and body-worn SAR test reduction for GSM and GPRS and EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the EUT was set in GPRS (4Tx slots) for GSM850 and GPRS (3Tx slots) for GSM1900.
- Per KDB 941225 D01v03, for Hotspot SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance, for modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested, therefore, the EUT was set in GPRS (4Tx slots) for GSM850 and GPRS (3Tx slots) for GSM1900.

Band GSM850		Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel		128	189	251		128	189	251	
Frequency (MHz)		824.2	836.4	848.8		824.2	836.4	848.8	
GSM (GMSK, 1 Tx slot)		34.70	34.68	34.52	35.00	25.70	25.68	25.52	26.00
GPRS (GMSK, 1 Tx slot)		34.54	34.61	34.41	35.00	25.54	25.61	25.41	26.00
GPRS (GMSK, 2 Tx slots)		32.57	32.46	32.50	33.00	26.57	26.46	26.50	27.00
GPRS (GMSK, 3 Tx slots)		31.49	31.45	31.45	31.50	27.23	27.19	27.19	27.24
GPRS (GMSK, 4 Tx slots)		30.40	30.42	30.00	30.50	27.40	27.42	27.00	27.50
EDGE (8PSK, 1 Tx slot)		27.81	27.70	27.64	28.00	18.81	18.70	18.64	19.00
EDGE (8PSK, 2 Tx slots)		27.22	27.05	26.99	27.50	21.22	21.05	20.99	21.50
EDGE (8PSK, 3 Tx slots)		27.07	26.93	26.84	27.50	22.81	22.67	22.58	23.24
EDGE (8PSK, 4 Tx slots)		24.77	24.68	24.52	25.00	21.77	21.68	21.52	22.00
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	32.89	32.41	32.49	33.00	26.75	26.29	26.36	26.98
	GPRS (GMSK, 1 Tx slot)	32.65	32.20	32.27	33.00				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	32.88	32.39	32.48	33.00	26.74	26.27	26.35	26.98
	GPRS (GMSK, 1 Tx slot)	32.63	32.18	32.25	33.00				
DTM 11 (3Tx slots)	GSM (GMSK, 1 Tx slot)	31.33	31.40	31.43	31.50	26.89	26.96	27.01	27.24
	GPRS (GMSK, 2 Tx slots)	31.06	31.13	31.18	31.50				
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	32.59	32.23	32.20	33.00	24.63	24.33	24.28	25.05
	EDGE (8PSK, 1 Tx slot)	27.07	26.95	26.84	27.50				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	32.58	32.22	32.18	33.00	24.62	24.32	24.26	25.05
	EDGE (8PSK, 1 Tx slot)	27.05	26.94	26.82	27.50				
DTM 11 (3Tx slots)	GSM (GMSK, 1 Tx slot)	31.26	31.27	31.20	31.50	24.62	24.58	24.50	25.01
	EDGE (8PSK, 2 Tx slots)	26.90	26.81	26.71	27.50				



Band GSM1900		Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel		512	661	810		512	661	810	
Frequency (MHz)		1850.2	1880	1909.8	1850.2	1880	1909.8		
GSM (GMSK, 1 Tx slot)		31.40	31.42	31.43	32.00	22.40	22.42	22.43	23.00
GPRS (GMSK, 1 Tx slot)		31.52	31.48	31.72	32.00	22.52	22.48	22.72	23.00
GPRS (GMSK, 2 Tx slots)		30.09	30.47	30.45	30.50	24.09	24.47	24.45	24.50
GPRS (GMSK, 3 Tx slots)		29.33	29.77	29.75	30.00	25.07	25.51	25.49	25.74
GPRS (GMSK, 4 Tx slots)		28.22	28.39	28.46	28.50	25.22	25.39	25.46	25.50
EDGE (8PSK, 1 Tx slot)		26.54	26.72	26.76	27.00	17.54	17.72	17.76	18.00
EDGE (8PSK, 2 Tx slots)		25.87	26.08	26.11	26.50	19.87	20.08	20.11	20.50
EDGE (8PSK, 3 Tx slots)		24.62	24.73	24.74	25.00	20.36	20.47	20.48	20.74
EDGE (8PSK, 4 Tx slots)		23.28	23.48	23.50	23.50	20.28	20.48	20.50	20.50
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	30.33	30.41	30.43	30.50	24.16	24.26	24.31	24.48
	GPRS (GMSK, 1 Tx slot)	30.02	30.15	30.22	30.50				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	30.32	30.39	30.41	30.50	24.14	24.24	24.29	24.48
	GPRS (GMSK, 1 Tx slot)	30.00	30.13	30.20	30.50				
DTM 11 (3Tx slots)	GSM (GMSK, 1 Tx slot)	29.62	29.70	29.76	30.00	25.14	25.25	25.33	25.74
	GPRS (GMSK, 2 Tx slots)	29.28	29.41	29.50	30.00				
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	29.82	30.28	30.29	30.50	22.22	22.61	22.50	22.92
	EDGE (8PSK, 1 Tx slot)	25.72	25.94	25.48	26.50				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	29.81	30.26	30.28	30.50	22.20	22.59	22.49	22.92
	EDGE (8PSK, 1 Tx slot)	25.70	25.92	25.49	26.50				
DTM 11 (3Tx slots)	GSM (GMSK, 1 Tx slot)	29.47	29.61	29.60	30.00	22.61	22.75	22.77	23.10
	EDGE (8PSK, 2 Tx slots)	24.57	24.72	24.78	25.00				



**<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 DPCCH, DPDCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

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

**Setup Configuration**

**HSUPA Setup Configuration:**

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

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

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

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

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

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

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

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

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

**Setup Configuration**

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

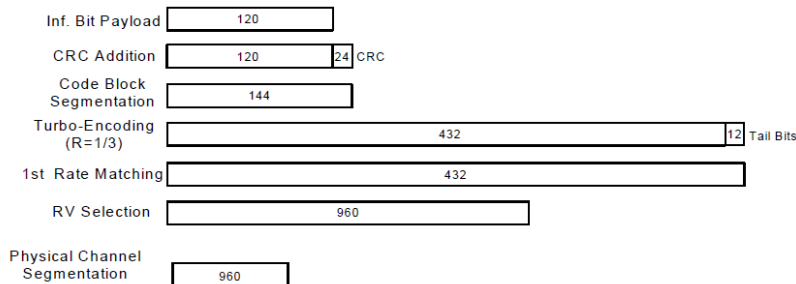
- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
  - i. Set RMC 12.2Kbps + HSDPA mode.
  - ii. Set Cell Power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

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

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

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

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



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

**Setup Configuration**



**<WCDMA Conducted Power>**

**General Note:**

1. Per KDB 941225 D01v03, SAR for Head / Hotspot / Body-worn exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is  $\leq \frac{1}{4}$  dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

Band			WCDMA V			WCDMA 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
MPR (dB)	3GPP Rel 99	AMR 12.2Kbps	23.01	23.04	23.02	23.11	23.28	23.27
	3GPP Rel 99	RMC 12.2Kbps	23.00	23.08	23.03	23.21	23.33	23.31
0	3GPP Rel 6	HSDPA Subtest-1	22.02	22.14	22.16	22.40	22.28	22.37
0	3GPP Rel 6	HSDPA Subtest-2	21.98	22.12	22.13	22.37	22.25	22.35
0.5	3GPP Rel 6	HSDPA Subtest-3	21.50	21.62	21.68	21.98	21.84	21.94
0.5	3GPP Rel 6	HSDPA Subtest-4	21.47	21.59	21.66	21.95	21.81	21.91
0	3GPP Rel 8	DC-HSDPA Subtest-1	22.02	22.13	22.15	22.40	22.26	22.36
0	3GPP Rel 8	DC-HSDPA Subtest-2	21.96	22.11	22.13	22.35	22.23	22.33
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	21.48	21.60	21.67	21.96	21.83	21.93
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	21.46	21.59	21.64	21.93	21.81	21.90
0	3GPP Rel 6	HSUPA Subtest-1	21.95	22.02	22.07	22.20	22.12	22.15
2	3GPP Rel 6	HSUPA Subtest-2	20.65	20.72	20.78	20.97	20.86	20.88
1	3GPP Rel 6	HSUPA Subtest-3	20.51	20.55	20.63	20.80	20.62	20.75
2	3GPP Rel 6	HSUPA Subtest-4	20.98	21.03	21.08	21.97	21.82	21.88
0	3GPP Rel 6	HSUPA Subtest-5	22.01	22.10	22.13	22.27	22.16	22.18



**<LTE Conducted Power>**

**General Note:**

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, Smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.



<LTE Band 5>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.88	22.66	22.74	23	0
10	QPSK	1	24	22.72	22.35	22.73		
10	QPSK	1	49	22.51	22.39	22.45		
10	QPSK	25	0	21.68	21.54	21.49	22	1
10	QPSK	25	12	21.57	21.53	21.52		
10	QPSK	25	24	21.62	21.55	21.51		
10	QPSK	50	0	21.57	21.56	21.52		
10	16QAM	1	0	21.70	21.72	21.82	22	1
10	16QAM	1	24	21.69	21.37	21.81		
10	16QAM	1	49	21.64	21.71	21.72		
10	16QAM	25	0	20.63	20.94	20.74	21	2
10	16QAM	25	12	20.81	20.83	20.81		
10	16QAM	25	24	20.65	20.46	20.52		
10	16QAM	50	0	20.62	20.70	20.51		
Channel				20425	20525	20625		
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.55	22.45	22.52	23	0
5	QPSK	1	12	22.40	22.44	22.51		
5	QPSK	1	24	22.44	22.37	22.22		
5	QPSK	12	0	21.59	21.52	21.48	22	1
5	QPSK	12	6	21.66	21.60	21.48		
5	QPSK	12	11	21.62	21.52	21.53		
5	QPSK	25	0	21.57	21.58	21.53	22	1
5	16QAM	1	0	21.78	21.78	21.79		
5	16QAM	1	12	21.75	21.36	21.78		
5	16QAM	1	24	21.62	21.19	21.50		
5	16QAM	12	0	20.56	20.66	20.54	21	2
5	16QAM	12	6	20.62	20.59	20.35		
5	16QAM	12	11	20.46	20.62	20.43		
5	16QAM	25	0	20.53	20.77	20.52		
Channel				20415	20525	20635		
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.45	22.40	22.52	23	0
3	QPSK	1	7	22.33	22.39	22.51		
3	QPSK	1	14	22.35	22.28	22.22		
3	QPSK	8	0	21.57	21.51	21.48	22	1
3	QPSK	8	4	21.61	21.57	21.43		
3	QPSK	8	7	21.57	21.44	21.53		
3	QPSK	15	0	21.53	21.51	21.46		
3	16QAM	1	0	21.75	21.75	21.70	22	1
3	16QAM	1	7	21.66	21.26	21.69		
3	16QAM	1	14	21.60	21.10	21.42		
3	16QAM	8	0	20.56	20.59	20.46	21	2
3	16QAM	8	4	20.57	20.50	20.28		
3	16QAM	8	7	20.40	20.59	20.40		
3	16QAM	15	0	20.46	20.75	20.47		



Channel				20407	20525	20643	Tune up Limit (dBm)	Target MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.74	22.66	22.67	23	0
1.4	QPSK	1	2	22.73	22.55	22.50		
1.4	QPSK	1	5	22.42	22.50	22.52		
1.4	QPSK	3	0	22.72	22.56	22.63		
1.4	QPSK	3	1	22.70	22.65	22.66		
1.4	QPSK	3	2	22.60	22.51	22.53		
1.4	QPSK	6	0	21.66	21.50	21.47	22	1
1.4	16QAM	1	0	21.95	21.94	21.88	22	1
1.4	16QAM	1	2	21.56	21.80	21.07		
1.4	16QAM	1	5	21.68	21.91	21.50		
1.4	16QAM	3	0	21.88	21.70	21.78		
1.4	16QAM	3	1	21.94	21.64	21.52		
1.4	16QAM	3	2	21.73	21.66	21.54		
1.4	16QAM	6	0	20.54	20.26	20.27	21	2



<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	22.48	21.92	21.71	23	0
20	QPSK	1	49	22.20	21.50	21.75		
20	QPSK	1	99	21.79	21.24	21.65		
20	QPSK	50	0	21.30	20.68	20.71	22	1
20	QPSK	50	24	21.12	20.49	20.71		
20	QPSK	50	49	20.98	20.31	20.79		
20	QPSK	100	0	21.21	20.51	20.68	22	1
20	16QAM	1	0	21.76	21.08	20.90		
20	16QAM	1	49	21.41	20.63	20.92		
20	16QAM	1	99	21.11	20.81	21.01	21	2
20	16QAM	50	0	20.37	19.76	19.65		
20	16QAM	50	24	20.15	19.57	19.67		
20	16QAM	50	49	20.12	19.32	19.74	21	2
20	16QAM	100	0	20.15	19.45	19.64		
Channel				20825	21100	21375		
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	22.47	21.66	21.69	23	0
15	QPSK	1	37	22.24	21.30	21.71		
15	QPSK	1	74	22.06	21.24	21.76		
15	QPSK	36	0	21.31	20.59	20.79	22	1
15	QPSK	36	18	21.27	20.31	20.66		
15	QPSK	36	37	21.12	20.33	20.72		
15	QPSK	75	0	21.22	20.42	20.76	22	1
15	16QAM	1	0	21.70	21.08	20.80		
15	16QAM	1	37	21.31	20.67	20.50		
15	16QAM	1	74	20.85	20.67	20.55	21	2
15	16QAM	36	0	20.34	19.66	19.74		
15	16QAM	36	18	20.30	19.36	19.73		
15	16QAM	36	37	20.17	19.27	19.78	21	2
15	16QAM	75	0	20.18	19.36	19.60		
Channel				20800	21100	21400		
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	22.26	21.52	21.71	23	0
10	QPSK	1	24	21.99	21.35	21.72		
10	QPSK	1	49	21.98	21.18	21.58		
10	QPSK	25	0	21.32	20.55	20.76	22	1
10	QPSK	25	12	21.23	20.30	20.79		
10	QPSK	25	24	21.23	20.30	20.71		
10	QPSK	50	0	21.30	20.38	20.63	22	1
10	16QAM	1	0	21.76	20.89	21.03		
10	16QAM	1	24	21.12	20.34	20.98		
10	16QAM	1	49	21.14	20.36	20.95	21	2
10	16QAM	25	0	20.27	19.78	19.74		
10	16QAM	25	12	20.26	19.43	19.78		
10	16QAM	25	24	20.26	19.46	19.80	21	2
10	16QAM	50	0	20.13	19.35	19.59		





Channel				20775	21100	21425	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	22.32	21.59	21.71	23	0
5	QPSK	1	12	22.02	21.49	21.64		
5	QPSK	1	24	21.88	21.23	21.44		
5	QPSK	12	0	21.32	20.50	20.74	22	1
5	QPSK	12	6	21.19	20.30	20.70		
5	QPSK	12	11	21.24	20.52	20.78		
5	QPSK	25	0	21.24	20.49	20.76		
5	16QAM	1	0	21.62	21.05	21.37	22	1
5	16QAM	1	12	21.69	20.74	21.61		
5	16QAM	1	24	21.54	20.71	20.96		
5	16QAM	12	0	20.24	19.40	19.70	21	2
5	16QAM	12	6	20.12	19.27	19.76		
5	16QAM	12	11	20.13	19.19	19.73		
5	16QAM	12	11	20.13	19.19	19.73		
5	16QAM	25	0	20.17	19.27	19.91		

<Bluetooth Power>

Mode Band	Average power(dBm)	
	Bluetooth v3.0+EDR	Bluetooth v4.0+LE
2.4GHz Bluetooth	9.0	7.0

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

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
9	< 5	2.48	2.52

Note:

Per KDB 447498 D01v05r02, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 2.52 which is ≤ 3, SAR testing is not required.



**<WLAN Conducted Power>**

**General Note:**

1. For 2.4GHz WLAN SAR testing, highest average RF output power channel for the lowest data rate for 802.11b were selected for SAR evaluation. 802.11g/n HT20 were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of 802.11b mode.
2. For 5 GHz WLAN SAR testing, highest average RF output power channel for the lowest data rate for 802.11a were selected for SAR evaluation. 802.11n HT20/HT40 modes were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of 802.11a mode.
3. Full SAR tests for SISO IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.

**<2.4GHz WLAN>**

WLAN 2.4GHz 802.11b Average Power (dBm)					
Power vs. Channel			Power vs. Data Rate		
Channel	Frequency (MHz)	Data Rate	2Mbps	5.5Mbps	11Mbps
		1Mbps			
CH 1	2412	16.54	16.50	16.65	16.45
CH 6	2437	16.84			
CH 11	2462	16.50			

WLAN 2.4GHz 802.11g Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
		6Mbps							
CH 1	2412	15.00	14.88	14.97	14.56	14.59	11.82	11.67	11.72
CH 6	2437	14.87							
CH 11	2462	14.92							

WLAN 2.4GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0							
CH 1	2412	11.69	11.88	11.78	11.89	11.86	11.72	11.81	11.87
CH 6	2437	11.98							
CH 11	2462	11.95							



<5GHz WLAN>

WLAN 5GHz 802.11a Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
		6Mbps							
CH 36	5180	11.87	11.27	11.30	11.34	11.48	11.52	11.67	11.50
CH 40	5200	11.76							
CH 44	5220	11.69							
CH 48	5240	11.93							
CH 52	5260	11.84	11.61	11.62	11.74	11.63	11.84	11.76	11.80
CH 56	5280	11.96							
CH 60	5300	11.97							
CH 64	5320	11.79							
CH 100	5500	11.76	11.43	11.52	11.61	11.63	11.63	11.71	11.76
CH 104	5520	11.68							
CH 108	5540	11.59							
CH 112	5560	11.81							
CH 116	5580	11.65							
CH 132	5660	11.81							
CH 136	5680	11.79							
CH 140	5700	11.89							
CH 144	5720	11.81							
CH 149	5745	11.55	11.68	11.69	11.72	11.74	11.32	11.42	11.34
CH 153	5765	11.62							
CH 157	5785	11.76							
CH 161	5805	11.61							
CH 165	5825	11.62							



WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	Data Rate	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
		6Mbps							
CH 36	5180	11.93	11.89	11.43	11.38	11.64	11.70	11.70	11.57
CH 40	5200	11.82							
CH 44	5220	11.89							
CH 48	5240	11.54							
CH 52	5260	11.75	11.80	11.83	11.90	11.88	11.89	11.75	11.90
CH 56	5280	11.73							
CH 60	5300	11.64							
CH 64	5320	11.91							
CH 100	5500	11.94							
CH 104	5520	11.83	11.92	11.85	11.78	11.84	11.92	11.86	11.76
CH 108	5540	11.79							
CH 112	5560	11.84							
CH 116	5580	11.81							
CH 132	5660	11.83							
CH 136	5680	11.89							
CH 140	5700	11.50							
CH 144	5720	11.87	11.30	11.27	11.30	11.25	11.34	11.23	11.32
CH 149	5745	11.63							
CH 153	5765	11.61							
CH 157	5785	11.64							
CH 161	5805	11.62							
CH 165	5825	11.61							

WLAN 5GHz 802.11n-HT40 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0							
CH 38	5190	11.60	11.67	11.77	11.71	11.85	11.82	11.90	11.85
CH 46	5230	11.93							
CH 54	5270	11.89	11.99	11.66	11.71	11.68	11.87	11.69	11.41
CH 62	5310	12.00							
CH 102	5510	11.91							
CH 110	5550	11.68	11.53	11.58	11.60	11.67	11.48	11.75	11.56
CH 134	5670	11.70							
CH 142	5710	11.58							
CH 151	5755	11.86	11.78	11.87	11.90	11.59	11.65	11.56	11.74
CH 159	5795	11.92							



WLAN 5GHz 802.11ac-VHT20 Average Power (dBm)										
Power vs. Channel			Power vs. MCS Index							
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8
		MCS0								
CH 36	5180	9.99	9.98	9.96	9.88	9.94	9.96	9.95	9.94	9.94
CH 40	5200	9.96								
CH 44	5220	9.83								
CH 48	5240	9.89								
CH 52	5260	9.61	9.97	9.93	9.96	9.92	9.97	9.90	9.94	9.93
CH 56	5280	9.58								
CH 60	5300	9.87								
CH 64	5320	9.98								
CH 100	5500	9.63	9.58	9.48	9.59	9.56	9.60	9.52	9.62	9.57
CH 104	5520	9.63								
CH 108	5540	9.78								
CH 112	5560	9.81								
CH 116	5580	9.55								
CH 132	5660	9.55								
CH 136	5680	9.74								
CH 140	5700	9.60								
CH 144	5720	9.84	9.97	9.97	9.95	9.93	9.95	9.94	9.99	9.93
CH 149	5745	9.89								
CH 153	5765	9.68								
CH 157	5785	9.99								
CH 161	5805	9.88								
CH 165	5825	9.91								

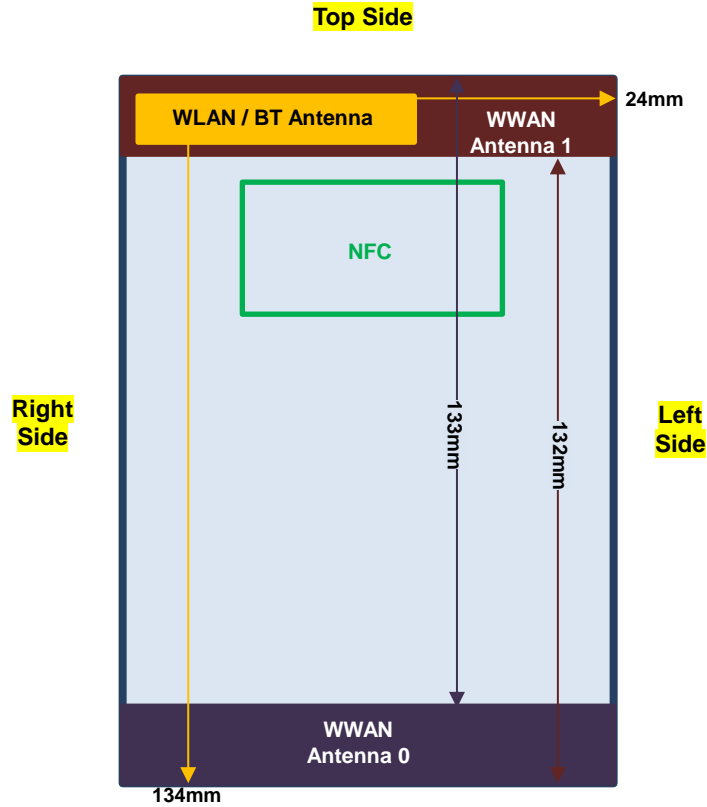


WLAN 5GHz 802.11ac-VHT40 Average Power (dBm)											
Power vs. Channel			Power vs. MCS Index								
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
		MCS0									
CH 38	5190	9.70	9.66	9.66	9.61	9.66	9.65	9.65	9.68	9.62	9.63
CH 46	5230	9.63									
CH 54	5270	9.70	9.91	9.89	9.85	9.83	9.86	9.88	9.89	9.84	9.87
CH 62	5310	9.94									
CH 102	5510	9.72	9.60	9.69	9.59	9.70	9.71	9.68	9.69	9.71	9.68
CH 110	5550	9.69									
CH 134	5670	9.65									
CH 142	5710	9.48									
CH 151	5755	9.87	9.95	9.94	9.82	9.92	8.83	9.84	9.77	9.95	9.92
CH 159	5795	9.98									

WLAN 5GHz 802.11ac-VHT80 Average Power (dBm)											
Power vs. Channel			Power vs. MCS Index								
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
		MCS0									
CH 42	5210	9.98	9.94	9.92	9.96	9.95	9.91	9.88	9.93	9.91	9.92
CH 58	5290	9.80	9.50	9.59	9.53	9.69	9.65	9.66	9.67	9.74	9.73
CH 106	5530	9.71	9.84	9.82	9.83	9.85	9.75	9.83	9.74	9.84	9.80
CH 138	5690	9.83									
CH 155	5775	9.99	9.86	9.97	9.96	9.79	9.88	9.84	9.81	9.90	9.94

### 13. Antenna Location

<Mobile Phone>



**Bottom Side**

**Back View**

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Antenna 0	≤ 25mm	≤ 25mm	133mm	≤ 25mm	≤ 25mm	≤ 25mm
WWAN Antenna 1	≤ 25mm	≤ 25mm	≤ 25mm	132mm	≤ 25mm	≤ 25mm
BT&WLAN	≤ 25mm	≤ 25mm	≤ 25mm	134mm	≤ 25mm	≤ 25mm

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

**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



## 14. SAR Test Results

### General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
  - c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor
  - d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
  - $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
3. This device supports dual SIM dual antenna single active, the WWAN radio cannot simultaneous transmission at the same time.
4. Per KDB 941225 D01v03, considering the possibility of e.g. 3rd party VoIP operation for Head and body-worn SAR test reduction for GSM and GPRS and EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the EUT was set in GPRS (4Tx slots) for GSM850 and GPRS (3Tx slots) for GSM1900.
5. Per KDB 941225 D01v03, for Hotspot SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance, for modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested, therefore, the EUT was set in GPRS (4Tx slots) for GSM850 and GPRS (3Tx slots) for GSM1900.
6. Per KDB 648474 D04v01r02, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is  $\leq 1.2$  W/kg, SAR testing with a headset connected to the handset is not required.
7. Per KDB 941225 D01v03, SAR for head / Hotspot / Body-worn exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
8. Per KDB 941225 D01v03, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is  $\leq 1/4$  dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.
9. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
10. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
11. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
12. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is  $>$  not  $1/2$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
13. Per KDB 941225 D05v02r03, Smaller bandwidth output power for each RB allocation configuration is  $>$  not  $1/2$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.
14. During SAR testing the WLAN transmission was verified using a spectrum analyzer.





14.1 Head SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS (4 Tx slots)	Right Cheek	Ant 0	189	836.4	30.42	30.50	1.019	0	0.147	0.150
	GSM850	GPRS (4 Tx slots)	Right Tilted	Ant 0	189	836.4	30.42	30.50	1.019	0.05	0.090	0.092
	GSM850	GPRS (4 Tx slots)	Left Cheek	Ant 0	189	836.4	30.42	30.50	1.019	0.01	0.231	0.235
	GSM850	GPRS (4 Tx slots)	Left Tilted	Ant 0	189	836.4	30.42	30.50	1.019	0.02	0.071	0.072
01	GSM850	GPRS (4 Tx slots)	Right Cheek	Ant 1	189	836.4	30.42	30.50	1.019	-0.04	0.711	0.724
	GSM850	GPRS (4 Tx slots)	Right Tilted	Ant 1	189	836.4	30.42	30.50	1.019	-0.02	0.376	0.383
	GSM850	GPRS (4 Tx slots)	Left Cheek	Ant 1	189	836.4	30.42	30.50	1.019	0.08	0.415	0.423
	GSM850	GPRS (4 Tx slots)	Left Tilted	Ant 1	189	836.4	30.42	30.50	1.019	0.04	0.275	0.280
	GSM1900	GPRS (3 Tx slots)	Right Cheek	Ant 0	661	1880	29.77	30.00	1.054	0.07	0.091	0.096
	GSM1900	GPRS (3 Tx slots)	Right Tilted	Ant 0	661	1880	29.77	30.00	1.054	0	0.032	0.034
	GSM1900	GPRS (3 Tx slots)	Left Cheek	Ant 0	661	1880	29.77	30.00	1.054	-0.03	0.190	0.200
	GSM1900	GPRS (3 Tx slots)	Left Tilted	Ant 0	661	1880	29.77	30.00	1.054	0.07	0.046	0.049
02	GSM1900	GPRS (3 Tx slots)	Right Cheek	Ant 1	661	1880	29.77	30.00	1.054	-0.05	0.424	0.447
	GSM1900	GPRS (3 Tx slots)	Right Tilted	Ant 1	661	1880	29.77	30.00	1.054	0.09	0.293	0.309
	GSM1900	GPRS (3 Tx slots)	Left Cheek	Ant 1	661	1880	29.77	30.00	1.054	0.06	0.129	0.136
	GSM1900	GPRS (3 Tx slots)	Left Tilted	Ant 1	661	1880	29.77	30.00	1.054	0.04	0.117	0.123

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Right Cheek	Ant 0	4182	836.4	23.08	23.50	1.102	0.15	0.066	0.073
	WCDMA V	RMC 12.2Kbps	Right Tilted	Ant 0	4182	836.4	23.08	23.50	1.102	0.04	0.036	0.040
	WCDMA V	RMC 12.2Kbps	Left Cheek	Ant 0	4182	836.4	23.08	23.50	1.102	0.07	0.086	0.095
	WCDMA V	RMC 12.2Kbps	Left Tilted	Ant 0	4182	836.4	23.08	23.50	1.102	-0.01	0.033	0.036
03	WCDMA V	RMC 12.2Kbps	Right Cheek	Ant 1	4182	836.4	23.08	23.50	1.102	0.04	0.286	0.315
	WCDMA V	RMC 12.2Kbps	Right Tilted	Ant 1	4182	836.4	23.08	23.50	1.102	0.01	0.143	0.158
	WCDMA V	RMC 12.2Kbps	Left Cheek	Ant 1	4182	836.4	23.08	23.50	1.102	0.11	0.168	0.185
	WCDMA V	RMC 12.2Kbps	Left Tilted	Ant 1	4182	836.4	23.08	23.50	1.102	0.06	0.119	0.131
	WCDMA II	RMC 12.2Kbps	Right Cheek	Ant 0	9400	1880	23.33	23.50	1.040	0.04	0.107	0.111
	WCDMA II	RMC 12.2Kbps	Right Tilted	Ant 0	9400	1880	23.33	23.50	1.040	0.03	0.038	0.040
	WCDMA II	RMC 12.2Kbps	Left Cheek	Ant 0	9400	1880	23.33	23.50	1.040	0.03	0.170	0.177
	WCDMA II	RMC 12.2Kbps	Left Tilted	Ant 0	9400	1880	23.33	23.50	1.040	-0.17	0.050	0.052
04	WCDMA II	RMC 12.2Kbps	Right Cheek	Ant 1	9400	1880	23.33	23.50	1.040	-0.07	0.576	0.599
	WCDMA II	RMC 12.2Kbps	Right Tilted	Ant 1	9400	1880	23.33	23.50	1.040	-0.01	0.334	0.347
	WCDMA II	RMC 12.2Kbps	Left Cheek	Ant 1	9400	1880	23.33	23.50	1.040	-0.04	0.153	0.159
	WCDMA II	RMC 12.2Kbps	Left Tilted	Ant 1	9400	1880	23.33	23.50	1.040	0.04	0.172	0.179



<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1RB	0offset	Right Cheek	Ant 0	20450	829	22.88	23.00	1.028	0.13	0.051	0.052
	LTE Band 5	10M	QPSK	25RB	0offset	Right Cheek	Ant 0	20450	829	21.68	22.00	1.076	0.14	0.037	0.040
	LTE Band 5	10M	QPSK	1RB	0offset	Right Tilted	Ant 0	20450	829	22.88	23.00	1.028	0.06	0.033	0.034
	LTE Band 5	10M	QPSK	25RB	0offset	Right Tilted	Ant 0	20450	829	21.68	22.00	1.076	0.18	0.024	0.026
	LTE Band 5	10M	QPSK	1RB	0offset	Left Cheek	Ant 0	20450	829	22.88	23.00	1.028	0.05	0.072	0.074
	LTE Band 5	10M	QPSK	25RB	0offset	Left Cheek	Ant 0	20450	829	21.68	22.00	1.076	0.06	0.056	0.060
	LTE Band 5	10M	QPSK	1RB	0offset	Left Tilted	Ant 0	20450	829	22.88	23.00	1.028	0.16	0.028	0.029
	LTE Band 5	10M	QPSK	25RB	0offset	Left Tilted	Ant 0	20450	829	21.68	22.00	1.076	0.16	0.021	0.023
05	LTE Band 5	10M	QPSK	1RB	0offset	Right Cheek	Ant 1	20450	829	22.88	23.00	1.028	-0.06	0.242	0.249
	LTE Band 5	10M	QPSK	25RB	0offset	Right Cheek	Ant 1	20450	829	21.68	22.00	1.076	0.04	0.185	0.199
	LTE Band 5	10M	QPSK	1RB	0offset	Right Tilted	Ant 1	20450	829	22.88	23.00	1.028	0.07	0.125	0.129
	LTE Band 5	10M	QPSK	25RB	0offset	Right Tilted	Ant 1	20450	829	21.68	22.00	1.076	-0.05	0.099	0.107
	LTE Band 5	10M	QPSK	1RB	0offset	Left Cheek	Ant 1	20450	829	22.88	23.00	1.028	0.01	0.152	0.156
	LTE Band 5	10M	QPSK	25RB	0offset	Left Cheek	Ant 1	20450	829	21.68	22.00	1.076	0.1	0.116	0.125
	LTE Band 5	10M	QPSK	1RB	0offset	Left Tilted	Ant 1	20450	829	22.88	23.00	1.028	-0.14	0.083	0.085
	LTE Band 5	10M	QPSK	25RB	0offset	Left Tilted	Ant 1	20450	829	21.68	22.00	1.076	0.15	0.064	0.069
	LTE Band 7	20M	QPSK	1RB	0offset	Right Cheek	Ant 0	20850	2510	22.48	23.00	1.127	0.15	0.066	0.074
	LTE Band 7	20M	QPSK	50RB	0offset	Right Cheek	Ant 0	20850	2510	21.30	22.00	1.175	0.04	0.053	0.062
	LTE Band 7	20M	QPSK	1RB	0offset	Right Tilted	Ant 0	20850	2510	22.48	23.00	1.127	-0.08	0.017	0.019
	LTE Band 7	20M	QPSK	50RB	0offset	Right Tilted	Ant 0	20850	2510	21.30	22.00	1.175	0.06	0.013	0.015
	LTE Band 7	20M	QPSK	1RB	0offset	Left Cheek	Ant 0	20850	2510	22.48	23.00	1.127	0.02	0.183	0.206
	LTE Band 7	20M	QPSK	50RB	0offset	Left Cheek	Ant 0	20850	2510	21.30	22.00	1.175	-0.16	0.134	0.157
	LTE Band 7	20M	QPSK	1RB	0offset	Left Tilted	Ant 0	20850	2510	22.48	23.00	1.127	0.04	0.020	0.023
	LTE Band 7	20M	QPSK	50RB	0offset	Left Tilted	Ant 0	20850	2510	21.30	22.00	1.175	0.09	0.024	0.028
06	LTE Band 7	20M	QPSK	1RB	0offset	Right Cheek	Ant 1	20850	2510	22.48	23.00	1.127	0.05	0.385	0.434
	LTE Band 7	20M	QPSK	50RB	0offset	Right Cheek	Ant 1	20850	2510	21.30	22.00	1.175	0.07	0.312	0.367
	LTE Band 7	20M	QPSK	1RB	0offset	Right Tilted	Ant 1	20850	2510	22.48	23.00	1.127	0.09	0.150	0.169
	LTE Band 7	20M	QPSK	50RB	0offset	Right Tilted	Ant 1	20850	2510	21.30	22.00	1.175	-0.12	0.123	0.145
	LTE Band 7	20M	QPSK	1RB	0offset	Left Cheek	Ant 1	20850	2510	22.48	23.00	1.127	0.04	0.126	0.142
	LTE Band 7	20M	QPSK	50RB	0offset	Left Cheek	Ant 1	20850	2510	21.30	22.00	1.175	0.07	0.104	0.122
	LTE Band 7	20M	QPSK	1RB	0offset	Left Tilted	Ant 1	20850	2510	22.48	23.00	1.127	0.08	0.076	0.086
	LTE Band 7	20M	QPSK	50RB	0offset	Left Tilted	Ant 1	20850	2510	21.30	22.00	1.175	0.01	0.061	0.072



<WLAN SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Right Cheek	6	2437	16.84	17.00	1.037	97.63	1.024	-0.12	0.069	0.073
	WLAN2.4GHz	802.11b 1Mbps	Right Tilted	6	2437	16.84	17.00	1.037	97.63	1.024	-0.18	0.063	0.067
07	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	6	2437	16.84	17.00	1.037	97.63	1.024	-0.15	0.218	0.231
	WLAN2.4GHz	802.11b 1Mbps	Left Tilted	6	2437	16.84	17.00	1.037	97.63	1.024	0	0.157	0.167
08	WLAN5GHz	802.11a 6Mbps	Right Cheek	48	5240	11.93	12.00	1.016	87.26	1.146	-0.11	0.016	0.019
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Cheek	42	5210	9.98	10.00	1.005	56.00	1.786	0.02	0.004	0.007
	WLAN5GHz	802.11a 6Mbps	Right Tilted	48	5240	11.93	12.00	1.016	87.26	1.146	-0.18	0.011	0.013
	WLAN5GHz	802.11a 6Mbps	Left Cheek	48	5240	11.93	12.00	1.016	87.26	1.146	-0.04	0.015	0.017
	WLAN5GHz	802.11a 6Mbps	Left Tilted	48	5240	11.93	12.00	1.016	87.26	1.146	-0.17	0.013	0.015
09	WLAN5GHz	802.11a 6Mbps	Right Cheek	60	5300	11.97	12.00	1.007	87.26	1.146	-0.15	0.024	0.028
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Cheek	58	5290	9.80	10.00	1.047	56.00	1.786	0.04	0.004	0.008
	WLAN5GHz	802.11a 6Mbps	Right Tilted	60	5300	11.97	12.00	1.007	87.26	1.146	-0.11	0.014	0.016
	WLAN5GHz	802.11a 6Mbps	Left Cheek	60	5300	11.97	12.00	1.007	87.26	1.146	-0.08	0.021	0.024
	WLAN5GHz	802.11a 6Mbps	Left Tilted	60	5300	11.97	12.00	1.007	87.26	1.146	-0.08	0.013	0.015
	WLAN5GHz	802.11a 6Mbps	Right Cheek	140	5700	11.89	12.00	1.025	87.26	1.146	-0.02	0.043	0.051
	WLAN5GHz	802.11a 6Mbps	Right Tilted	140	5700	11.89	12.00	1.025	87.26	1.146	-0.04	0.035	0.041
10	WLAN5GHz	802.11a 6Mbps	Left Cheek	140	5700	11.89	12.00	1.025	87.26	1.146	0.03	0.047	0.055
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Cheek	138	5690	9.83	10.00	1.040	56.00	1.786	0.095	0.023	0.043
	WLAN5GHz	802.11a 6Mbps	Left Tilted	140	5700	11.89	12.00	1.025	87.26	1.146	-0.07	0.037	0.043
11	WLAN5GHz	802.11a 6Mbps	Right Cheek	157	5785	11.76	12.00	1.056	87.26	1.146	-0.07	0.057	0.069
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Cheek	155	5775	9.99	10.00	1.002	56.00	1.786	0.14	0.036	0.064
	WLAN5GHz	802.11a 6Mbps	Right Tilted	157	5785	11.76	12.00	1.056	87.26	1.146	0.18	0.045	0.054
	WLAN5GHz	802.11a 6Mbps	Left Cheek	157	5785	11.76	12.00	1.056	87.26	1.146	-0.09	0.043	0.052
	WLAN5GHz	802.11a 6Mbps	Left Tilted	157	5785	11.76	12.00	1.056	87.26	1.146	-0.06	0.038	0.046



14.2 Hotspot SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS (4 Tx slots)	Front	1cm	Ant 0	189	836.4	30.42	30.50	1.019	-0.02	0.292	0.297
12	GSM850	GPRS (4 Tx slots)	Back	1cm	Ant 0	189	836.4	30.42	30.50	1.019	-0.06	0.360	0.367
	GSM850	GPRS (4 Tx slots)	Left Side	1cm	Ant 0	189	836.4	30.42	30.50	1.019	-0.04	0.286	0.291
	GSM850	GPRS (4 Tx slots)	Right Side	1cm	Ant 0	189	836.4	30.42	30.50	1.019	0.01	0.061	0.062
	GSM850	GPRS (4 Tx slots)	Bottom Side	1cm	Ant 0	189	836.4	30.42	30.50	1.019	-0.09	0.156	0.159
	GSM850	GPRS (4 Tx slots)	Front	1cm	Ant 1	189	836.4	30.42	30.50	1.019	0.01	0.158	0.161
	GSM850	GPRS (4 Tx slots)	Back	1cm	Ant 1	189	836.4	30.42	30.50	1.019	-0.04	0.222	0.226
	GSM850	GPRS (4 Tx slots)	Left Side	1cm	Ant 1	189	836.4	30.42	30.50	1.019	0	0.140	0.143
	GSM850	GPRS (4 Tx slots)	Right Side	1cm	Ant 1	189	836.4	30.42	30.50	1.019	-0.08	0.246	0.251
	GSM850	GPRS (4 Tx slots)	Top Side	1cm	Ant 1	189	836.4	30.42	30.50	1.019	0.06	0.062	0.063
	GSM1900	GPRS (3 Tx slots)	Front	1cm	Ant 0	661	1880	29.77	30.00	1.054	-0.04	0.147	0.155
	GSM1900	GPRS (3 Tx slots)	Back	1cm	Ant 0	661	1880	29.77	30.00	1.054	-0.06	0.142	0.150
	GSM1900	GPRS (3 Tx slots)	Left Side	1cm	Ant 0	661	1880	29.77	30.00	1.054	-0.05	0.117	0.123
	GSM1900	GPRS (3 Tx slots)	Right Side	1cm	Ant 0	661	1880	29.77	30.00	1.054	0.08	0.023	0.024
13	GSM1900	GPRS (3 Tx slots)	Bottom Side	1cm	Ant 0	661	1880	29.77	30.00	1.054	0.05	0.163	0.172
	GSM1900	GPRS (3 Tx slots)	Front	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.16	0.046	0.049
	GSM1900	GPRS (3 Tx slots)	Back	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.17	0.059	0.062
	GSM1900	GPRS (3 Tx slots)	Left Side	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.06	0.046	0.049
	GSM1900	GPRS (3 Tx slots)	Right Side	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.05	0.004	0.004
	GSM1900	GPRS (3 Tx slots)	Top Side	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.14	0.056	0.059

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	-0.07	0.117	0.129
14	WCDMA V	RMC 12.2Kbps	Back	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	-0.1	0.147	0.162
	WCDMA V	RMC 12.2Kbps	Left Side	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	0	0.122	0.134
	WCDMA V	RMC 12.2Kbps	Right Side	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	0.03	0.027	0.030
	WCDMA V	RMC 12.2Kbps	Bottom Side	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	-0.01	0.061	0.067
	WCDMA V	RMC 12.2Kbps	Front	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	0.02	0.061	0.067
	WCDMA V	RMC 12.2Kbps	Back	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	-0.01	0.096	0.106
	WCDMA V	RMC 12.2Kbps	Left Side	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	0.02	0.052	0.057
	WCDMA V	RMC 12.2Kbps	Right Side	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	0.06	0.106	0.117
	WCDMA V	RMC 12.2Kbps	Top Side	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	-0.04	0.023	0.025
15	WCDMA II	RMC 12.2Kbps	Front	1cm	Ant 0	9400	1880	23.33	23.50	1.040	-0.03	0.161	0.167
	WCDMA II	RMC 12.2Kbps	Back	1cm	Ant 0	9400	1880	23.33	23.50	1.040	-0.11	0.105	0.109
	WCDMA II	RMC 12.2Kbps	Left Side	1cm	Ant 0	9400	1880	23.33	23.50	1.040	-0.03	0.114	0.119
	WCDMA II	RMC 12.2Kbps	Right Side	1cm	Ant 0	9400	1880	23.33	23.50	1.040	0.03	0.023	0.024
	WCDMA II	RMC 12.2Kbps	Bottom Side	1cm	Ant 0	9400	1880	23.33	23.50	1.040	0.03	0.131	0.136
	WCDMA II	RMC 12.2Kbps	Front	1cm	Ant 1	9400	1880	23.33	23.50	1.040	0.09	0.060	0.062
	WCDMA II	RMC 12.2Kbps	Back	1cm	Ant 1	9400	1880	23.33	23.50	1.040	0.03	0.069	0.072
	WCDMA II	RMC 12.2Kbps	Left Side	1cm	Ant 1	9400	1880	23.33	23.50	1.040	0.06	0.064	0.067
	WCDMA II	RMC 12.2Kbps	Right Side	1cm	Ant 1	9400	1880	23.33	23.50	1.040	0.06	0.005	0.005
	WCDMA II	RMC 12.2Kbps	Top Side	1cm	Ant 1	9400	1880	23.33	23.50	1.040	-0.11	0.086	0.089



<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1RB	0offset	Front	1cm	Ant 0	20450	829	22.88	23.00	1.028	0.17	0.148	0.152
	LTE Band 5	10M	QPSK	25RB	0offset	Front	1cm	Ant 0	20450	829	21.68	22.00	1.076	0	0.115	0.124
16	LTE Band 5	10M	QPSK	1RB	0offset	Back	1cm	Ant 0	20450	829	22.88	23.00	1.028	-0.01	0.179	0.184
	LTE Band 5	10M	QPSK	25RB	0offset	Back	1cm	Ant 0	20450	829	21.68	22.00	1.076	0.02	0.137	0.147
	LTE Band 5	10M	QPSK	1RB	0offset	Left Side	1cm	Ant 0	20450	829	22.88	23.00	1.028	0.08	0.140	0.144
	LTE Band 5	10M	QPSK	25RB	0offset	Left Side	1cm	Ant 0	20450	829	21.68	22.00	1.076	-0.02	0.107	0.115
	LTE Band 5	10M	QPSK	1RB	0offset	Right Side	1cm	Ant 0	20450	829	22.88	23.00	1.028	0.07	0.041	0.042
	LTE Band 5	10M	QPSK	25RB	0offset	Right Side	1cm	Ant 0	20450	829	21.68	22.00	1.076	0.03	0.030	0.032
	LTE Band 5	10M	QPSK	1RB	0offset	Bottom Side	1cm	Ant 0	20450	829	22.88	23.00	1.028	0.05	0.067	0.069
	LTE Band 5	10M	QPSK	25RB	0offset	Bottom Side	1cm	Ant 0	20450	829	21.68	22.00	1.076	-0.03	0.052	0.056
	LTE Band 5	10M	QPSK	1RB	0offset	Front	1cm	Ant 1	20450	829	22.88	23.00	1.028	0.18	0.057	0.059
	LTE Band 5	10M	QPSK	25RB	0offset	Front	1cm	Ant 1	20450	829	21.68	22.00	1.076	0.01	0.047	0.051
	LTE Band 5	10M	QPSK	1RB	0offset	Back	1cm	Ant 1	20450	829	22.88	23.00	1.028	-0.05	0.091	0.094
	LTE Band 5	10M	QPSK	25RB	0offset	Back	1cm	Ant 1	20450	829	21.68	22.00	1.076	0.07	0.075	0.081
	LTE Band 5	10M	QPSK	1RB	0offset	Left Side	1cm	Ant 1	20450	829	22.88	23.00	1.028	0.08	0.066	0.068
	LTE Band 5	10M	QPSK	25RB	0offset	Left Side	1cm	Ant 1	20450	829	21.68	22.00	1.076	0.08	0.054	0.058
	LTE Band 5	10M	QPSK	1RB	0offset	Right Side	1cm	Ant 1	20450	829	22.88	23.00	1.028	0.14	0.108	0.111
	LTE Band 5	10M	QPSK	25RB	0offset	Right Side	1cm	Ant 1	20450	829	21.68	22.00	1.076	-0.03	0.094	0.101
	LTE Band 5	10M	QPSK	1RB	0offset	Top Side	1cm	Ant 1	20450	829	22.88	23.00	1.028	0.11	0.019	0.020
	LTE Band 5	10M	QPSK	25RB	0offset	Top Side	1cm	Ant 1	20450	829	21.68	22.00	1.076	0.03	0.016	0.017
	LTE Band 7	20M	QPSK	1RB	0offset	Front	1cm	Ant 0	20850	2510	22.48	23.00	1.127	-0.06	0.126	0.142
	LTE Band 7	20M	QPSK	50RB	0offset	Front	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0.01	0.103	0.121
	LTE Band 7	20M	QPSK	1RB	0offset	Back	1cm	Ant 0	20850	2510	22.48	23.00	1.127	0.02	0.145	0.163
	LTE Band 7	20M	QPSK	50RB	0offset	Back	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0	0.112	0.132
17	LTE Band 7	20M	QPSK	1RB	0offset	Left Side	1cm	Ant 0	20850	2510	22.48	23.00	1.127	-0.18	0.149	0.168
	LTE Band 7	20M	QPSK	50RB	0offset	Left Side	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0.15	0.107	0.126
	LTE Band 7	20M	QPSK	1RB	0offset	Right Side	1cm	Ant 0	20850	2510	22.48	23.00	1.127	0.07	0.003	0.003
	LTE Band 7	20M	QPSK	50RB	0offset	Right Side	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0.02	0.002	0.003
	LTE Band 7	20M	QPSK	1RB	0offset	Bottom Side	1cm	Ant 0	20850	2510	22.48	23.00	1.127	-0.1	0.078	0.088
	LTE Band 7	20M	QPSK	50RB	0offset	Bottom Side	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0.14	0.076	0.089
	LTE Band 7	20M	QPSK	1RB	0offset	Front	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0.13	0.086	0.097
	LTE Band 7	20M	QPSK	50RB	0offset	Front	1cm	Ant 1	20850	2510	21.30	22.00	1.175	-0.05	0.067	0.079
	LTE Band 7	20M	QPSK	1RB	0offset	Back	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0.12	0.071	0.080
	LTE Band 7	20M	QPSK	50RB	0offset	Back	1cm	Ant 1	20850	2510	21.30	22.00	1.175	-0.08	0.052	0.061
	LTE Band 7	20M	QPSK	1RB	0offset	Left Side	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0.17	0.068	0.077
	LTE Band 7	20M	QPSK	50RB	0offset	Left Side	1cm	Ant 1	20850	2510	21.30	22.00	1.175	-0.04	0.053	0.062
	LTE Band 7	20M	QPSK	1RB	0offset	Right Side	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0	0.001	0.001
	LTE Band 7	20M	QPSK	50RB	0offset	Right Side	1cm	Ant 1	20850	2510	21.30	22.00	1.175	-	0.001	0.001
	LTE Band 7	20M	QPSK	1RB	0offset	Top Side	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0.11	0.030	0.034
	LTE Band 7	20M	QPSK	50RB	0offset	Top Side	1cm	Ant 1	20850	2510	21.30	22.00	1.175	0	0.023	0.027



<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	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)
18	WLAN2.4GHz	802.11b 1Mbps	Front	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.12	0.021	0.022
	WLAN2.4GHz	802.11b 1Mbps	Back	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.17	0.016	0.017
	WLAN2.4GHz	802.11b 1Mbps	Left Side	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.16	0.001	0.001
	WLAN2.4GHz	802.11b 1Mbps	Right Side	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.1	0.018	0.019
	WLAN2.4GHz	802.11b 1Mbps	Top Side	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.1	0.011	0.012

14.3 Body Worn Accessory SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS (4 Tx slots)	Front	1cm	Ant 0	189	836.4	30.42	30.50	1.019	-0.02	0.292	0.297
19	GSM850	GPRS (4 Tx slots)	Back	1cm	Ant 0	189	836.4	30.42	30.50	1.019	-0.06	0.360	0.367
	GSM850	GPRS (4 Tx slots)	Front	1cm	Ant 1	189	836.4	30.42	30.50	1.019	0.01	0.158	0.161
	GSM850	GPRS (4 Tx slots)	Back	1cm	Ant 1	189	836.4	30.42	30.50	1.019	-0.04	0.222	0.226
20	GSM1900	GPRS (3 Tx slots)	Front	1cm	Ant 0	661	1880	29.77	30.00	1.054	-0.04	0.147	0.155
	GSM1900	GPRS (3 Tx slots)	Back	1cm	Ant 0	661	1880	29.77	30.00	1.054	-0.06	0.142	0.150
	GSM1900	GPRS (3 Tx slots)	Front	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.16	0.046	0.049
	GSM1900	GPRS (3 Tx slots)	Back	1cm	Ant 1	661	1880	29.77	30.00	1.054	0.17	0.059	0.062

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	-0.07	0.117	0.129
21	WCDMA V	RMC 12.2Kbps	Back	1cm	Ant 0	4182	836.4	23.08	23.50	1.102	-0.1	0.147	0.162
	WCDMA V	RMC 12.2Kbps	Front	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	0.02	0.061	0.067
	WCDMA V	RMC 12.2Kbps	Back	1cm	Ant 1	4182	836.4	23.08	23.50	1.102	-0.01	0.096	0.106
22	WCDMA II	RMC 12.2Kbps	Front	1cm	Ant 0	9400	1880	23.33	23.50	1.040	-0.03	0.161	0.167
	WCDMA II	RMC 12.2Kbps	Back	1cm	Ant 0	9400	1880	23.33	23.50	1.040	-0.11	0.105	0.109
	WCDMA II	RMC 12.2Kbps	Front	1cm	Ant 1	9400	1880	23.33	23.50	1.040	0.09	0.060	0.062
	WCDMA II	RMC 12.2Kbps	Back	1cm	Ant 1	9400	1880	23.33	23.50	1.040	0.03	0.069	0.072



<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1RB	0offset	Front	1cm	Ant 0	20450	829	22.88	23.00	1.028	0.17	0.148	0.152
	LTE Band 5	10M	QPSK	25RB	0offset	Front	1cm	Ant 0	20450	829	21.68	22.00	1.076	0	0.115	0.124
23	LTE Band 5	10M	QPSK	1RB	0offset	Back	1cm	Ant 0	20450	829	22.88	23.00	1.028	-0.01	0.179	0.184
	LTE Band 5	10M	QPSK	25RB	0offset	Back	1cm	Ant 0	20450	829	21.68	22.00	1.076	0.02	0.137	0.147
	LTE Band 5	10M	QPSK	1RB	0offset	Front	1cm	Ant 1	20450	829	22.88	23.00	1.028	0.18	0.057	0.059
	LTE Band 5	10M	QPSK	25RB	0offset	Front	1cm	Ant 1	20450	829	21.68	22.00	1.076	0.01	0.047	0.051
	LTE Band 5	10M	QPSK	1RB	0offset	Back	1cm	Ant 1	20450	829	22.88	23.00	1.028	-0.05	0.091	0.094
	LTE Band 5	10M	QPSK	25RB	0offset	Back	1cm	Ant 1	20450	829	21.68	22.00	1.076	0.07	0.075	0.081
	LTE Band 7	20M	QPSK	1RB	0offset	Front	1cm	Ant 0	20850	2510	22.48	23.00	1.127	-0.06	0.126	0.142
	LTE Band 7	20M	QPSK	50RB	0offset	Front	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0.01	0.103	0.121
24	LTE Band 7	20M	QPSK	1RB	0offset	Back	1cm	Ant 0	20850	2510	22.48	23.00	1.127	0.02	0.145	0.163
	LTE Band 7	20M	QPSK	50RB	0offset	Back	1cm	Ant 0	20850	2510	21.30	22.00	1.175	0	0.112	0.132
	LTE Band 7	20M	QPSK	1RB	0offset	Front	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0.13	0.086	0.097
	LTE Band 7	20M	QPSK	50RB	0offset	Front	1cm	Ant 1	20850	2510	21.30	22.00	1.175	-0.05	0.067	0.079
	LTE Band 7	20M	QPSK	1RB	0offset	Back	1cm	Ant 1	20850	2510	22.48	23.00	1.127	0.12	0.071	0.080
	LTE Band 7	20M	QPSK	50RB	0offset	Back	1cm	Ant 1	20850	2510	21.30	22.00	1.175	-0.08	0.052	0.061

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	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)
25	WLAN2.4GHz	802.11b 1Mbps	Front	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.12	0.021	0.022
	WLAN2.4GHz	802.11b 1Mbps	Back	1cm	6	2437	16.84	17.00	1.037	97.63	1.024	-0.17	0.016	0.017
	WLAN5GHz	802.11a 6Mbps	Front	1cm	48	5240	11.93	12.00	1.016	87.26	1.146	0.06	0.001	0.001
26	WLAN5GHz	802.11a 6Mbps	Back	1cm	48	5240	11.93	12.00	1.016	87.26	1.146	0.09	0.014	0.016
	WLAN5GHz	802.11ac-VHT80 MCS0	Back	1cm	42	5210	9.98	10.00	1.005	56.00	1.786	-0.143	0.008	0.014
27	WLAN5GHz	802.11a 6Mbps	Front	1cm	60	5300	11.97	12.00	1.007	87.26	1.146	-0.01	0.020	0.023
	WLAN5GHz	802.11ac-VHT80 MCS0	Front	1cm	58	5290	9.80	10.00	1.047	56.00	1.786	-0.01	0.004	0.007
	WLAN5GHz	802.11a 6Mbps	Back	1cm	60	5300	11.97	12.00	1.007	87.26	1.146	-0.09	0.017	0.020
	WLAN5GHz	802.11a 6Mbps	Front	1cm	140	5700	11.89	12.00	1.025	87.26	1.146	-0.09	0.018	0.021
28	WLAN5GHz	802.11a 6Mbps	Back	1cm	140	5700	11.89	12.00	1.025	87.26	1.146	-0.01	0.020	0.023
	WLAN5GHz	802.11ac-VHT80 MCS0	Back	1cm	138	5690	9.83	10.00	1.040	56.00	1.786	-0.16	0.006	0.011
	WLAN5GHz	802.11a 6Mbps	Front	1cm	157	5785	11.76	12.00	1.056	87.26	1.146	0.05	0.015	0.018
29	WLAN5GHz	802.11a 6Mbps	Back	1cm	157	5785	11.76	12.00	1.056	87.26	1.146	-0.02	0.020	0.024
	WLAN5GHz	802.11ac-VHT80 MCS0	Back	1cm	155	5775	9.99	10.00	1.002	56.00	1.786	-0.09	0.011	0.020

**15. Simultaneous Transmission Analysis**

NO.	Simultaneous Transmission Configurations	Portable Handset			Note
		Head	Body-worn	Hotspot	
1.	GSM(Voice) + WLAN2.4GHz(data)	Yes	Yes		
2.	WCDMA(Voice) + WLAN2.4GHz(data)	Yes	Yes		
3.	GSM(Voice) + Bluetooth(data)	Yes	Yes		
4.	WCDMA((Voice) + Bluetooth(data)	Yes	Yes		
5.	GSM(Voice) + WLAN5GHz(data)	Yes	Yes		
6.	WCDMA((Voice) + WLAN5GHz(data)	Yes	Yes		
7.	GPRS/EDGE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
8.	WCDMA(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
9.	LTE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
10.	GPRS/EDGE(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
11.	WCDMA(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
12.	LTE(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
13.	GPRS/EDGE(data) + WLAN5GHz(data)				
14.	WCDMA(data) + WLAN5GHz(data)				
15.	LTE(data) + WLAN5GHz(data)				

**General Note:**

- This device supported VoIP in EGPRS, WCDMA, LTE (e.g. 3rd party VoIP).
- WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
- EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
- The worst case reported SAR for each configuration was used for SAR summation. Therefore, the following summations represent the absolute worst cases for simultaneous transmission.
- The Scaled SAR summation is calculated based on the same configuration and test position.
- Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
  - Scalar SAR summation < 1.6W/kg.
  - $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ , where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
  - If  $SPLSR \leq 0.04$ , simultaneously transmission SAR measurement is not necessary.
  - Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.
- For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
  - $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$  for test separation distances  $\leq 50 \text{ mm}$ ; where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.
  - When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
  - 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Bluetooth Max Power	Exposure Position	Head	Hotspot	Body worn
	Test separation	0 mm	10 mm	15 mm
9.0 dBm	Estimated SAR (W/kg)	0.336 W/kg	0.168 W/kg	0.168 W/kg





**15.1 Head Exposure Conditions**

WWAN Band		Exposure Position	1	2	3	4		1+2 Summed SAR (W/kg)	1+3 Summed SAR (W/kg)	1+4 Summed SAR (W/kg)
			WWAN	2.4GHz	2.4GHz Bluetooth	5GHz WLAN				
			SAR (W/kg)	SAR (W/kg)	Estimated SAR (W/kg)	Band	SAR (W/kg)			
GSM	GSM850	Right Cheek	0.724	0.073	0.336	5.8GHz WLAN	0.069	<b>0.80</b>	<b>1.06</b>	<b>0.79</b>
		Right Tilted	0.383	0.067	0.336	5.8GHz WLAN	0.054	<b>0.45</b>	<b>0.72</b>	<b>0.44</b>
		Left Cheek	0.423	0.231	0.336	5.5GHz WLAN	0.055	<b>0.65</b>	<b>0.76</b>	<b>0.48</b>
		Left Tilted	0.280	0.167	0.336	5.8GHz WLAN	0.046	<b>0.45</b>	<b>0.62</b>	<b>0.33</b>
	GSM1900	Right Cheek	0.447	0.073	0.336	5.8GHz WLAN	0.069	<b>0.52</b>	<b>0.78</b>	<b>0.52</b>
		Right Tilted	0.309	0.067	0.336	5.8GHz WLAN	0.054	<b>0.38</b>	<b>0.65</b>	<b>0.36</b>
		Left Cheek	0.200	0.231	0.336	5.5GHz WLAN	0.055	<b>0.43</b>	<b>0.54</b>	<b>0.26</b>
		Left Tilted	0.123	0.167	0.336	5.8GHz WLAN	0.046	<b>0.29</b>	<b>0.46</b>	<b>0.17</b>
WCDMA	Band V	Right Cheek	0.315	0.073	0.336	5.8GHz WLAN	0.069	<b>0.39</b>	<b>0.65</b>	<b>0.38</b>
		Right Tilted	0.158	0.067	0.336	5.8GHz WLAN	0.054	<b>0.23</b>	<b>0.49</b>	<b>0.21</b>
		Left Cheek	0.185	0.231	0.336	5.5GHz WLAN	0.055	<b>0.42</b>	<b>0.52</b>	<b>0.24</b>
		Left Tilted	0.131	0.167	0.336	5.8GHz WLAN	0.046	<b>0.30</b>	<b>0.47</b>	<b>0.18</b>
	Band II	Right Cheek	0.599	0.073	0.336	5.8GHz WLAN	0.069	<b>0.67</b>	<b>0.94</b>	<b>0.67</b>
		Right Tilted	0.347	0.067	0.336	5.8GHz WLAN	0.054	<b>0.41</b>	<b>0.68</b>	<b>0.40</b>
		Left Cheek	0.177	0.231	0.336	5.5GHz WLAN	0.055	<b>0.41</b>	<b>0.51</b>	<b>0.23</b>
		Left Tilted	0.179	0.167	0.336	5.8GHz WLAN	0.046	<b>0.35</b>	<b>0.52</b>	<b>0.23</b>
LTE	Band 5	Right Cheek	0.249	0.073	0.336	5.8GHz WLAN	0.069	<b>0.32</b>	<b>0.59</b>	<b>0.32</b>
		Right Tilted	0.129	0.067	0.336	5.8GHz WLAN	0.054	<b>0.20</b>	<b>0.47</b>	<b>0.18</b>
		Left Cheek	0.156	0.231	0.336	5.5GHz WLAN	0.055	<b>0.39</b>	<b>0.49</b>	<b>0.21</b>
		Left Tilted	0.085	0.167	0.336	5.8GHz WLAN	0.046	<b>0.25</b>	<b>0.42</b>	<b>0.13</b>
	Band 7	Right Cheek	0.434	0.073	0.336	5.8GHz WLAN	0.069	<b>0.51</b>	<b>0.77</b>	<b>0.50</b>
		Right Tilted	0.169	0.067	0.336	5.8GHz WLAN	0.054	<b>0.24</b>	<b>0.51</b>	<b>0.22</b>
		Left Cheek	0.206	0.231	0.336	5.5GHz WLAN	0.055	<b>0.44</b>	<b>0.54</b>	<b>0.26</b>
		Left Tilted	0.086	0.167	0.336	5.8GHz WLAN	0.046	<b>0.25</b>	<b>0.42</b>	<b>0.13</b>



**15.2 Hotspot Exposure Conditions**

WWAN Band		Exposure Position	1	2	3	1+2 Summed SAR (W/kg)	1+3 Summed SAR (W/kg)
			WWAN SAR (W/kg)	2.4GHz SAR (W/kg)	2.4GHz Bluetooth Estimated SAR (W/kg)		
GSM	GSM850	Front	0.297	0.022	0.168	<b>0.32</b>	<b>0.47</b>
		Back	0.367	0.017	0.168	<b>0.38</b>	<b>0.54</b>
		Left side	0.291	0.001	0.168	<b>0.29</b>	<b>0.46</b>
		Right side	0.251	0.019	0.168	<b>0.27</b>	<b>0.42</b>
		Top side	0.063	0.012	0.168	<b>0.08</b>	<b>0.23</b>
		Bottom side	0.159			<b>0.16</b>	<b>0.16</b>
	GSM1900	Front	0.155	0.022	0.168	<b>0.18</b>	<b>0.32</b>
		Back	0.150	0.017	0.168	<b>0.17</b>	<b>0.32</b>
		Left side	0.123	0.001	0.168	<b>0.12</b>	<b>0.29</b>
		Right side	0.024	0.019	0.168	<b>0.04</b>	<b>0.19</b>
		Top side	0.059	0.012	0.168	<b>0.07</b>	<b>0.23</b>
		Bottom side	0.172			<b>0.17</b>	<b>0.17</b>
WCDMA	Band V	Front	0.129	0.022	0.168	<b>0.15</b>	<b>0.30</b>
		Back	0.162	0.017	0.168	<b>0.18</b>	<b>0.33</b>
		Left side	0.134	0.001	0.168	<b>0.14</b>	<b>0.30</b>
		Right side	0.117	0.019	0.168	<b>0.14</b>	<b>0.29</b>
		Top side	0.025	0.012	0.168	<b>0.04</b>	<b>0.19</b>
		Bottom side	0.067			<b>0.07</b>	<b>0.07</b>
	Band II	Front	0.167	0.022	0.168	<b>0.19</b>	<b>0.34</b>
		Back	0.109	0.017	0.168	<b>0.13</b>	<b>0.28</b>
		Left side	0.119	0.001	0.168	<b>0.12</b>	<b>0.29</b>
		Right side	0.024	0.019	0.168	<b>0.04</b>	<b>0.19</b>
		Top side	0.089	0.012	0.168	<b>0.10</b>	<b>0.26</b>
		Bottom side	0.136			<b>0.14</b>	<b>0.14</b>
LTE	Band 5	Front	0.152	0.022	0.168	<b>0.17</b>	<b>0.32</b>
		Back	0.184	0.017	0.168	<b>0.20</b>	<b>0.35</b>
		Left side	0.144	0.001	0.168	<b>0.15</b>	<b>0.31</b>
		Right side	0.111	0.019	0.168	<b>0.13</b>	<b>0.28</b>
		Top side	0.020	0.012	0.168	<b>0.03</b>	<b>0.19</b>
		Bottom side	0.069			<b>0.07</b>	<b>0.07</b>
	Band 7	Front	0.142	0.022	0.168	<b>0.16</b>	<b>0.31</b>
		Back	0.163	0.017	0.168	<b>0.18</b>	<b>0.33</b>
		Left side	0.168	0.001	0.168	<b>0.17</b>	<b>0.34</b>
		Right side	0.003	0.019	0.168	<b>0.02</b>	<b>0.17</b>
		Top side	0.034	0.012	0.168	<b>0.05</b>	<b>0.20</b>
		Bottom side	0.089			<b>0.09</b>	<b>0.09</b>



**15.3 Body-Worn Accessory Exposure Conditions**

WWAN Band		Exposure Position	1	2	3	4		1+2 Summed SAR (W/kg)	1+3 Summed SAR (W/kg)	1.4 Summed SAR (W/kg)
			WWAN	2.4GHz	2.4GHz Bluetooth	5GHz WLAN				
			SAR (W/kg)	SAR (W/kg)	Estimated SAR (W/kg)	Band	SAR (W/kg)			
GSM	GSM850	Front	0.297	0.022	0.168	5.3GHz WLAN	0.023	<b>0.32</b>	<b>0.47</b>	<b>0.32</b>
		Back	0.367	0.017	0.168	5.8GHz WLAN	0.024	<b>0.38</b>	<b>0.54</b>	<b>0.39</b>
	GSM1900	Front	0.155	0.022	0.168	5.3GHz WLAN	0.023	<b>0.18</b>	<b>0.32</b>	<b>0.18</b>
		Back	0.150	0.017	0.168	5.8GHz WLAN	0.024	<b>0.17</b>	<b>0.32</b>	<b>0.17</b>
WCDMA	Band V	Front	0.129	0.022	0.168	5.3GHz WLAN	0.023	<b>0.15</b>	<b>0.30</b>	<b>0.15</b>
		Back	0.162	0.017	0.168	5.8GHz WLAN	0.024	<b>0.18</b>	<b>0.33</b>	<b>0.19</b>
	Band II	Front	0.167	0.022	0.168	5.3GHz WLAN	0.023	<b>0.19</b>	<b>0.34</b>	<b>0.19</b>
		Back	0.109	0.017	0.168	5.8GHz WLAN	0.024	<b>0.13</b>	<b>0.28</b>	<b>0.13</b>
LTE	Band 5	Front	0.152	0.022	0.168	5.3GHz WLAN	0.023	<b>0.17</b>	<b>0.32</b>	<b>0.19</b>
		Back	0.184	0.017	0.168	5.8GHz WLAN	0.024	<b>0.20</b>	<b>0.35</b>	<b>0.19</b>
	Band 7	Front	0.142	0.022	0.168	5.3GHz WLAN	0.023	<b>0.16</b>	<b>0.31</b>	<b>0.19</b>
		Back	0.163	0.017	0.168	5.8GHz WLAN	0.024	<b>0.18</b>	<b>0.33</b>	<b>0.19</b>

Test Engineer : Lawrence Chen, Jerry Hu, Steven Chang, Aaron Chen and Frank Wu

## **16. 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 16.1. 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 Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
<b>Measurement System</b>							
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	1	± 0.2 %	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
<b>Test Sample Related</b>							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
<b>Phantom and Setup</b>							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
<b>Combined Standard Uncertainty</b>						± 11.0 %	± 10.8 %
<b>Coverage Factor for 95 %</b>						K=2	
<b>Expanded Uncertainty</b>						± 22.0 %	± 21.5 %

Table 16.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
<b>Measurement System</b>							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Probe Positioning	9.9	Rectangular	√3	1	1	± 5.7 %	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
<b>Test Sample Related</b>							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
<b>Phantom and Setup</b>							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
<b>Combined Standard Uncertainty</b>						± 12.8 %	± 12.6 %
<b>Coverage Factor for 95 %</b>						K=2	
<b>Expanded Uncertainty</b>						± 25.6 %	± 25.2 %

**Table 16.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz**



## **17. References**

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] ANSI/IEEE Std. C95.1-1992, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", September 1992
- [3] IEEE Std. 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 248227 D01 v01r02, "SAR Measurement Procedures for 802.11 a/b/g Transmitters", May 2007
- [6] FCC KDB 447498 D01 v05r02, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Feb 2014
- [7] FCC KDB 648474 D04 v01r02, "SAR Evaluation Considerations for Wireless Handsets", Dec 2013.
- [8] FCC KDB 941225 D01 v03, "3G SAR MEAUREMENT PROCEDURES", Oct 2014
- [9] FCC KDB 941225 D05 v02r03, "SAR Evaluation Considerations for LTE Devices", Dec 2013
- [10] FCC KDB 941225 D06 v02, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2014.
- [11] FCC KDB 865664 D01 v01r03, "SAR Measurement Requirements for 100 MHz to 6 GHz", Feb 2014.
- [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\_Head\_835MHz\_150220

### DUT: D835V2-4d162

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

Medium: HSL\_850\_150220 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.884 \text{ S/m}$ ;  $\epsilon_r = 40.96$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.4 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.4 \text{ }^\circ\text{C}$

### DASY5 Configuration:

- Probe: ES3DV3 - SN3270; ConvF(6.43, 6.43, 6.43); Calibrated: 2014/9/26;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2014/8/21
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) =  $2.50 \text{ W/kg}$

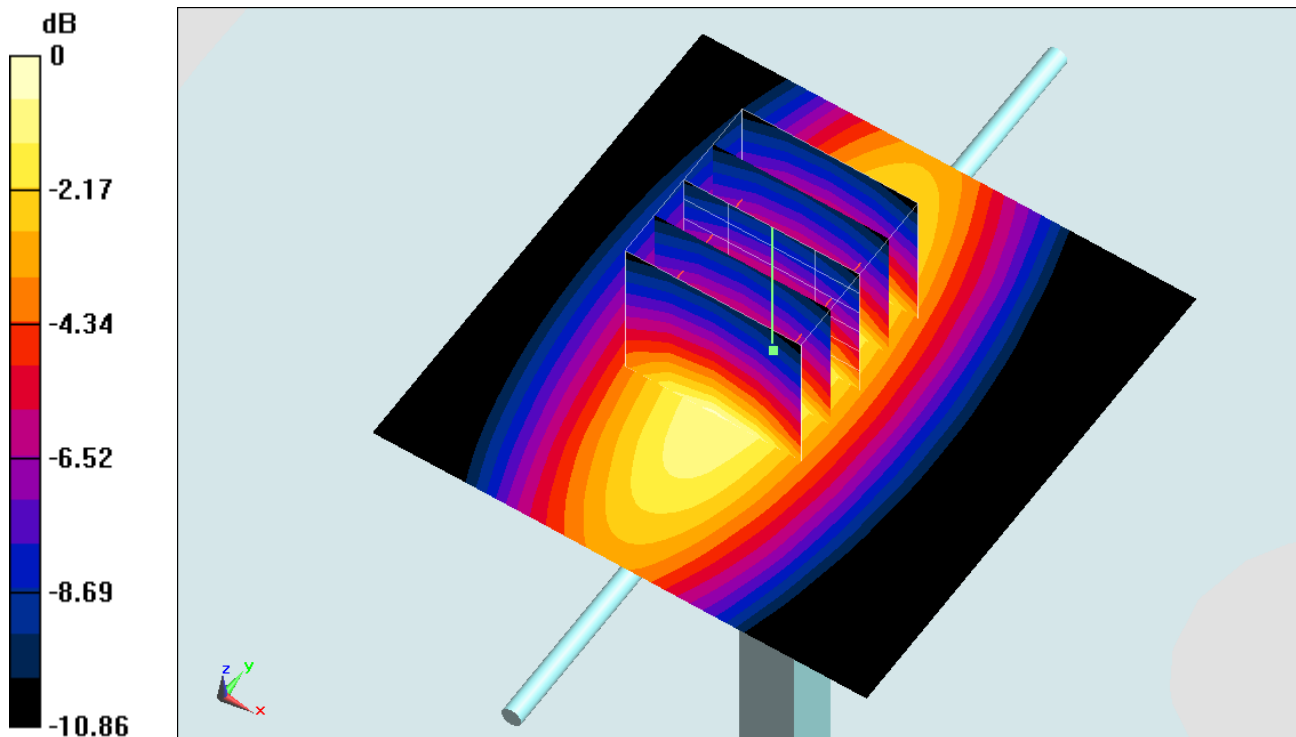
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $55.655 \text{ V/m}$ ; Power Drift =  $0.07 \text{ dB}$

Peak SAR (extrapolated) =  $3.52 \text{ W/kg}$

**SAR(1 g) =  $2.14 \text{ W/kg}$ ; SAR(10 g) =  $1.38 \text{ W/kg}$**

Maximum value of SAR (measured) =  $2.79 \text{ W/kg}$



0 dB =  $2.79 \text{ W/kg}$  =  $4.46 \text{ dBW/kg}$

## System Check\_Head\_835MHz\_150302

### DUT: D835V2-4d162

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

Medium: HSL\_850\_150302 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.922 \text{ S/m}$ ;  $\epsilon_r = 41.877$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.3 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.3 \text{ }^\circ\text{C}$

### DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.93, 8.93, 8.93); Calibrated: 2014/9/29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2014/9/24
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1446
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Maximum value of SAR (interpolated) =  $3.22 \text{ W/kg}$

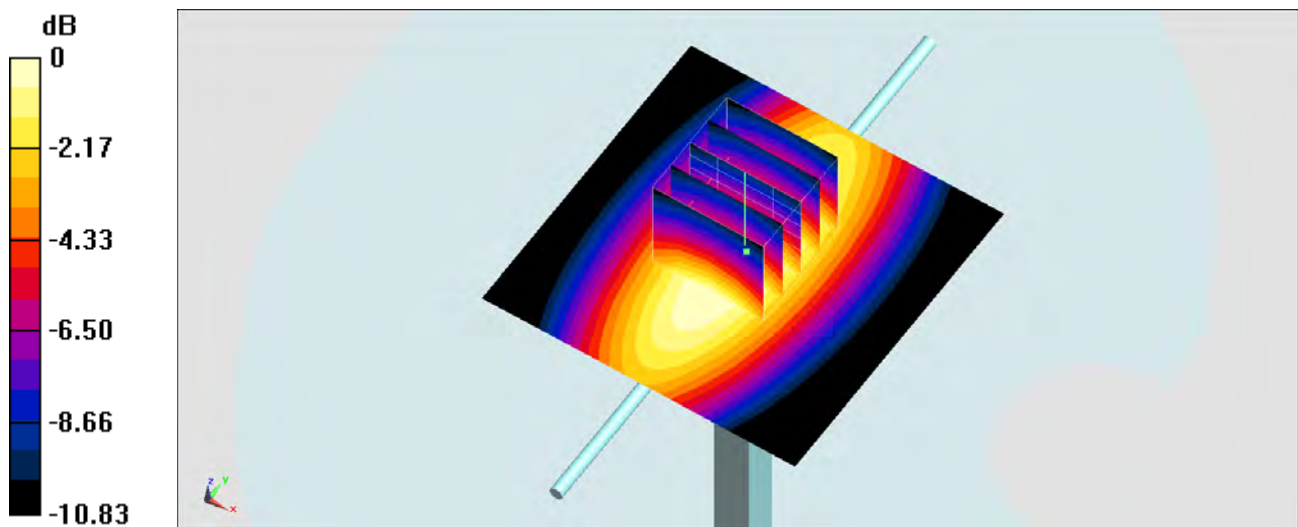
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $61.64 \text{ V/m}$ ; Power Drift =  $-0.02 \text{ dB}$

Peak SAR (extrapolated) =  $3.53 \text{ W/kg}$

**SAR(1 g) =  $2.36 \text{ W/kg}$ ; SAR(10 g) =  $1.54 \text{ W/kg}$**

Maximum value of SAR (measured) =  $2.99 \text{ W/kg}$



0 dB =  $2.99 \text{ W/kg} = 4.76 \text{ dBW/kg}$

## System Check\_Body\_835MHz\_150219

### DUT: D835V2-4d162

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

Medium: MSL\_850\_150219 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.938 \text{ S/m}$ ;  $\epsilon_r = 53.717$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.4 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.4 \text{ }^\circ\text{C}$

### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(10.13, 10.13, 10.13); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) =  $2.94 \text{ W/kg}$

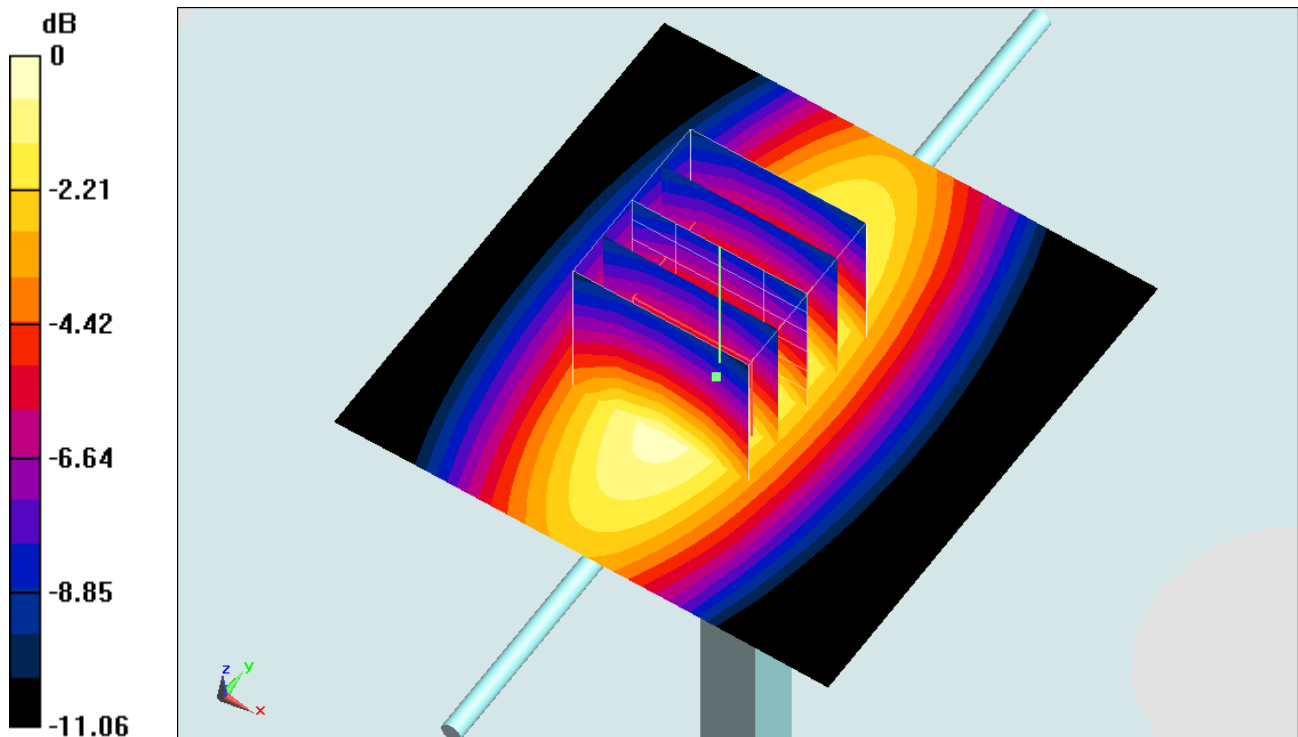
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $57.073 \text{ V/m}$ ; Power Drift =  $-0.01 \text{ dB}$

Peak SAR (extrapolated) =  $3.42 \text{ W/kg}$

**SAR(1 g) =  $2.36 \text{ W/kg}$ ; SAR(10 g) =  $1.57 \text{ W/kg}$**

Maximum value of SAR (measured) =  $2.95 \text{ W/kg}$



0 dB =  $2.95 \text{ W/kg}$  =  $4.70 \text{ dBW/kg}$

## System Check\_Body\_835MHz\_150303

### DUT: D835V2-4d162

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

Medium: MSL\_850\_150303 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.973 \text{ S/m}$ ;  $\epsilon_r = 54.315$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.4 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.4 \text{ }^\circ\text{C}$

### DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.75, 8.75, 8.75); Calibrated: 2014/9/29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2014/9/24
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1446
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

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

Maximum value of SAR (interpolated) =  $3.14 \text{ W/kg}$

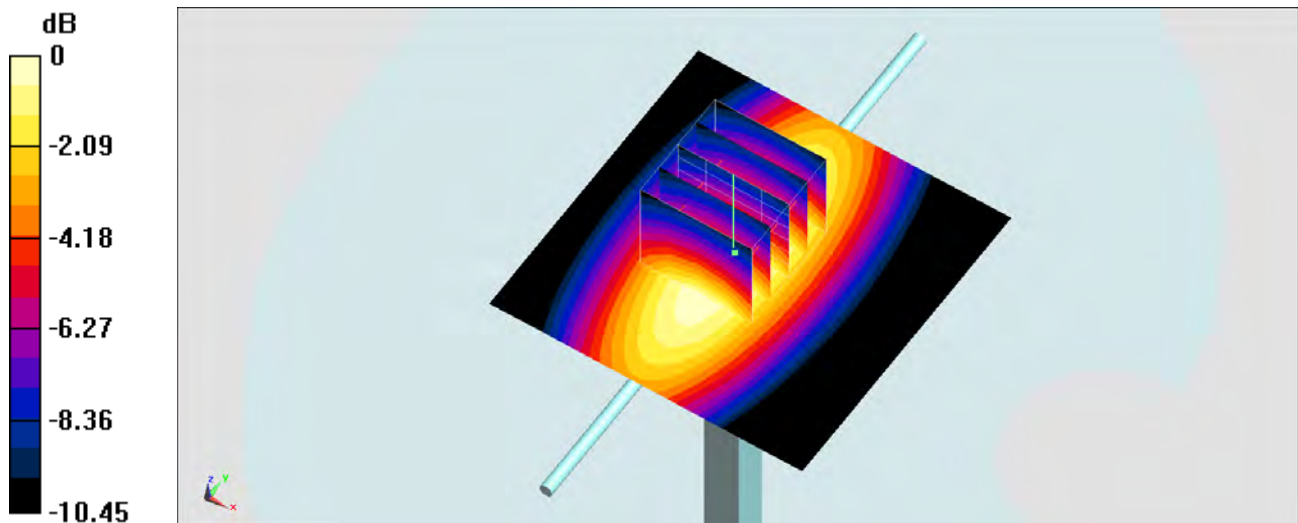
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $58.98 \text{ V/m}$ ; Power Drift =  $-0.14 \text{ dB}$

Peak SAR (extrapolated) =  $3.64 \text{ W/kg}$

**SAR(1 g) =  $2.45 \text{ W/kg}$ ; SAR(10 g) =  $1.62 \text{ W/kg}$**

Maximum value of SAR (measured) =  $3.07 \text{ W/kg}$



0 dB =  $3.07 \text{ W/kg}$  =  $4.87 \text{ dBW/kg}$

## System Check\_Body\_835MHz\_150303

### DUT: D835V2-4d162

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

Medium: MSL\_850\_150303 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.973 \text{ S/m}$ ;  $\epsilon_r = 54.315$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.4 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.4 \text{ }^\circ\text{C}$

### DASY5 Configuration:

- Probe: EX3DV4 - SN3820; ConvF(9.01, 9.01, 9.01); Calibrated: 2014/5/15;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2014/9/24
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1446
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Maximum value of SAR (interpolated) =  $3.02 \text{ W/kg}$

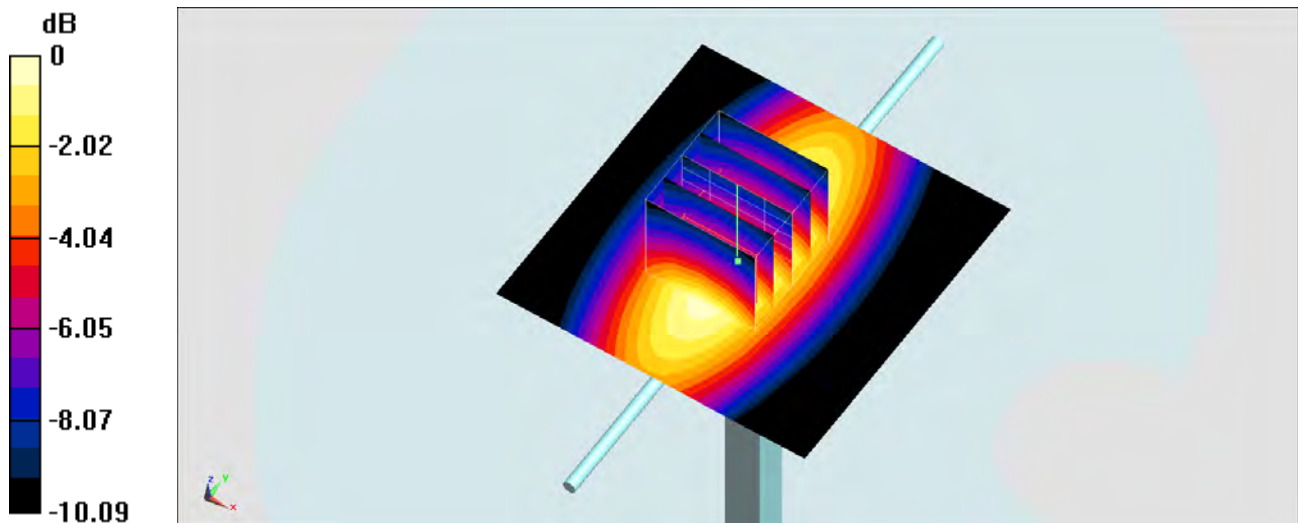
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $56.65 \text{ V/m}$ ; Power Drift =  $-0.00 \text{ dB}$

Peak SAR (extrapolated) =  $3.47 \text{ W/kg}$

**SAR(1 g) =  $2.4 \text{ W/kg}$ ; SAR(10 g) =  $1.6 \text{ W/kg}$**

Maximum value of SAR (measured) =  $2.98 \text{ W/kg}$



0 dB =  $2.98 \text{ W/kg}$  =  $4.74 \text{ dBW/kg}$

## System Check\_Head\_1900MHz\_150220

### DUT: D1900V2-5d182

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

Medium: HSL\_1900\_150220 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.429$  S/m;  $\epsilon_r = 40.06$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration:

- Probe: ES3DV3 - SN3270; ConvF(5.05, 5.05, 5.05); Calibrated: 2014/9/26;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2014/8/21
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

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

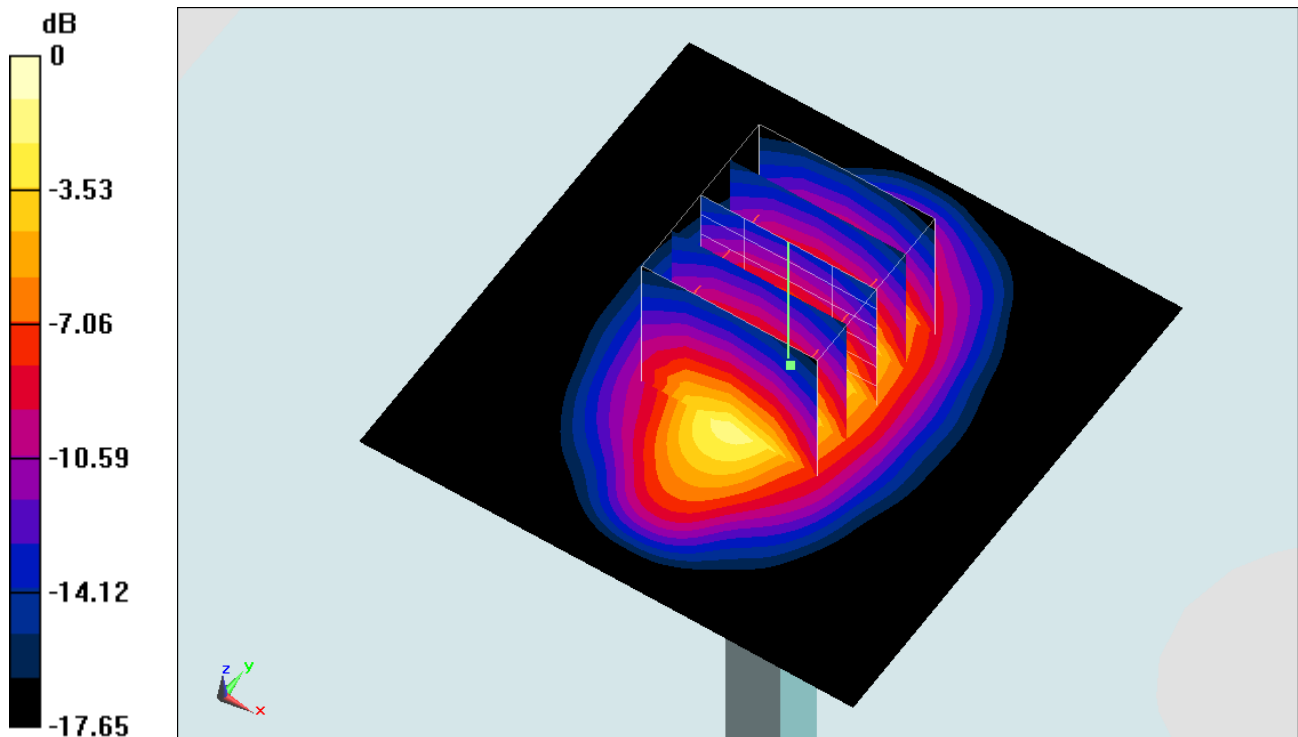
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 99.485 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 18.5 W/kg

**SAR(1 g) = 9.81 W/kg; SAR(10 g) = 5.08 W/kg**

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



0 dB = 14.0 W/kg = 11.46 dBW/kg

## System Check\_Body\_1900MHz\_150219

### DUT: D1900V2-5d182

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

Medium: MSL\_1900\_150219 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.524$  S/m;  $\epsilon_r = 54.037$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.8, 7.8, 7.8); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 15.1 W/kg

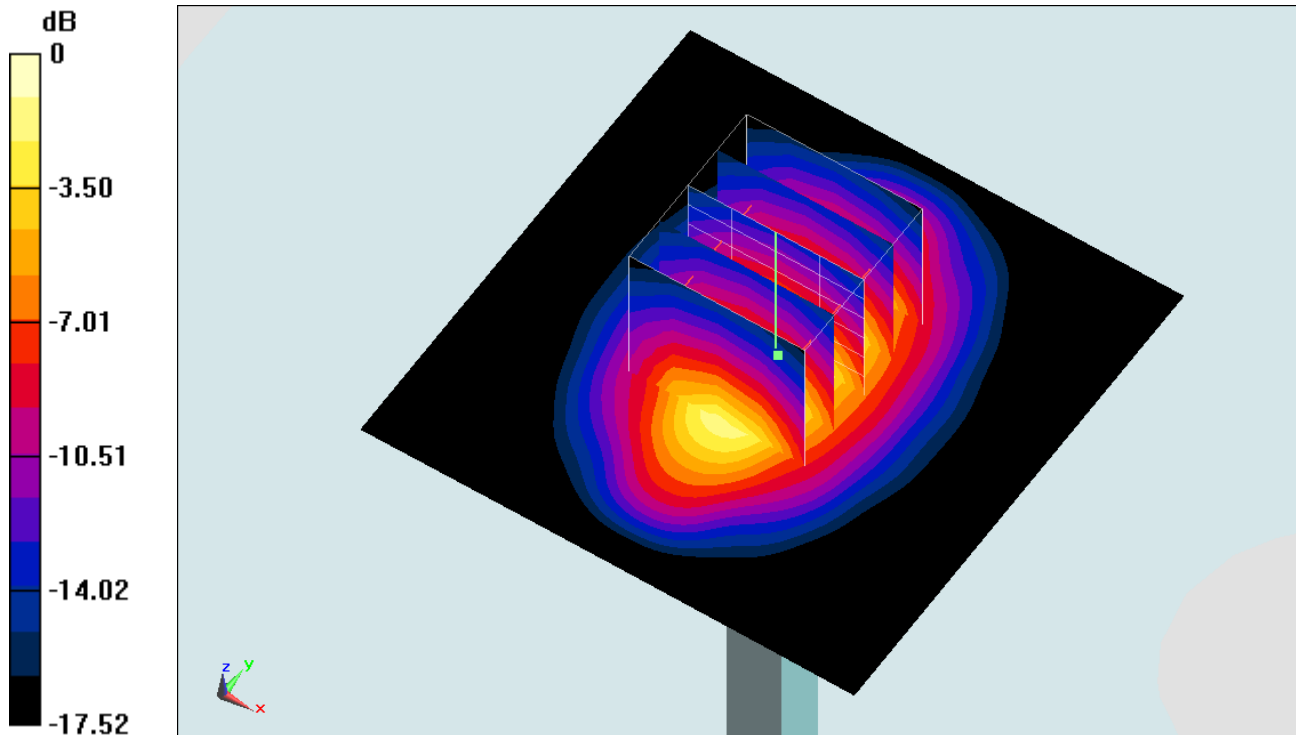
**Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 103.7 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 17.7 W/kg

**SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.17 W/kg**

Maximum value of SAR (measured) = 14.9 W/kg



0 dB = 14.9 W/kg = 11.73 dBW/kg

## System Check\_Head\_2450MHz\_150220

### DUT: D2450V2-924

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

Medium: HSL\_2450\_150220 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.861$  S/m;  $\epsilon_r = 39.392$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(7.25, 7.25, 7.25); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 28.0 W/kg

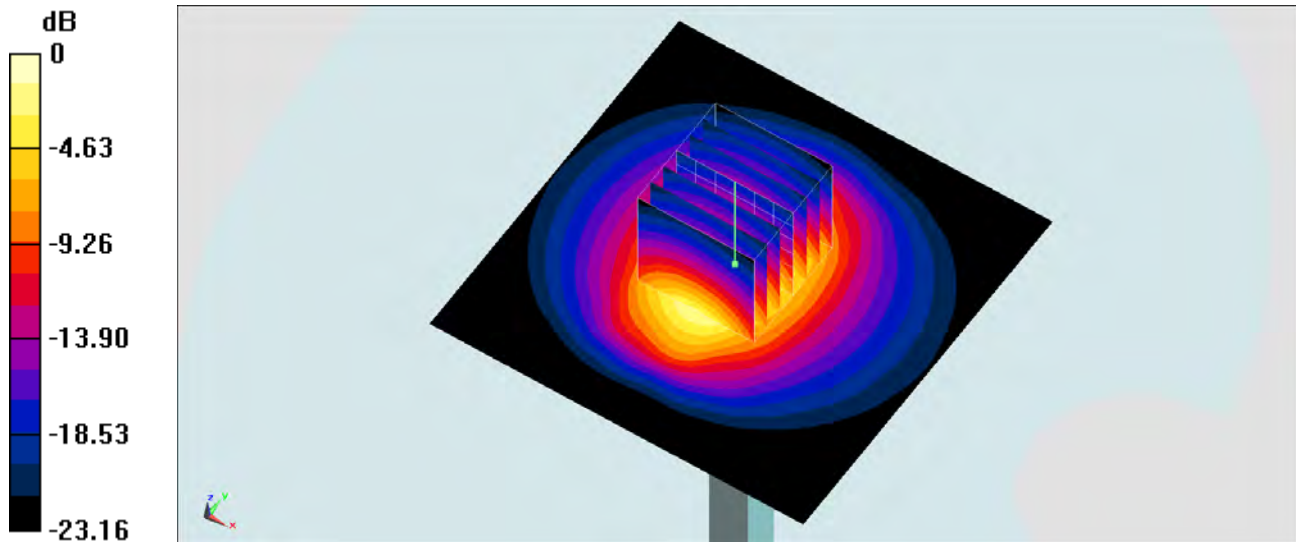
**Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 125.0 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 29.2 W/kg

**SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6 W/kg**

Maximum value of SAR (measured) = 23.1 W/kg



0 dB = 23.1 W/kg = 13.64 dBW/kg



## System Check\_Body\_2450MHz\_150220

### DUT: D2450V2-924

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

Medium: MSL\_2450\_150220 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.026$  S/m;  $\epsilon_r = 51.576$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.6 °C; Liquid Temperature : 22.6 °C

### DASY5 Configuration:

- Probe: EX3DV4 - SN3955; ConvF(7.32, 7.32, 7.32); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2014/11/13
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1478
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Configuration/Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

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

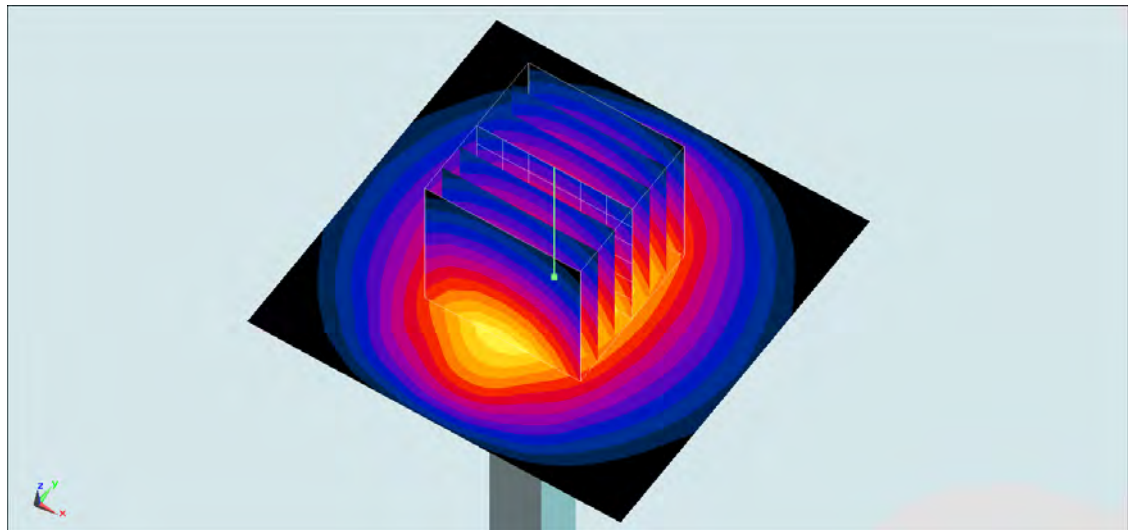
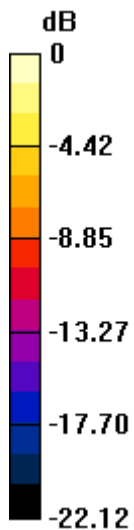
**Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.3 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 24.9 W/kg

**SAR(1 g) = 12.2 W/kg; SAR(10 g) = 5.64 W/kg**

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



0 dB = 20.3 W/kg = 13.07 dBW/kg

## System Check\_Head\_2600MHz\_150221

### DUT: D2600V2-1070

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

Medium: HSL2600\_150221 Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.023$  S/m;  $\epsilon_r = 38.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.09, 7.09, 7.09); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 24.1 W/kg

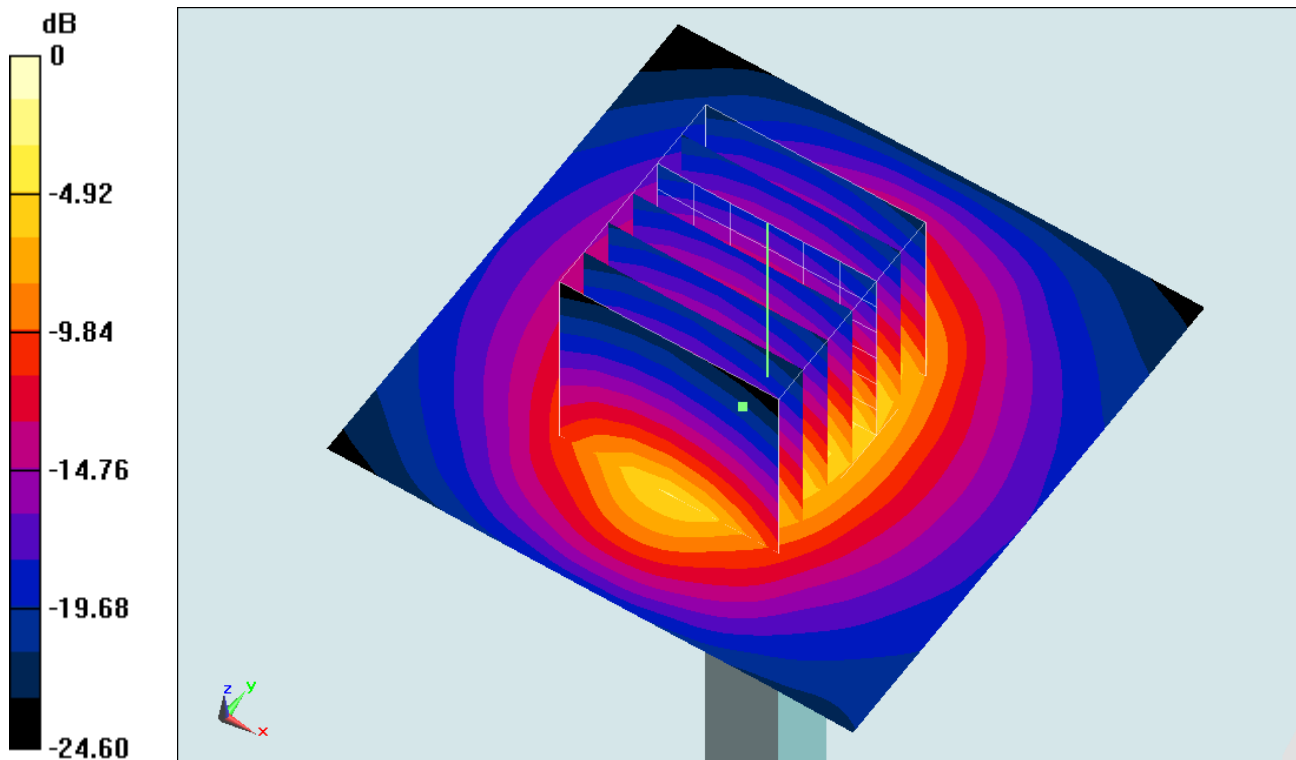
**Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.7 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 31.8 W/kg

**SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.29 W/kg**

Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 22.3 W/kg = 13.48 dBW/kg

## System Check\_Body\_2600MHz\_150220

### DUT: D2600V2-1070

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

Medium: MSL2600\_150220 Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.234$  S/m;  $\epsilon_r = 51.034$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.2, 7.2, 7.2); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

**Configuration/Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 22.7 W/kg

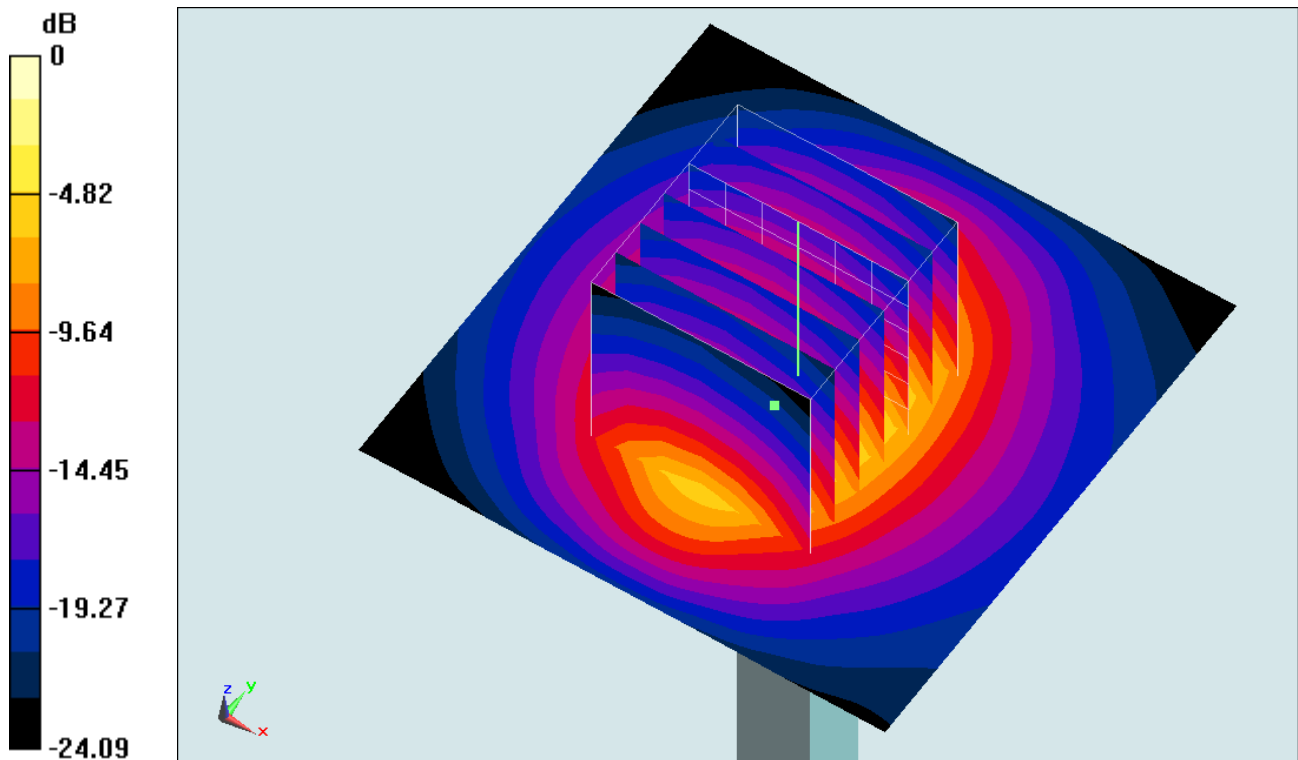
**Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.943 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 31.0 W/kg

**SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.45 W/kg**

Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.5 W/kg = 13.52 dBW/kg

## System Check\_Head\_5200MHz\_150221

### DUT: D5GHzV2-1006

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

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.585$  S/m;  $\epsilon_r = 36.242$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(5.17, 5.17, 5.17); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 21.1 W/kg

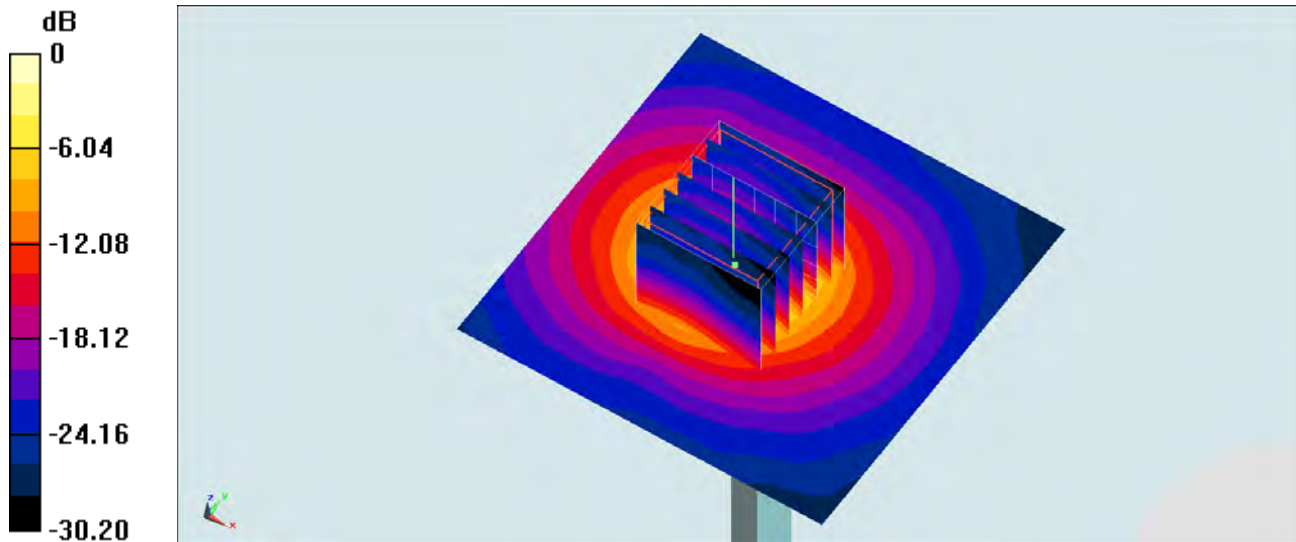
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.134 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 35.3 W/kg

**SAR(1 g) = 8.72 W/kg; SAR(10 g) = 2.47 W/kg**

Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

## System Check\_Head\_5200MHz\_150313

### DUT: D5GHzV2-1006

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

Medium: HSL\_5G\_150313 Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.8$  mho/m;  $\epsilon_r = 35.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(5.17, 5.17, 5.17); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) = 21.9 mW/g

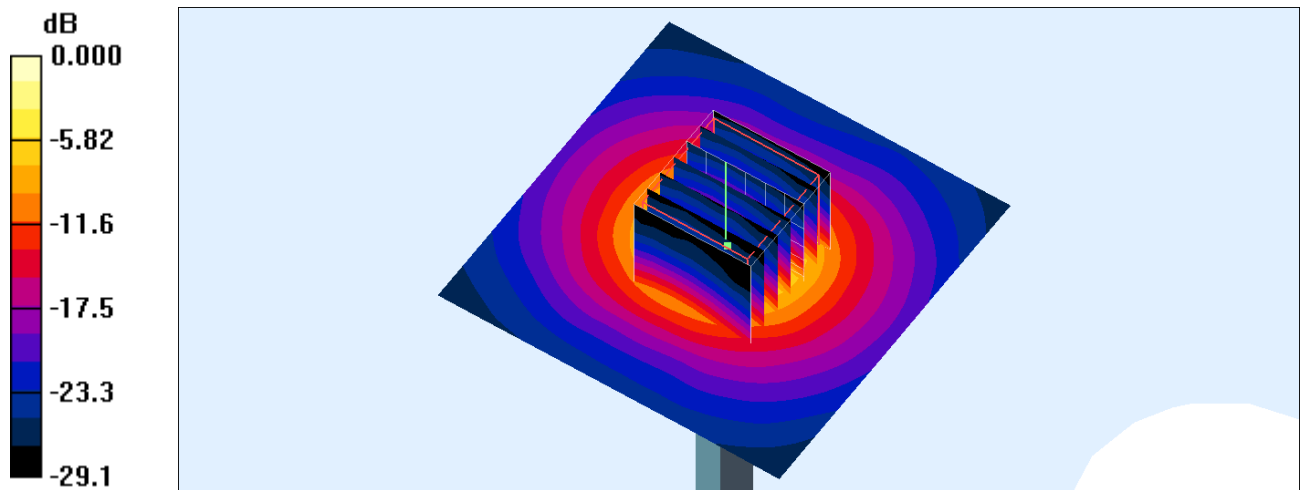
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.0 V/m; Power Drift = -0.037 dB

Peak SAR (extrapolated) = 31.6 W/kg

**SAR(1 g) = 7.95 mW/g; SAR(10 g) = 2.25 mW/g**

Maximum value of SAR (measured) = 19.3 mW/g



0 dB = 19.3mW/g

## System Check\_Body\_5200MHz\_150221

### DUT: D5GHzV2-1006

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

Medium: MSL\_5G\_150221 Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.408$  S/m;  $\epsilon_r = 47.798$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.32, 4.32, 4.32); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

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

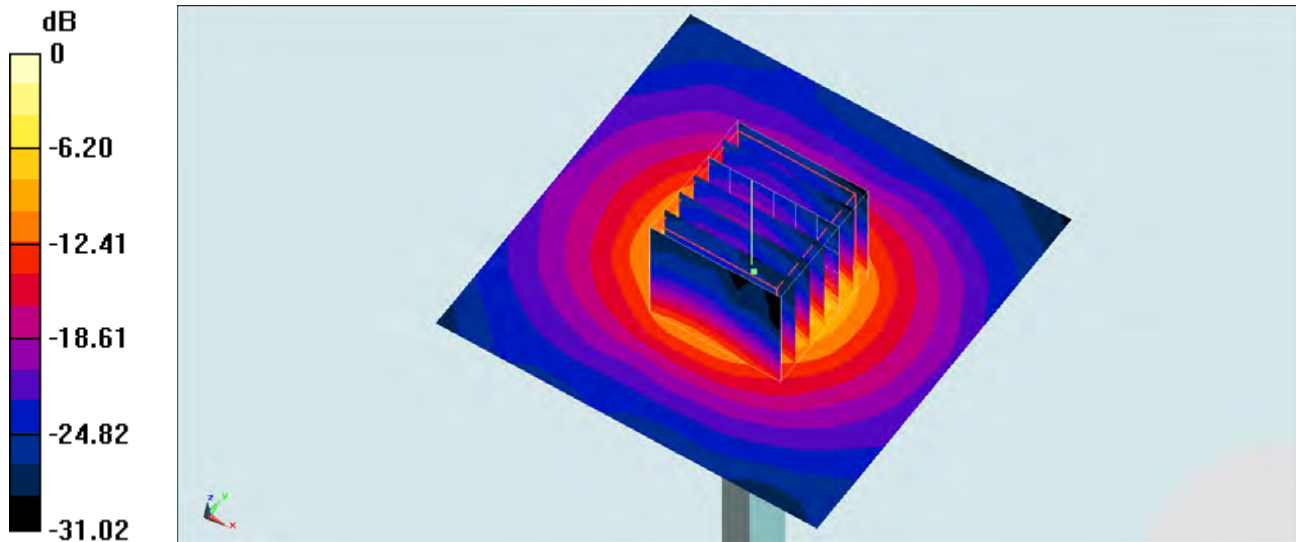
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.903 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 30.9 W/kg

**SAR(1 g) = 7.6 W/kg; SAR(10 g) = 2.1 W/kg**

Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

### System Check\_Body\_5200MHz\_150313

#### DUT: D5GHzV2-1006

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

Medium: MSL\_5G\_150313 Medium parameters used:  $f = 5200 \text{ MHz}$ ;  $\sigma = 5.33 \text{ mho/m}$ ;  $\epsilon_r = 48.6$ ;  $\rho = 1000 \text{ kg/m}^3$

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.32, 4.32, 4.32); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) =  $18.3 \text{ mW/g}$

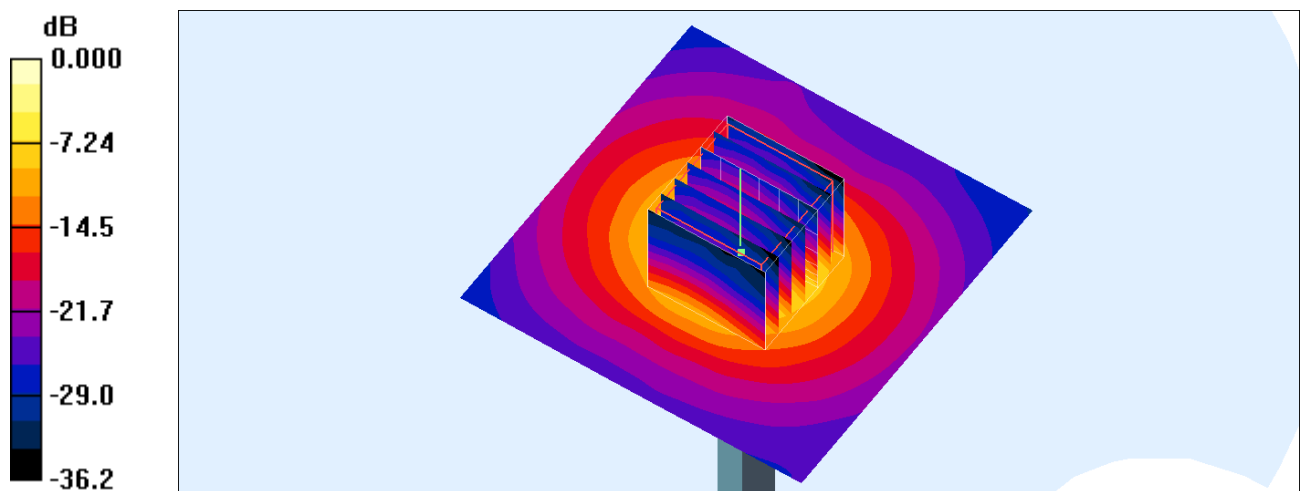
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value =  $68.1 \text{ V/m}$ ; Power Drift =  $-0.149 \text{ dB}$

Peak SAR (extrapolated) =  $30.2 \text{ W/kg}$

**SAR(1 g) =  $7.57 \text{ mW/g}$ ; SAR(10 g) =  $2.07 \text{ mW/g}$**

Maximum value of SAR (measured) =  $18.7 \text{ mW/g}$



0 dB =  $18.7 \text{ mW/g}$

## System Check\_Head\_5300MHz\_150221

### DUT: D5GHzV2-1006

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.673$  S/m;  $\epsilon_r = 36.087$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.92, 4.92, 4.92); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 23.2 W/kg

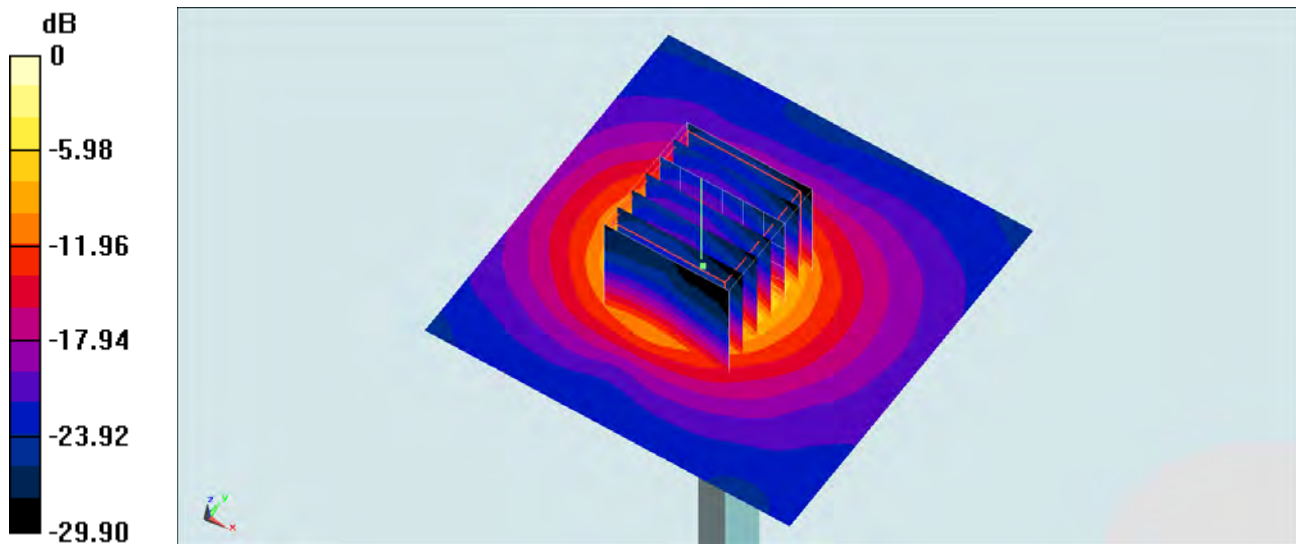
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.814 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 38.4 W/kg

**SAR(1 g) = 9.26 W/kg; SAR(10 g) = 2.59 W/kg**

Maximum value of SAR (measured) = 22.9 W/kg



0 dB = 22.9 W/kg = 13.60 dBW/kg



## System Check\_Head\_5300MHz\_150313

### DUT: D5GHzV2-1006

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: HSL\_5G\_150313 Medium parameters used:  $f = 5300 \text{ MHz}$ ;  $\sigma = 4.91 \text{ mho/m}$ ;  $\epsilon_r = 35.3$ ;  $\rho = 1000 \text{ kg/m}^3$

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.92, 4.92, 4.92); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) =  $23.3 \text{ mW/g}$

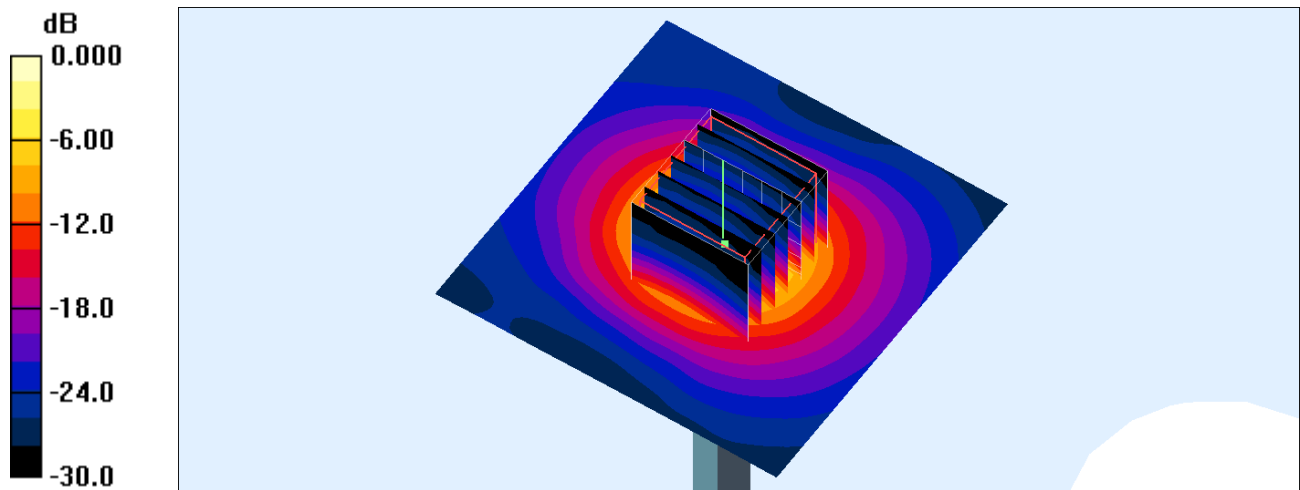
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $71.3 \text{ V/m}$ ; Power Drift =  $0.070 \text{ dB}$

Peak SAR (extrapolated) =  $39.1 \text{ W/kg}$

**SAR(1 g) =  $8.61 \text{ mW/g}$ ; SAR(10 g) =  $2.38 \text{ mW/g}$**

Maximum value of SAR (measured) =  $22.6 \text{ mW/g}$



0 dB =  $22.6\text{mW/g}$

## System Check\_Body\_5300MHz\_150221

### DUT: D5GHzV2-1006

Communication System: CW ; Frequency: 5300 MHz;Duty Cycle: 1:1

Medium: MSL\_5G\_150221 Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.549$  S/m;  $\epsilon_r = 47.628$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.15, 4.15, 4.15); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 19.8 W/kg

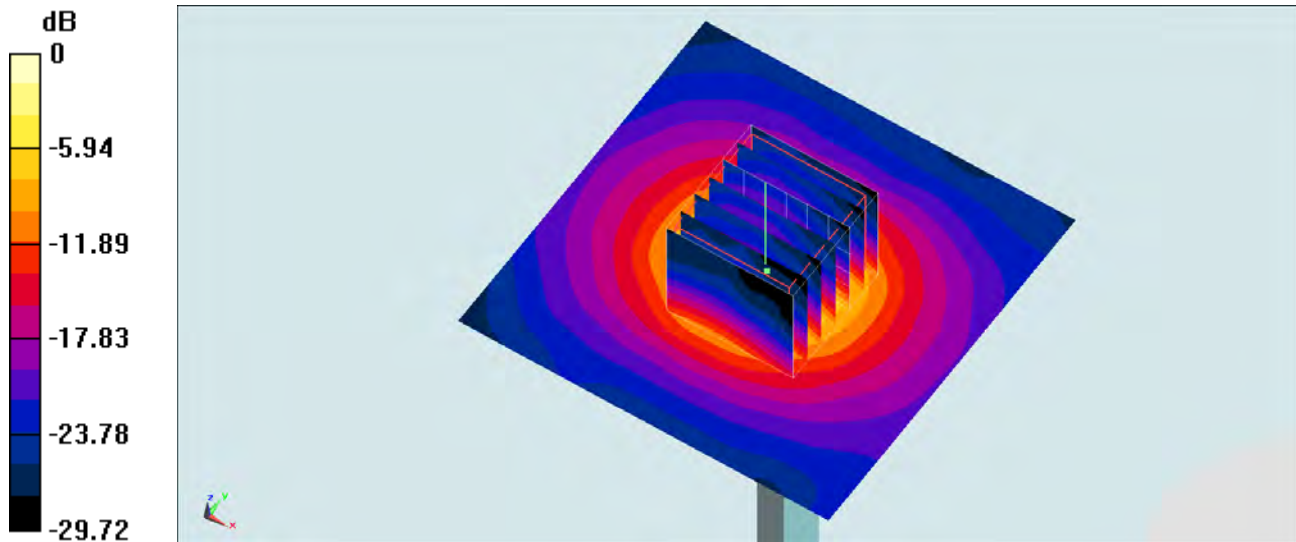
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.816 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 32.7 W/kg

**SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.23 W/kg**

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



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

## System Check\_Body\_5300MHz\_150313

### DUT: D5GHzV2-1006

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: MSL\_5G\_150313 Medium parameters used:  $f = 5300 \text{ MHz}$ ;  $\sigma = 5.47 \text{ mho/m}$ ;  $\epsilon_r = 48.5$ ;  $\rho = 1000 \text{ kg/m}^3$

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.15, 4.15, 4.15); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) =  $18.7 \text{ mW/g}$

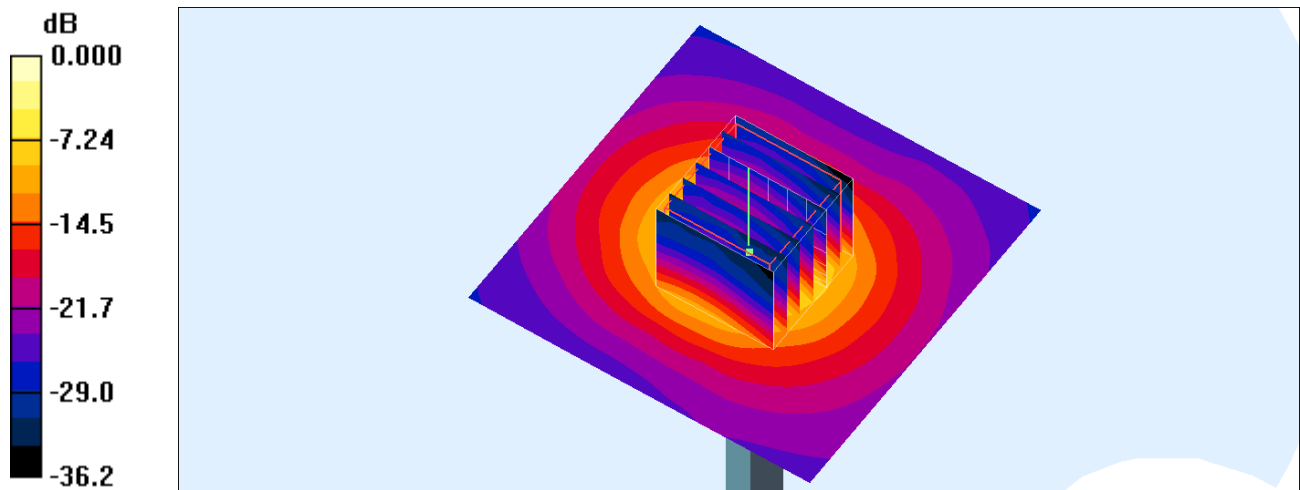
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $67.3 \text{ V/m}$ ; Power Drift =  $-0.040 \text{ dB}$

Peak SAR (extrapolated) =  $31.1 \text{ W/kg}$

**SAR(1 g) =  $7.6 \text{ mW/g}$ ; SAR(10 g) =  $2.06 \text{ mW/g}$**

Maximum value of SAR (measured) =  $19.1 \text{ mW/g}$



0 dB =  $19.1 \text{ mW/g}$

## System Check\_Head\_5600MHz\_150221

### DUT: D5GHzV2-1006

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

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.986$  S/m;  $\epsilon_r = 35.845$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 22.8 W/kg

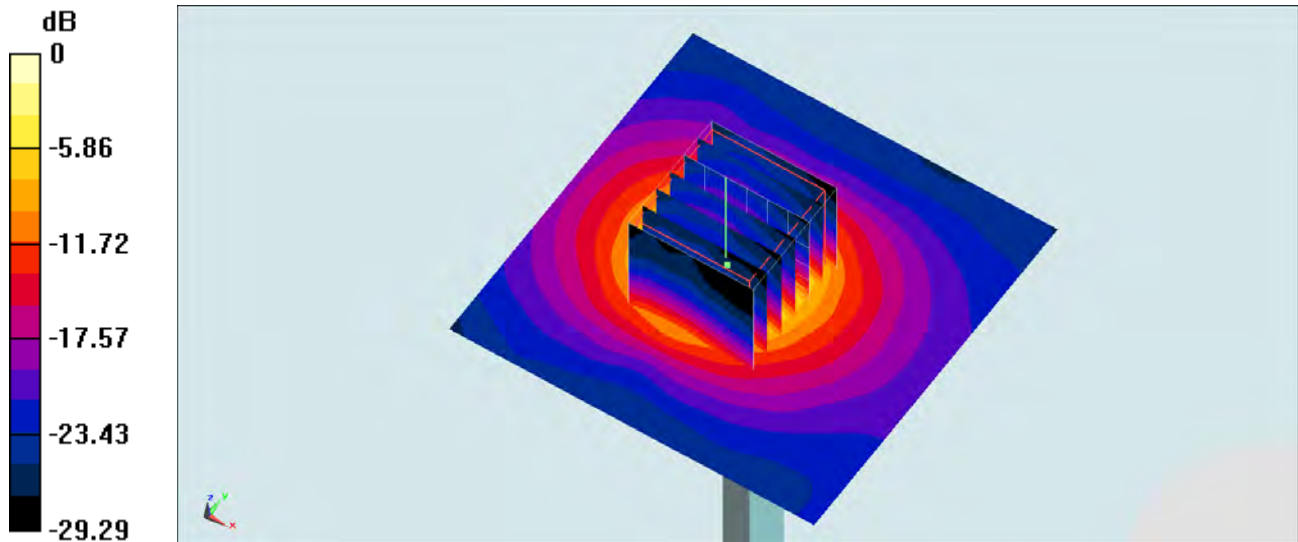
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.352 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 37.6 W/kg

**SAR(1 g) = 8.82 W/kg; SAR(10 g) = 2.46 W/kg**

Maximum value of SAR (measured) = 22.1 W/kg



0 dB = 22.1 W/kg = 13.44 dBW/kg

### System Check\_Head\_5600MHz\_150313

#### DUT: D5GHzV2-1006

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

Medium: HSL\_5G\_150313 Medium parameters used:  $f = 5600 \text{ MHz}$ ;  $\sigma = 5.22 \text{ mho/m}$ ;  $\epsilon_r = 34.7$ ;  $\rho = 1000 \text{ kg/m}^3$

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) =  $19.8 \text{ mW/g}$

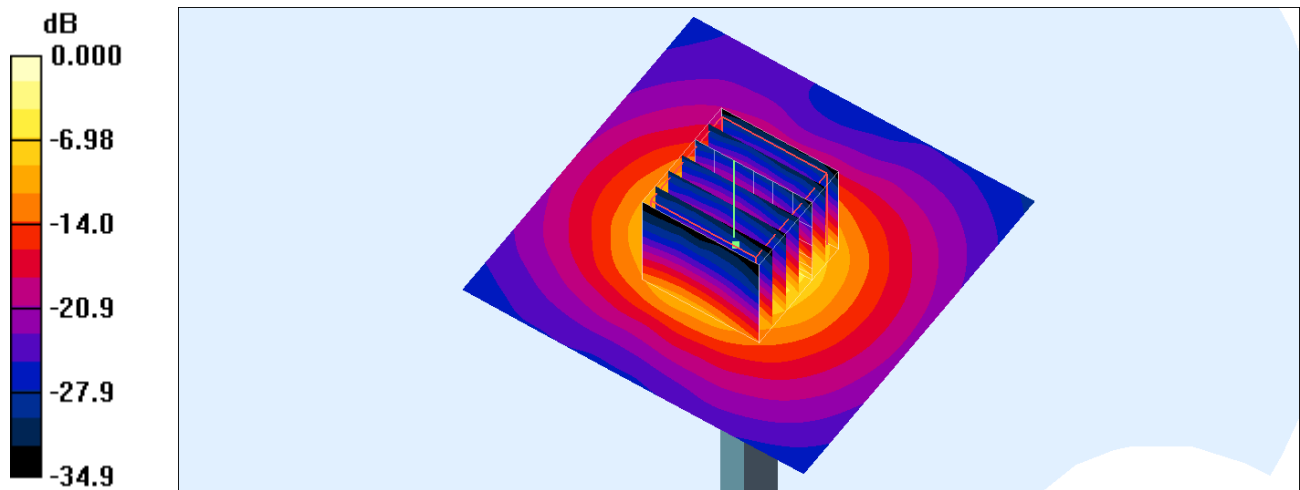
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $50.7 \text{ V/m}$ ; Power Drift =  $-0.056 \text{ dB}$

Peak SAR (extrapolated) =  $31.9 \text{ W/kg}$

**SAR(1 g) =  $8.38 \text{ mW/g}$ ; SAR(10 g) =  $2.38 \text{ mW/g}$**

Maximum value of SAR (measured) =  $19.7 \text{ mW/g}$



0 dB =  $19.7\text{mW/g}$

## System Check\_Body\_5600MHz\_150221

### DUT: D5GHzV2-1006

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

Medium: MSL\_5G\_150221 Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.934$  S/m;  $\epsilon_r = 47.048$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(3.74, 3.74, 3.74); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 22.7 W/kg

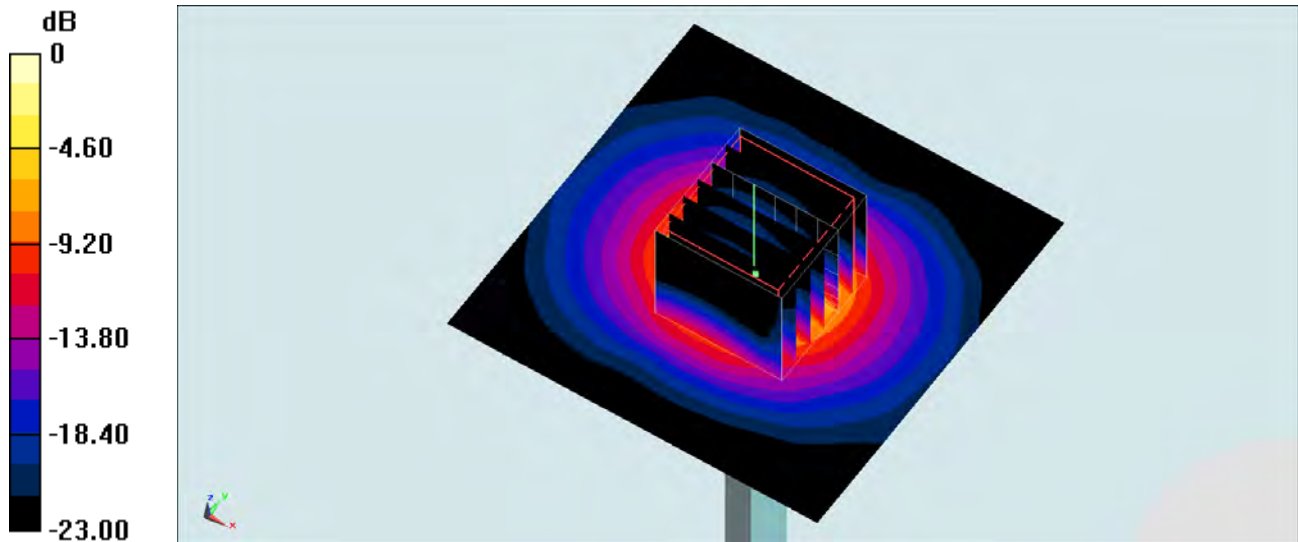
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.524 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 32.5 W/kg

**SAR(1 g) = 8.26 W/kg; SAR(10 g) = 2.3 W/kg**

Maximum value of SAR (measured) = 20.5 W/kg



0 dB = 20.5 W/kg = 13.12 dBW/kg

## System Check\_Body\_5600MHz\_150313

### DUT: D5GHzV2-1006

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

Medium: MSL\_5G\_150313 Medium parameters used:  $f = 5600 \text{ MHz}$ ;  $\sigma = 5.85 \text{ mho/m}$ ;  $\epsilon_r = 47.7$ ;  $\rho = 1000 \text{ kg/m}^3$

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(3.74, 3.74, 3.74); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) = 19.9 mW/g

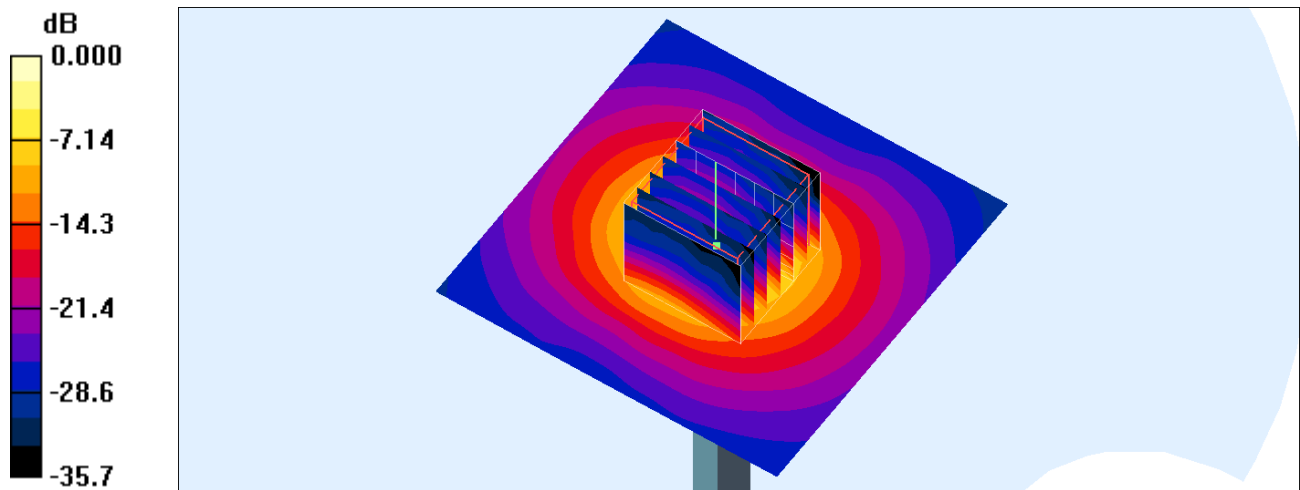
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.4 V/m; Power Drift = 0.023 dB

Peak SAR (extrapolated) = 34.0 W/kg

**SAR(1 g) = 7.94 mW/g; SAR(10 g) = 2.15 mW/g**

Maximum value of SAR (measured) = 20.4 mW/g



0 dB = 20.4mW/g

## System Check\_Head\_5800MHz\_150221

### DUT: D5GHzV2-1006

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

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.214$  S/m;  $\epsilon_r = 35.421$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.64, 4.64, 4.64); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 21.4 W/kg

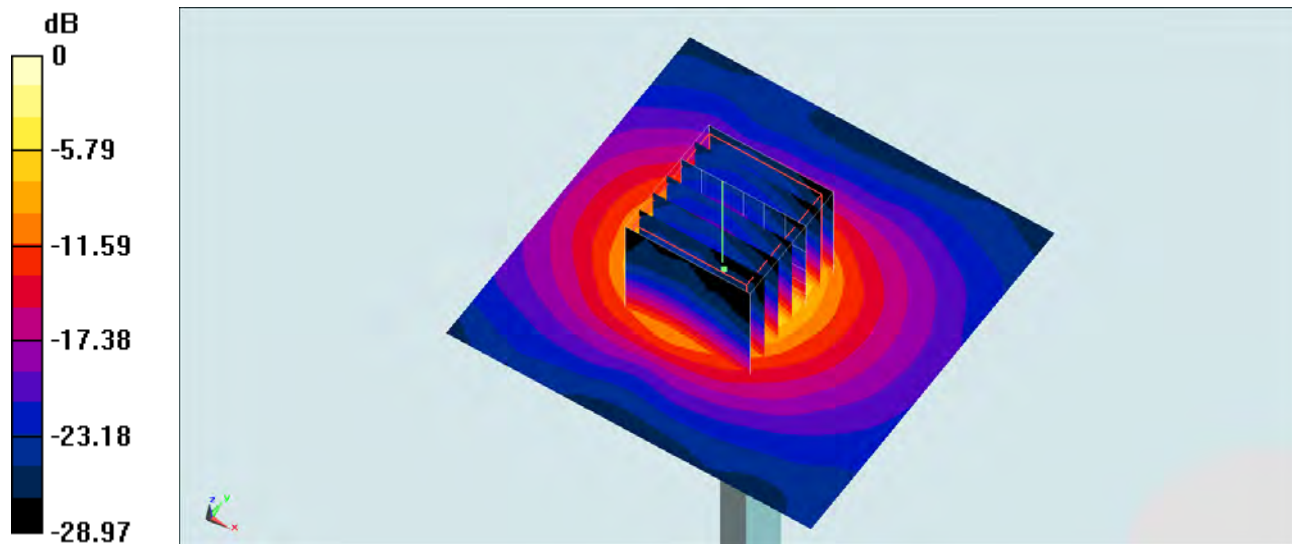
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.889 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 36.6 W/kg

**SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.3 W/kg**

Maximum value of SAR (measured) = 20.8 W/kg



0 dB = 20.8 W/kg = 13.18 dBW/kg



### System Check\_Head\_5800MHz\_150313

#### DUT: D5GHzV2-1006

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

Medium: HSL\_5G\_150313 Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.4$  mho/m;  $\epsilon_r = 34.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.64, 4.64, 4.64); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) = 22.0 mW/g

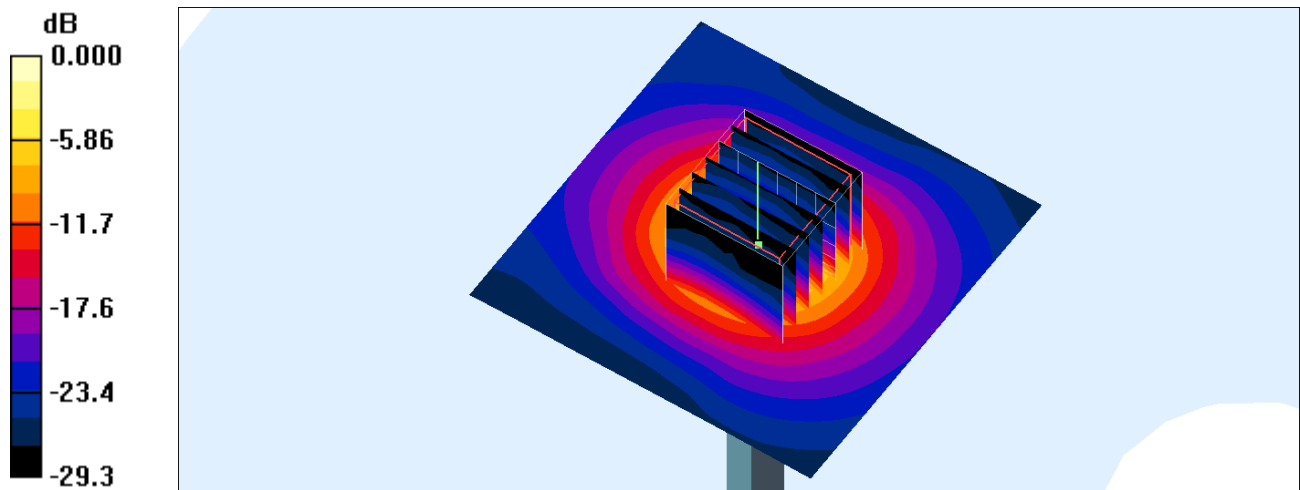
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.7 V/m; Power Drift = -0.030 dB

Peak SAR (extrapolated) = 36.6 W/kg

**SAR(1 g) = 8.09 mW/g; SAR(10 g) = 2.22 mW/g**

Maximum value of SAR (measured) = 20.9 mW/g



0 dB = 20.9mW/g

## System Check\_Body\_5800MHz\_150221

### DUT: D5GHzV2-1006

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

Medium: MSL\_5G\_150221 Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.183$  S/m;  $\epsilon_r = 46.751$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(3.96, 3.96, 3.96); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 18.3 W/kg

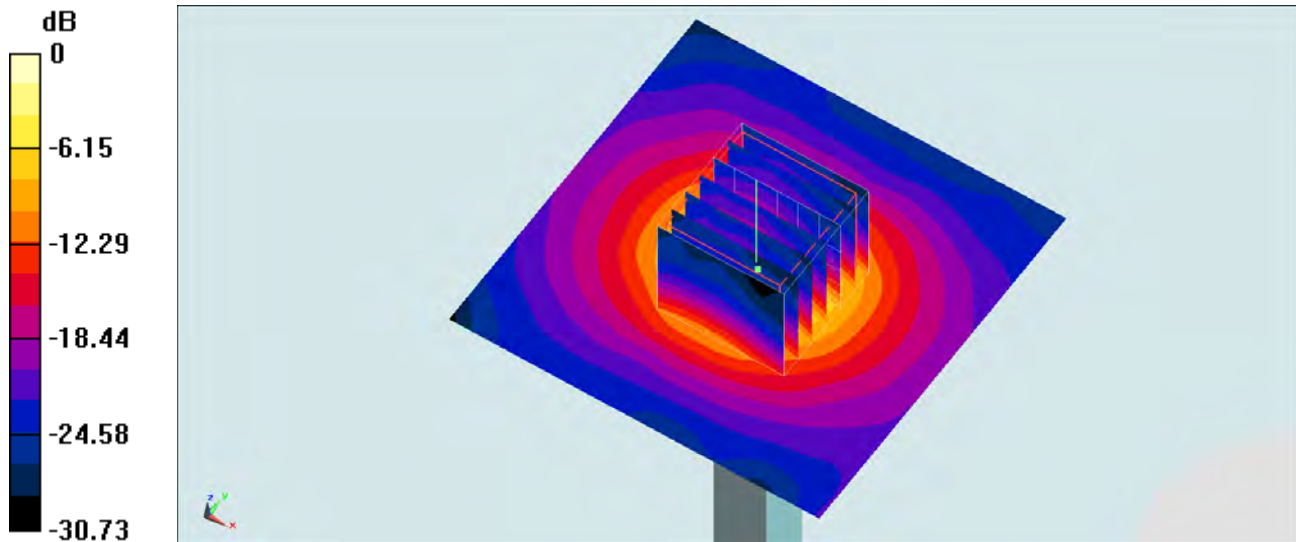
**Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.263 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 29.8 W/kg

**SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.1 W/kg**

Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.7 W/kg = 12.72 dBW/kg

### System Check\_Body\_5800MHz\_150313

#### DUT: D5GHzV2-1006

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

Medium: MSL\_5G\_150313 Medium parameters used:  $f = 5800 \text{ MHz}$ ;  $\sigma = 6.11 \text{ mho/m}$ ;  $\epsilon_r = 47.4$ ;  $\rho = 1000 \text{ kg/m}^3$

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

#### DASY4 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(3.96, 3.96, 3.96); Calibrated: 2014/11/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_Right; Type: SAM; Serial: TP-1303
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

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

Maximum value of SAR (interpolated) =  $21.2 \text{ mW/g}$

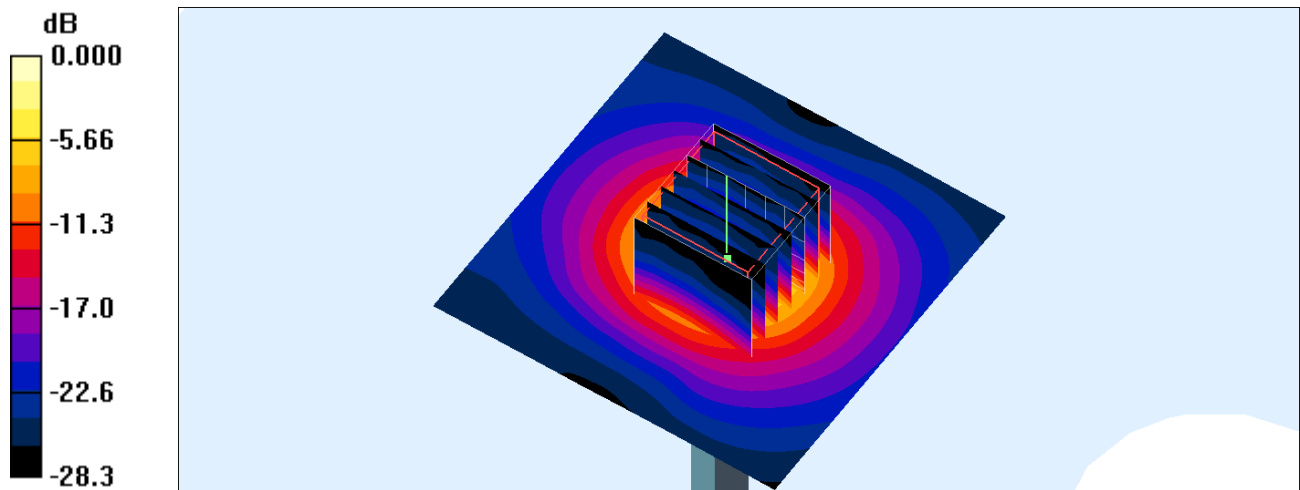
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $66.4 \text{ V/m}$ ; Power Drift =  $-0.063 \text{ dB}$

Peak SAR (extrapolated) =  $32.6 \text{ W/kg}$

**SAR(1 g) =  $7.91 \text{ mW/g}$ ; SAR(10 g) =  $2.21 \text{ mW/g}$**

Maximum value of SAR (measured) =  $19.8 \text{ mW/g}$



0 dB =  $19.8\text{mW/g}$



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**Appendix B. Plots of SAR Measurement**

The plots are shown as follows.

**#01\_GSM850\_GPRS (4 Tx slots)\_Right Cheek\_Ch189;Ant 1**

Communication System: GSM850; Frequency: 836.4 MHz; Duty Cycle: 1:2.08

Medium: HSL\_850\_150220 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.885$  S/m;  $\epsilon_r = 40.931$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3270; ConvF(6.43, 6.43, 6.43); Calibrated: 2014/9/26;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2014/8/21
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch189/Area Scan (61x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 1.10 W/kg

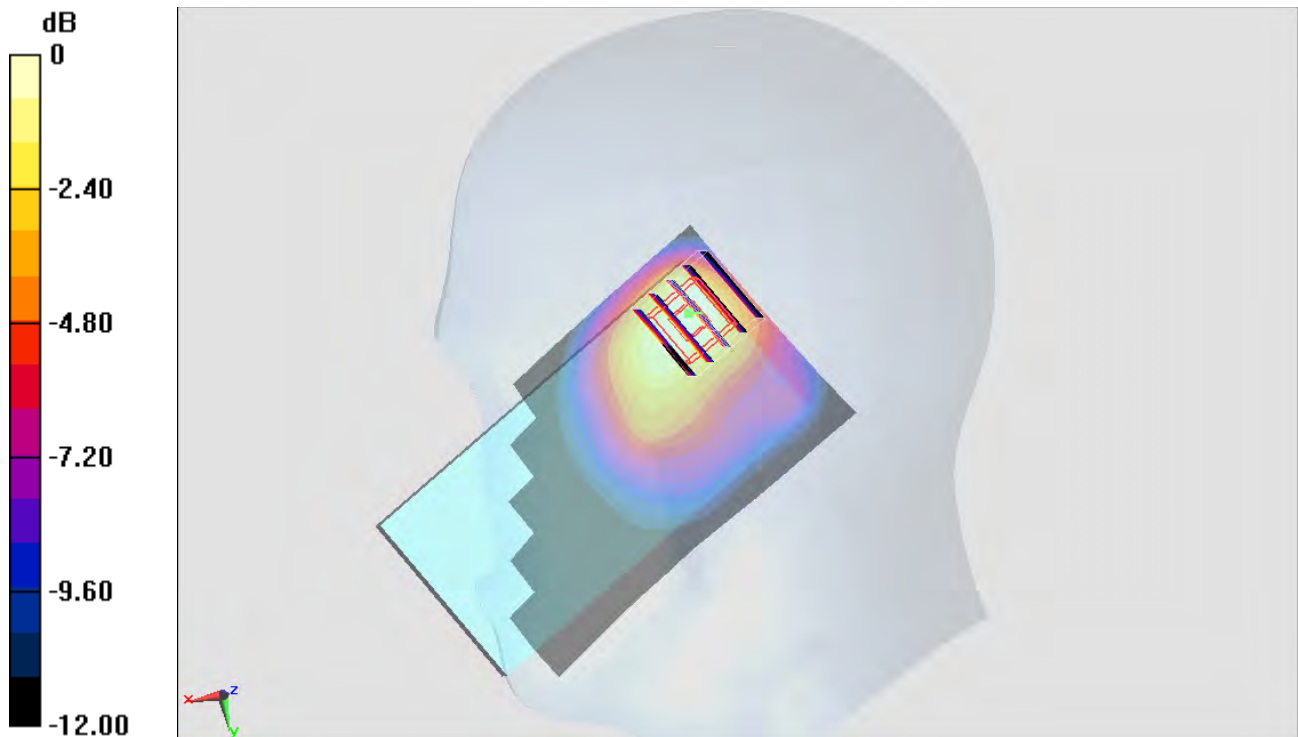
**Configuration/Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 35.058 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.24 W/kg

**SAR(1 g) = 0.711 W/kg; SAR(10 g) = 0.417 W/kg**

Maximum value of SAR (measured) = 0.968 W/kg



0 dB = 0.968 W/kg = -0.14 dBW/kg

## #02\_GSM1900\_GPRS (3 Tx slots)\_Right Cheek\_Ch661;Ant 1

Communication System: PCS; Frequency: 1880 MHz; Duty Cycle: 1:2.77

Medium: HSL\_1900\_150220 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.399$  S/m;  $\epsilon_r = 40.082$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3270; ConvF(5.05, 5.05, 5.05); Calibrated: 2014/9/26;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2014/8/21
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch661/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.705 W/kg

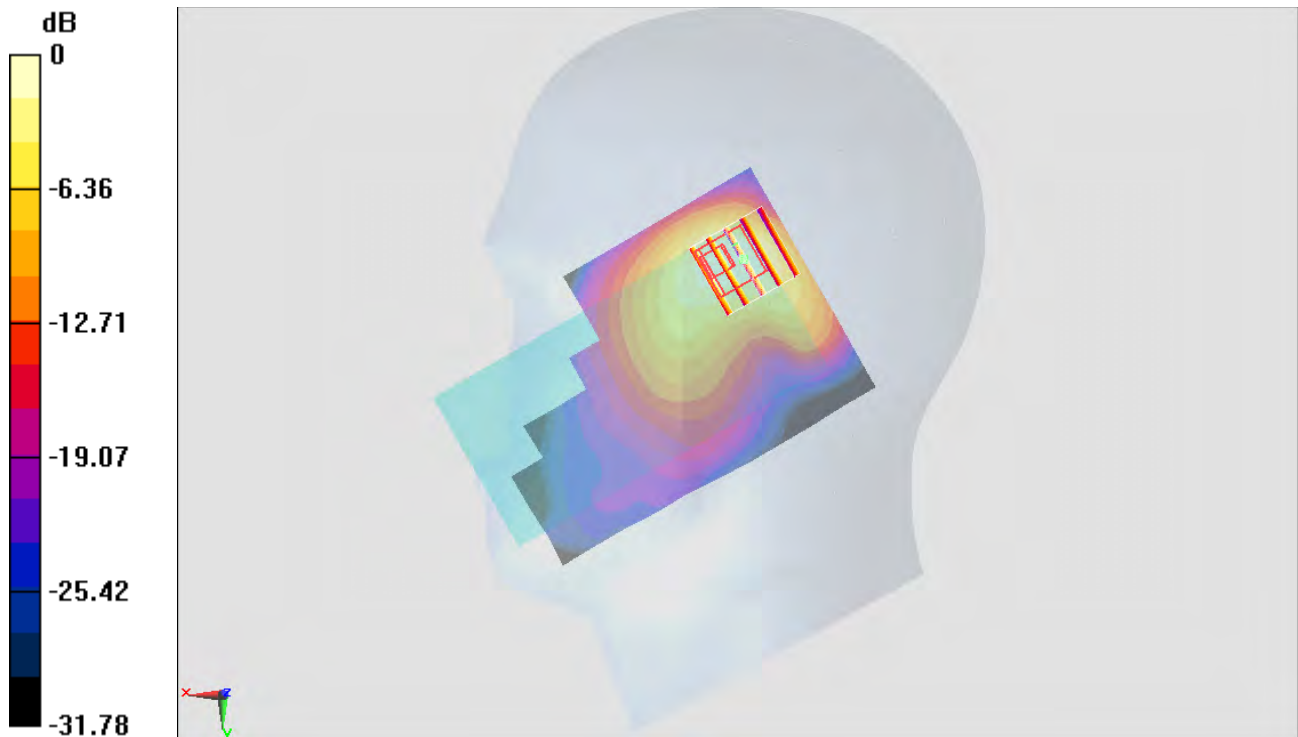
**Configuration/Ch661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.245 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.856 W/kg

**SAR(1 g) = 0.424 W/kg; SAR(10 g) = 0.192 W/kg**

Maximum value of SAR (measured) = 0.638 W/kg



0 dB = 0.638 W/kg = -1.95 dBW/kg

### #03\_WCDMA V\_RMC 12.2Kbps\_Right Cheek\_Ch4182;Ant 1

Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1  
 Medium: HSL\_850\_150220 Medium parameters used :  $f = 836.4$  MHz;  $\sigma = 0.885$  S/m;  $\epsilon_r = 40.931$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3270; ConvF(6.43, 6.43, 6.43); Calibrated: 2014/9/26;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2014/8/21
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch4182/Area Scan (61x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.443 W/kg

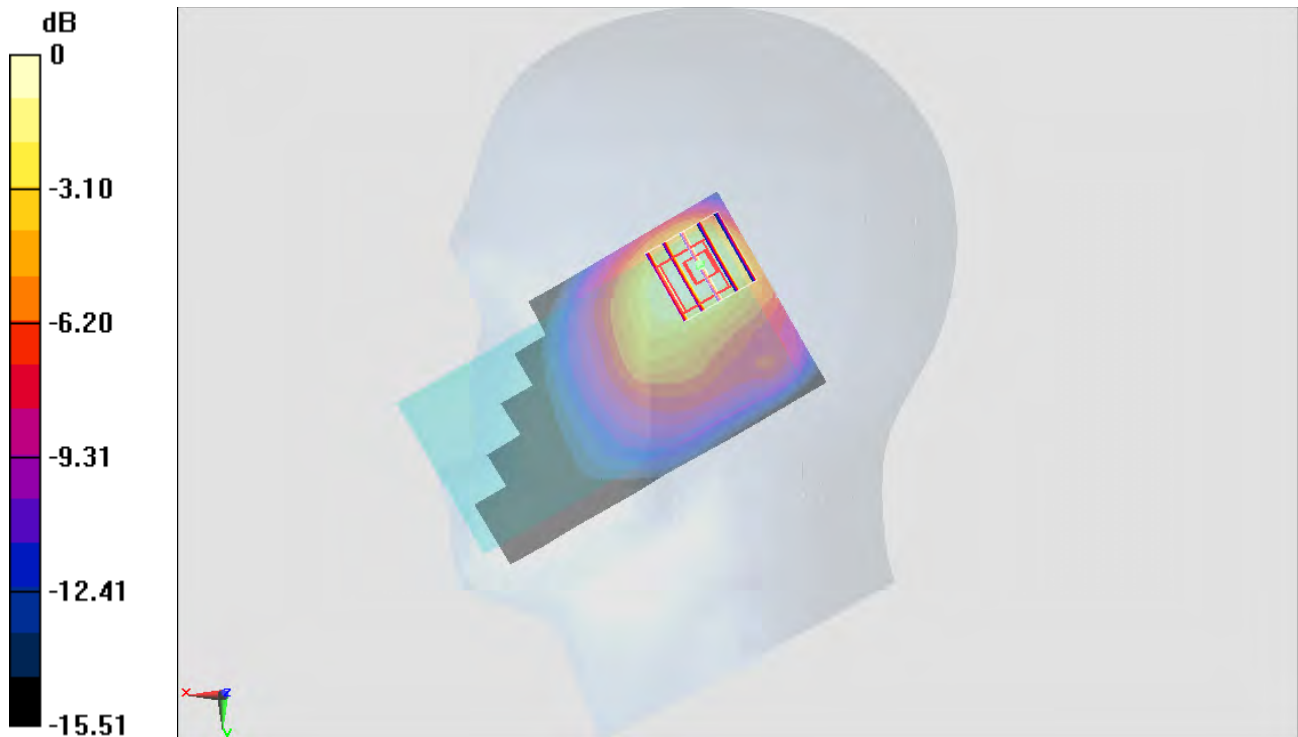
**Configuration/Ch4182/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.991 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.575 W/kg

**SAR(1 g) = 0.286 W/kg; SAR(10 g) = 0.172 W/kg**

Maximum value of SAR (measured) = 0.390 W/kg



0 dB = 0.390 W/kg = -4.09 dBW/kg

### #04\_WCDMA II\_RMC 12.2Kbps\_Right Cheek\_Ch9400;Ant 1

Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1  
 Medium: HSL\_1900\_150220 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.399$  S/m;  $\epsilon_r = 40.082$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.5 °C; Liquid Temperature : 22.5 °C

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3270; ConvF(5.05, 5.05, 5.05); Calibrated: 2014/9/26;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2014/8/21
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch9400/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.771 W/kg

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

Reference Value = 25.443 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.45 W/kg

**SAR(1 g) = 0.576 W/kg; SAR(10 g) = 0.299 W/kg**

Maximum value of SAR (measured) = 0.888 W/kg



0 dB = 0.888 W/kg = -0.52 dBW/kg



**#05\_LTE Band 5\_10M\_QPSK\_1RB\_0offset\_Right Cheek\_Ch20450;Ant 1**

Communication System: LTE ; Frequency: 829 MHz;Duty Cycle: 1:1

Medium: HSL\_850\_150302 Medium parameters used:  $f = 829 \text{ MHz}$ ;  $\sigma = 0.916 \text{ S/m}$ ;  $\epsilon_r = 41.955$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.3 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.3 \text{ }^\circ\text{C}$

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3697; ConvF(8.93, 8.93, 8.93); Calibrated: 2014/9/29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2014/9/24
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1446
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Configuration/Ch20450/Area Scan (71x121x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.372 \text{ W/kg}$

**Configuration/Ch20450/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $19.87 \text{ V/m}$ ; Power Drift =  $-0.06 \text{ dB}$

Peak SAR (extrapolated) =  $0.394 \text{ W/kg}$

**SAR(1 g) =  $0.242 \text{ W/kg}$ ; SAR(10 g) =  $0.146 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.339 \text{ W/kg}$



0 dB =  $0.339 \text{ W/kg} = -4.70 \text{ dBW/kg}$

**#06\_LTE Band 7\_20M\_QPSK\_1RB\_0offset\_Right Cheek\_Ch20850;Ant 1**

Communication System: LTE ; Frequency: 2510 MHz;Duty Cycle: 1:1

Medium: HSL2600\_150221 Medium parameters used:  $f = 2510$  MHz;  $\sigma = 1.917$  S/m;  $\epsilon_r = 38.53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3931; ConvF(7.09, 7.09, 7.09); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch20850/Area Scan (81x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.732 W/kg

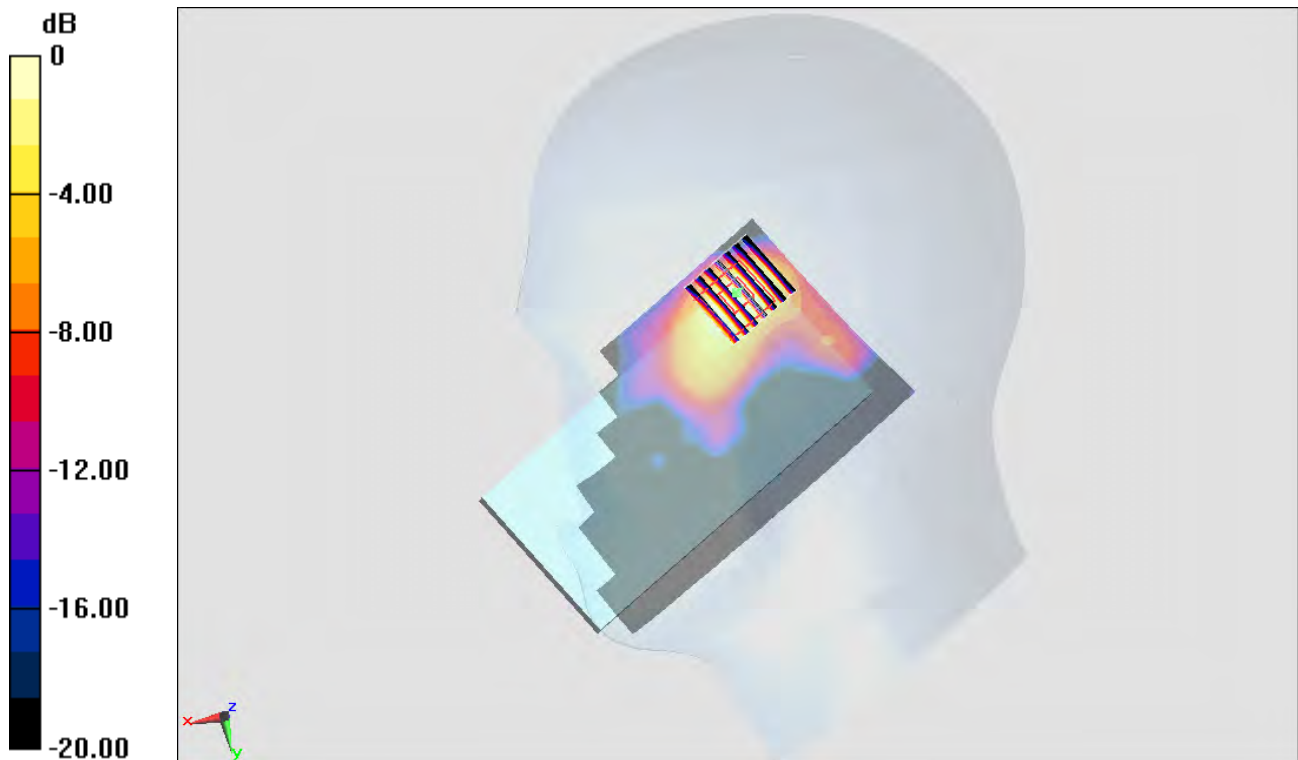
**Configuration/Ch20850/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.283 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.840 W/kg

**SAR(1 g) = 0.385 W/kg; SAR(10 g) = 0.169 W/kg**

Maximum value of SAR (measured) = 0.656 W/kg



0 dB = 0.656 W/kg = -1.83 dBW/kg

### #07\_WLAN2.4GHz\_802.11b 1Mbps\_Left Cheek\_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz; Duty Cycle: 1:1.024

Medium: HSL\_2450\_150220 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.845$  S/m;  $\epsilon_r = 39.389$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.4 °C

#### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(7.25, 7.25, 7.25); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch6/Area Scan (81x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.524 W/kg

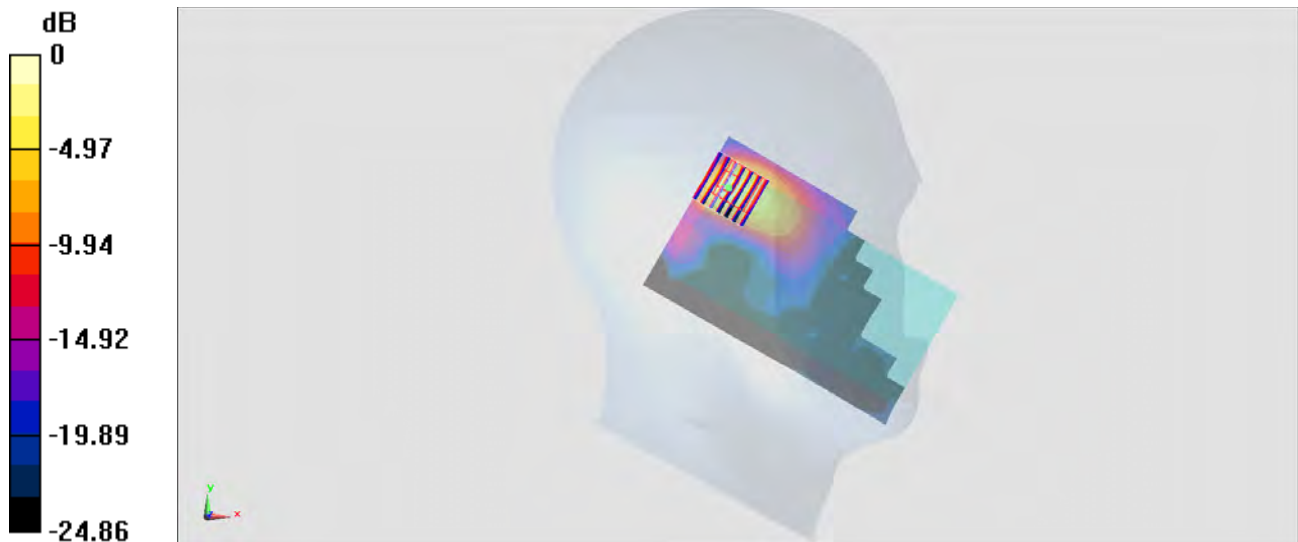
**Configuration/Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.089 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.643 W/kg

**SAR(1 g) = 0.218 W/kg; SAR(10 g) = 0.082 W/kg**

Maximum value of SAR (measured) = 0.453 W/kg



0 dB = 0.453 W/kg = -3.44 dBW/kg

## #08\_WLAN5GHz\_802.11a 6Mbps\_Right Cheek\_Ch48

Communication System: 802.11a ; Frequency: 5240 MHz;Duty Cycle: 1:1.146

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5240$  MHz;  $\sigma = 4.612$  S/m;  $\epsilon_r = 36.223$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(5.17, 5.17, 5.17); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch48/Area Scan (101x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
 Maximum value of SAR (interpolated) = 0.0370 W/kg

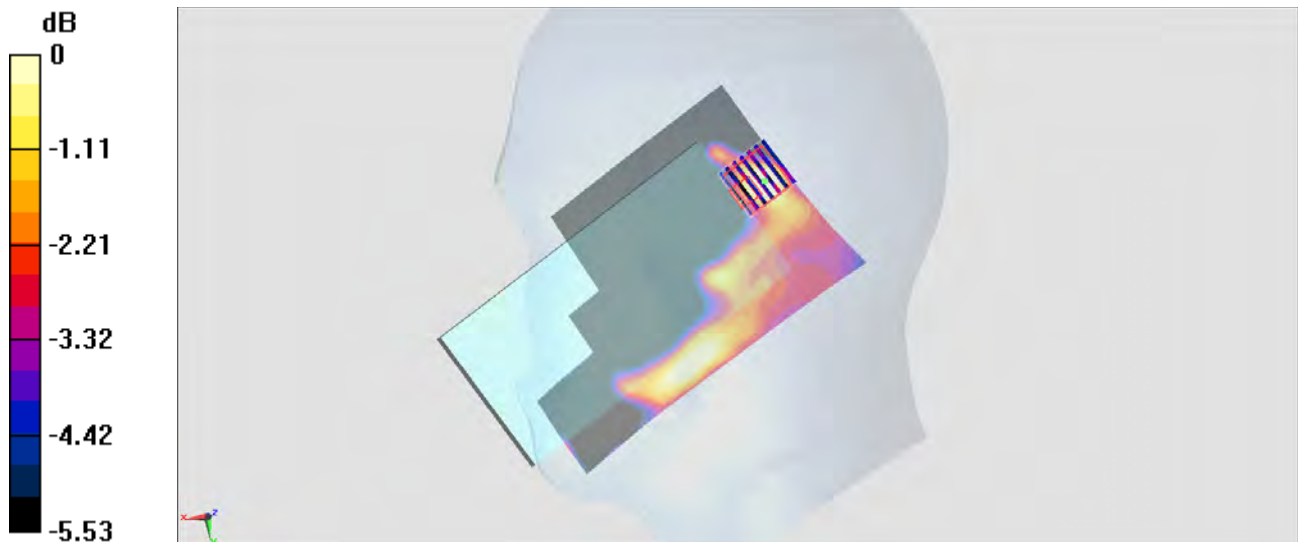
**Configuration/Ch48/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 2.486 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.0320 W/kg

**SAR(1 g) = 0.016 W/kg; SAR(10 g) = 0.011 W/kg**

Maximum value of SAR (measured) = 0.0300 W/kg



0 dB = 0.0300 W/kg = -15.23 dBW/kg

## #09\_WLAN5GHz\_802.11a 6Mbps\_Right Cheek\_Ch60

Communication System: 802.11a ; Frequency: 5300 MHz;Duty Cycle: 1:1.146

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.673$  S/m;  $\epsilon_r = 36.087$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.92, 4.92, 4.92); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch60/Area Scan (51x91x1):** Interpolated grid: dx=2.000 mm, dy=2.000 mm  
 Maximum value of SAR (interpolated) = 0.0312 W/kg

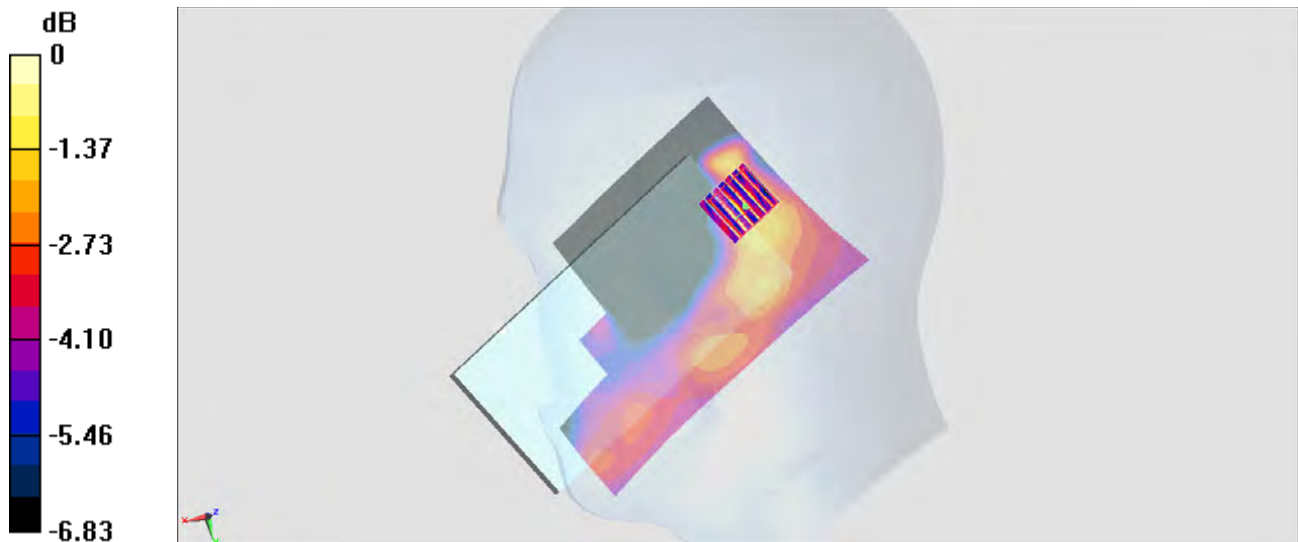
**Configuration/Ch60/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 2.909 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.0510 W/kg

**SAR(1 g) = 0.024 W/kg; SAR(10 g) = 0.016 W/kg**

Maximum value of SAR (measured) = 0.0414 W/kg



0 dB = 0.0414 W/kg = -13.83 dBW/kg

### #10\_WLAN5GHz\_802.11a\_6Mbps\_Left Cheek\_Ch140

Communication System: 802.11a ; Frequency: 5700 MHz; Duty Cycle: 1:1.146

Medium: HSL\_5G\_150221 Medium parameters used:  $f = 5700$  MHz;  $\sigma = 5.12$  S/m;  $\epsilon_r = 35.635$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

#### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch140/Area Scan (101x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0744 W/kg

**Configuration/Ch140/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 4.339 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.383 W/kg

**SAR(1 g) = 0.047 W/kg; SAR(10 g) = 0.017 W/kg**

Maximum value of SAR (measured) = 0.104 W/kg



0 dB = 0.104 W/kg = -9.83 dBW/kg

## #11\_WLAN5GHz\_802.11a 6Mbps\_Right Cheek\_Ch157

Communication System: 802.11a ; Frequency: 5785 MHz;Duty Cycle: 1:1.146

Medium: HSL\_5G\_150221 Medium parameters used :  $f = 5785 \text{ MHz}$ ;  $\sigma = 5.192 \text{ S/m}$ ;  $\epsilon_r = 35.454$ ;  $\rho = 1000 \text{ kg/m}^3$

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.64, 4.64, 4.64); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM\_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch157/Area Scan (101x181x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.0928 \text{ W/kg}$

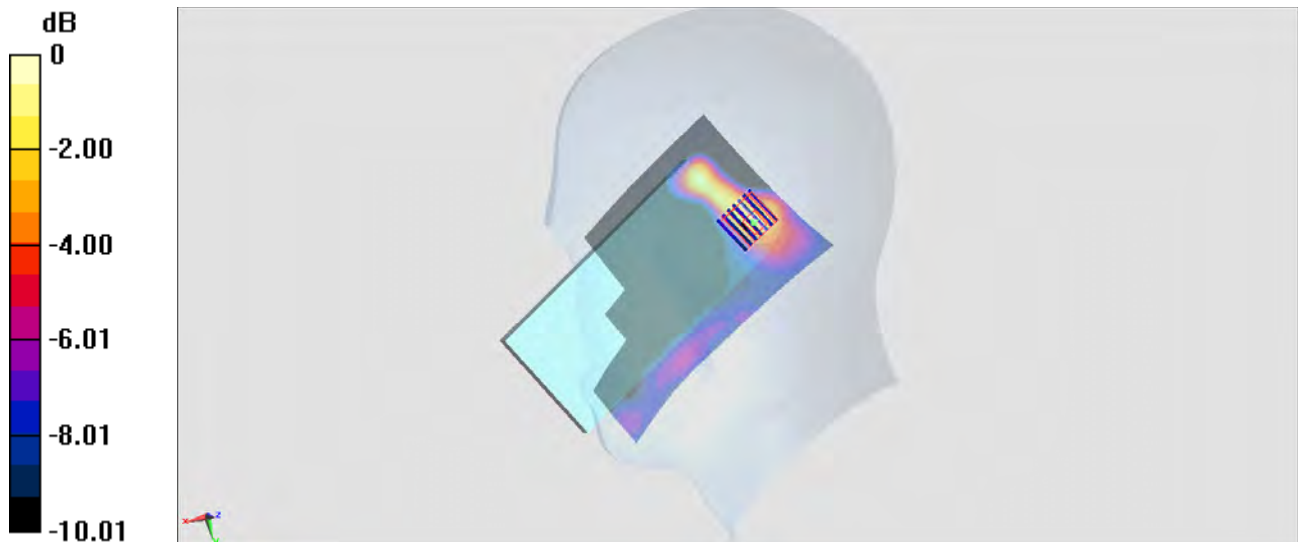
**Configuration/Ch157/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $5.309 \text{ V/m}$ ; Power Drift =  $-0.07 \text{ dB}$

Peak SAR (extrapolated) =  $0.174 \text{ W/kg}$

**SAR(1 g) =  $0.057 \text{ W/kg}$ ; SAR(10 g) =  $0.028 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.117 \text{ W/kg}$



0 dB =  $0.117 \text{ W/kg} = -9.32 \text{ dBW/kg}$

### #12\_GSM850\_GPRS (4 Tx slots)\_Back\_1cm\_Ch189;Ant 0

Communication System: GSM850; Frequency: 836.4 MHz; Duty Cycle: 1:2.08

Medium: MSL\_850\_150219 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.939$  S/m;  $\epsilon_r = 53.703$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(10.13, 10.13, 10.13); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch189/Area Scan (61x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.536 W/kg

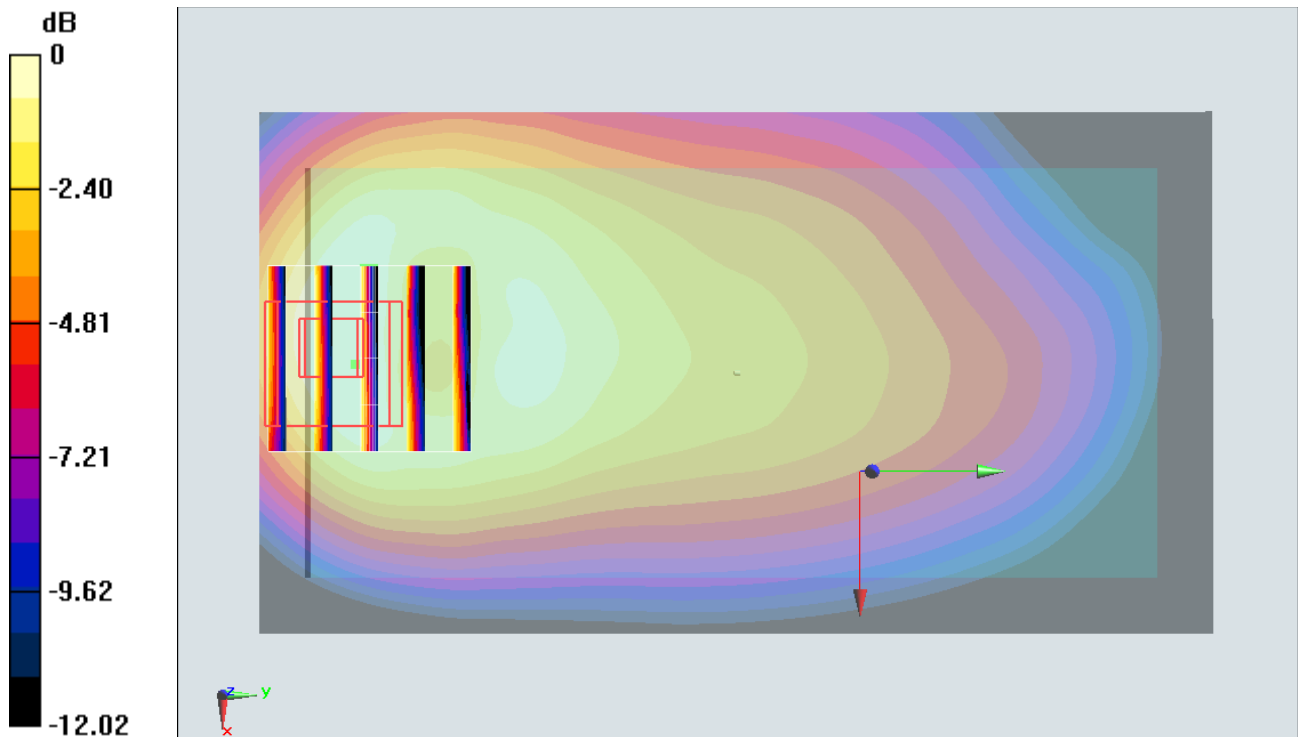
**Configuration/Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.291 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.622 W/kg

**SAR(1 g) = 0.360 W/kg; SAR(10 g) = 0.210 W/kg**

Maximum value of SAR (measured) = 0.487 W/kg



0 dB = 0.487 W/kg = -3.12 dBW/kg



### #13\_GSM1900\_GPRS (3 Tx slots)\_Bottom Side\_1cm\_Ch661;Ant 0

Communication System: PCS ; Frequency: 1880 MHz;Duty Cycle: 1:2.77

Medium: MSL\_1900\_150219 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.498$  S/m;  $\epsilon_r = 54.117$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3931; ConvF(7.8, 7.8, 7.8); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch661/Area Scan (41x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.249 W/kg

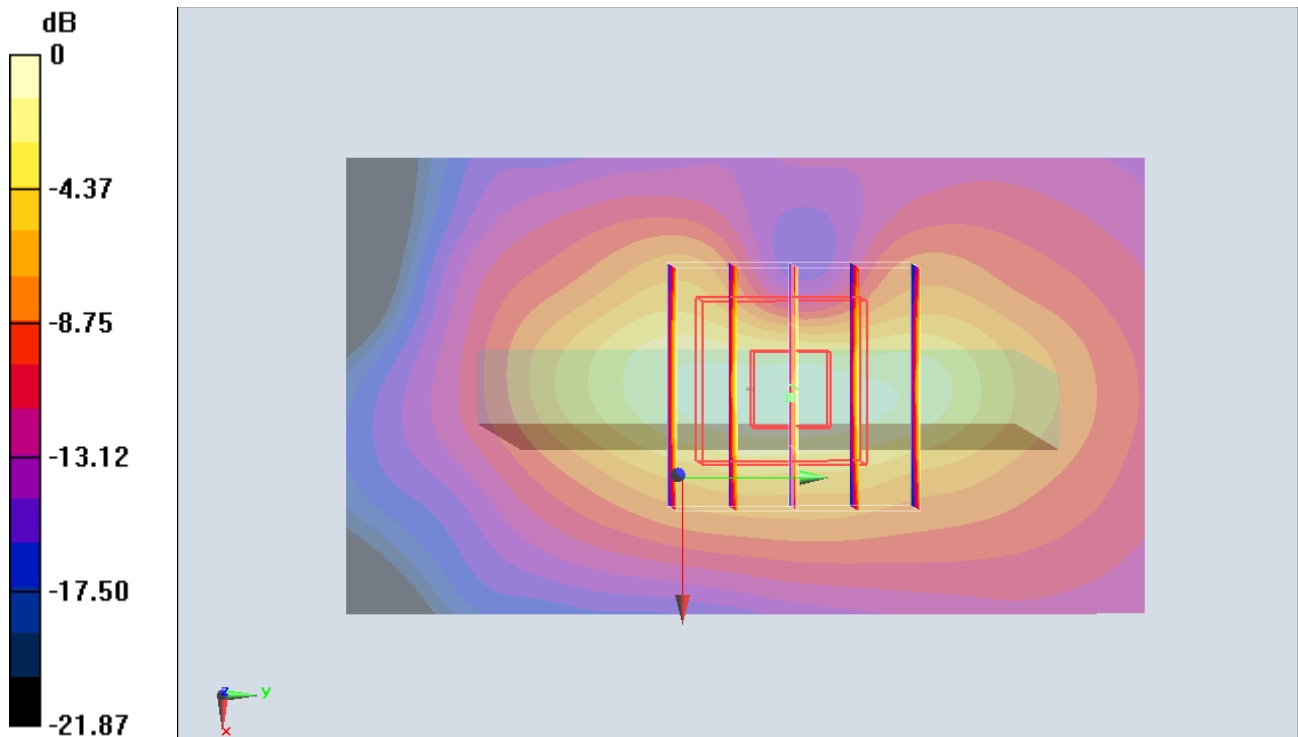
**Configuration/Ch661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.075 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.278 W/kg

**SAR(1 g) = 0.163 W/kg; SAR(10 g) = 0.088 W/kg**

Maximum value of SAR (measured) = 0.241 W/kg



0 dB = 0.241 W/kg = -6.18 dBW/kg

### #14\_WCDMA V\_RMC 12.2Kbps\_Back\_1cm\_Ch4182;Ant 0

Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1  
 Medium: MSL\_850\_150219 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.939$  S/m;  $\epsilon_r = 53.703$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3931; ConvF(10.13, 10.13, 10.13); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch4182/Area Scan (61x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.198 W/kg

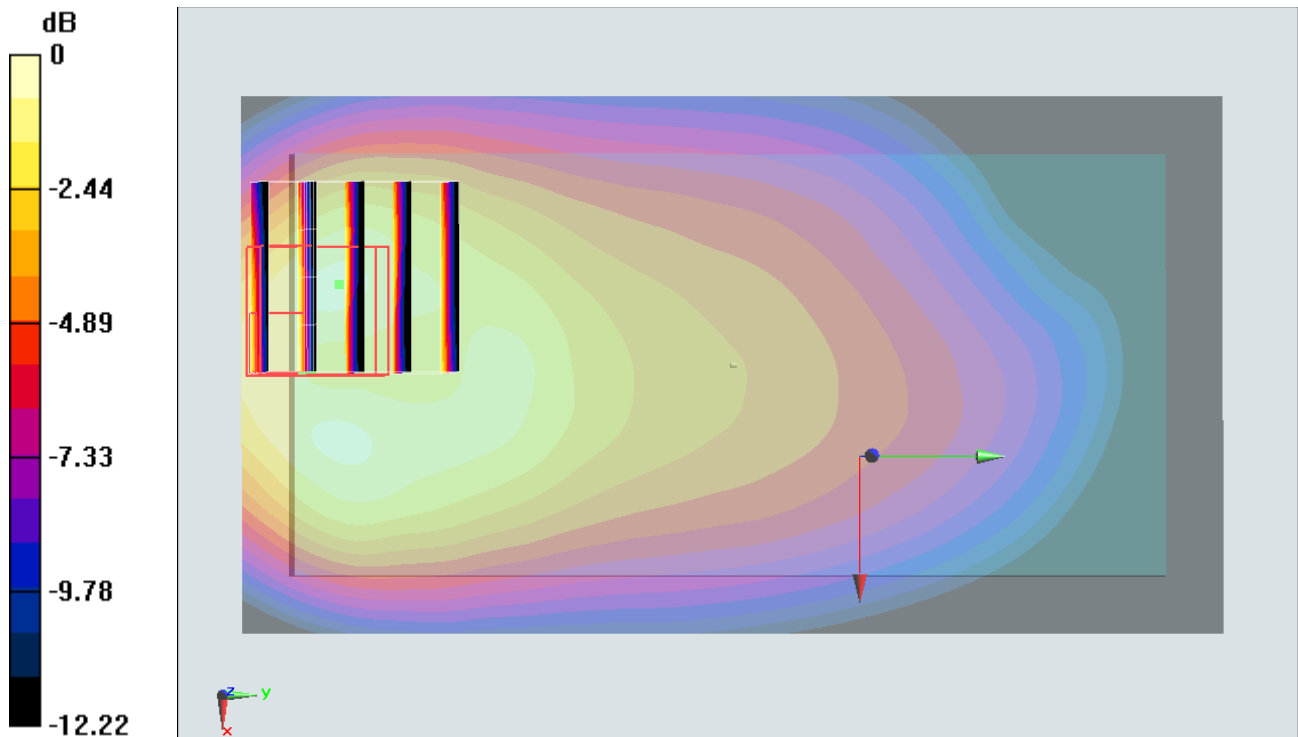
**Configuration/Ch4182/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.602 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.271 W/kg

**SAR(1 g) = 0.147 W/kg; SAR(10 g) = 0.084 W/kg**

Maximum value of SAR (measured) = 0.220 W/kg



0 dB = 0.220 W/kg = -6.58 dBW/kg

### #15\_WCDMA II\_RMC 12.2Kbps\_Front\_1cm\_Ch9400;Ant 0

Communication System: WCDMA ; Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: MSL\_1900\_150219 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.498$  S/m;  $\epsilon_r = 54.117$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.8, 7.8, 7.8); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 0.229 W/kg

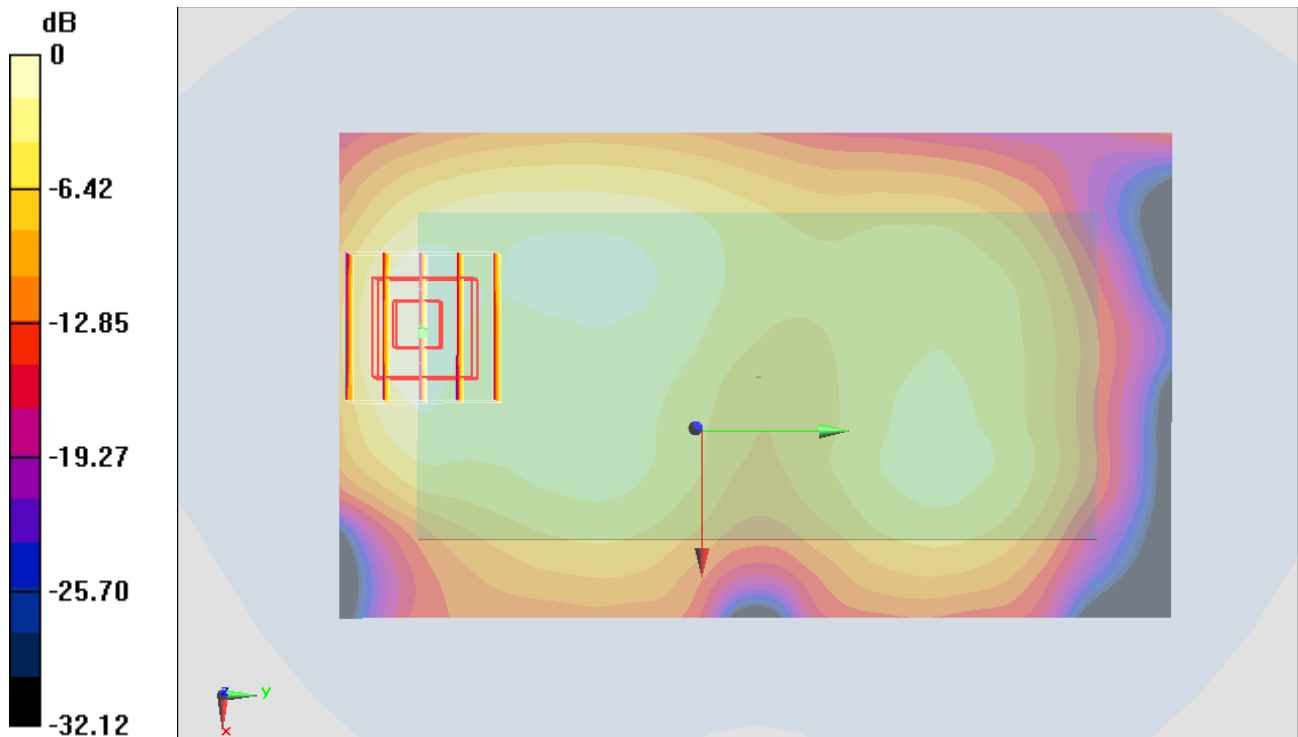
**Configuration/Ch9400/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.863 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.277 W/kg

**SAR(1 g) = 0.161 W/kg; SAR(10 g) = 0.087 W/kg**

Maximum value of SAR (measured) = 0.239 W/kg



0 dB = 0.239 W/kg = -6.22 dBW/kg

**#16\_LTE Band 5\_10M\_QPSK\_1RB\_0offset\_Back\_1cm\_Ch20450;Ant 0**

Communication System: LTE ; Frequency: 829 MHz;Duty Cycle: 1:1

Medium: MSL\_850\_150303 Medium parameters used:  $f = 829$  MHz;  $\sigma = 0.967$  S/m;  $\epsilon_r = 54.371$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3697; ConvF(8.75, 8.75, 8.75); Calibrated: 2014/9/29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2014/9/24
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1446
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Configuration/Ch20450/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.255 W/kg

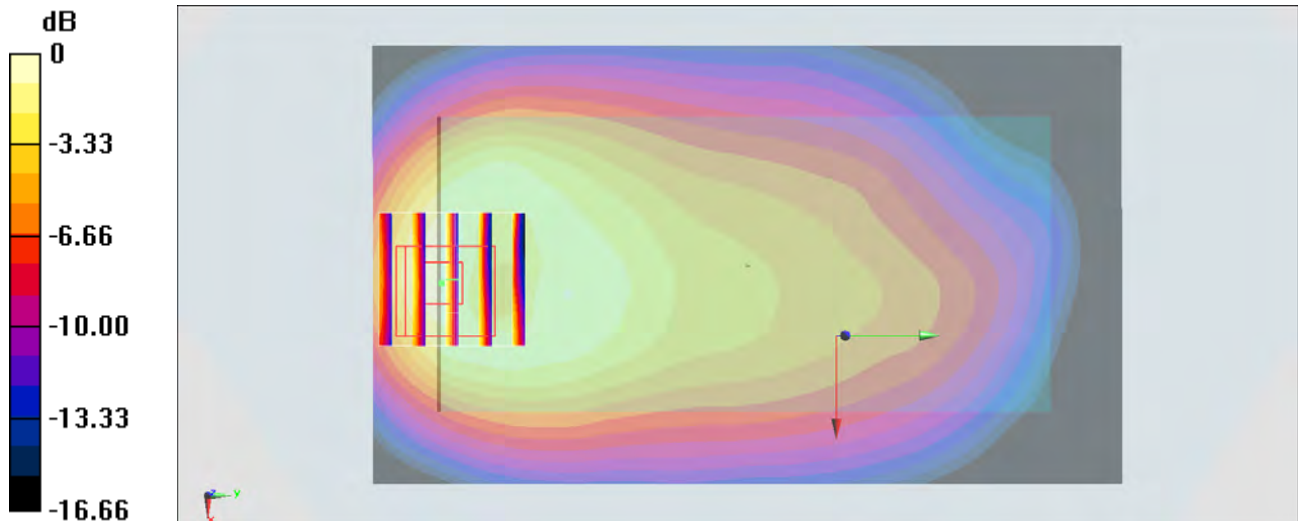
**Configuration/Ch20450/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.06 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.319 W/kg

**SAR(1 g) = 0.179 W/kg; SAR(10 g) = 0.102 W/kg**

Maximum value of SAR (measured) = 0.272 W/kg



0 dB = 0.272 W/kg = -5.65 dBW/kg

### #17\_LTE Band 7\_20M\_QPSK\_1RB\_0offset\_Left Side\_1cm\_Ch20850;Ant 0

Communication System: LTE ; Frequency: 2510 MHz;Duty Cycle: 1:1

Medium: MSL2600\_150220 Medium parameters used:  $f = 2510$  MHz;  $\sigma = 2.104$  S/m;  $\epsilon_r = 51.343$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.2, 7.2, 7.2); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch20850/Area Scan (41x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.234 W/kg

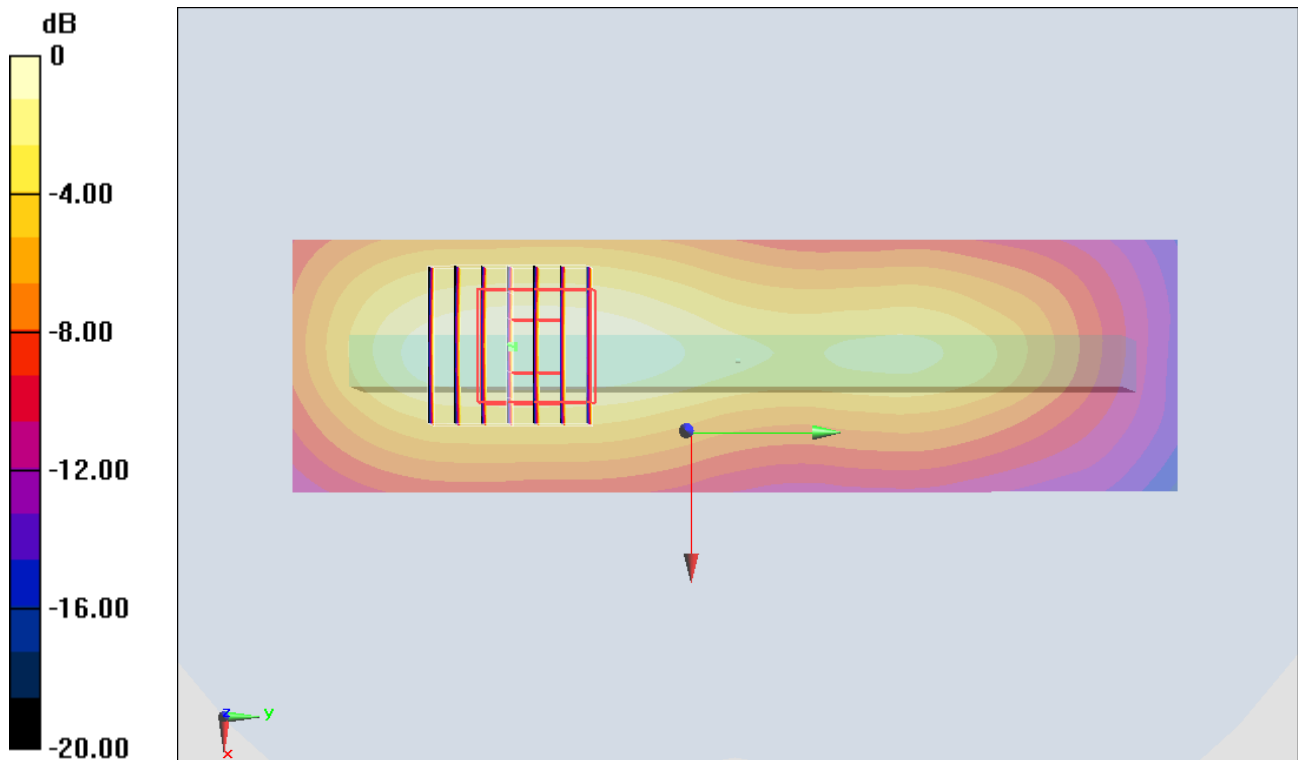
**Configuration/Ch20850/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.764 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.286 W/kg

**SAR(1 g) = 0.149 W/kg; SAR(10 g) = 0.078 W/kg**

Maximum value of SAR (measured) = 0.231 W/kg



0 dB = 0.231 W/kg = -6.36 dBW/kg

## #18\_WLAN2.4GHz\_802.11b 1Mbps\_Front\_1cm\_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.024

Medium: MSL\_2450\_150220 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 2.008$  S/m;  $\epsilon_r = 51.608$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

### DASY5 Configuration:

- Probe: EX3DV4 - SN3955; ConvF(7.32, 7.32, 7.32); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2014/11/13
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1478
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Configuration/Ch6/Area Scan (71x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
 Maximum value of SAR (interpolated) = 0.0392 W/kg

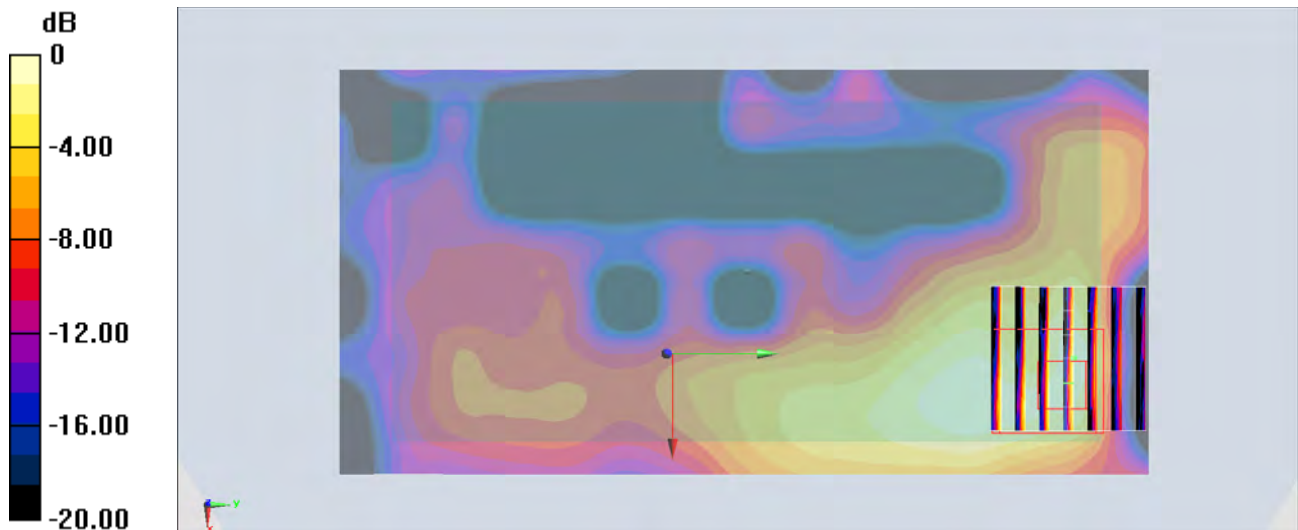
**Configuration/Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.209 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.0440 W/kg

**SAR(1 g) = 0.021 W/kg; SAR(10 g) = 0.00861 W/kg**

Maximum value of SAR (measured) = 0.0350 W/kg



0 dB = 0.0350 W/kg = -14.56 dBW/kg

### #19\_GSM850\_GPRS (4 Tx slots)\_Back\_1cm\_Ch189;Ant 0

Communication System: GSM850; Frequency: 836.4 MHz; Duty Cycle: 1:2.08

Medium: MSL\_850\_150219 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.939$  S/m;  $\epsilon_r = 53.703$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(10.13, 10.13, 10.13); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch189/Area Scan (61x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.536 W/kg

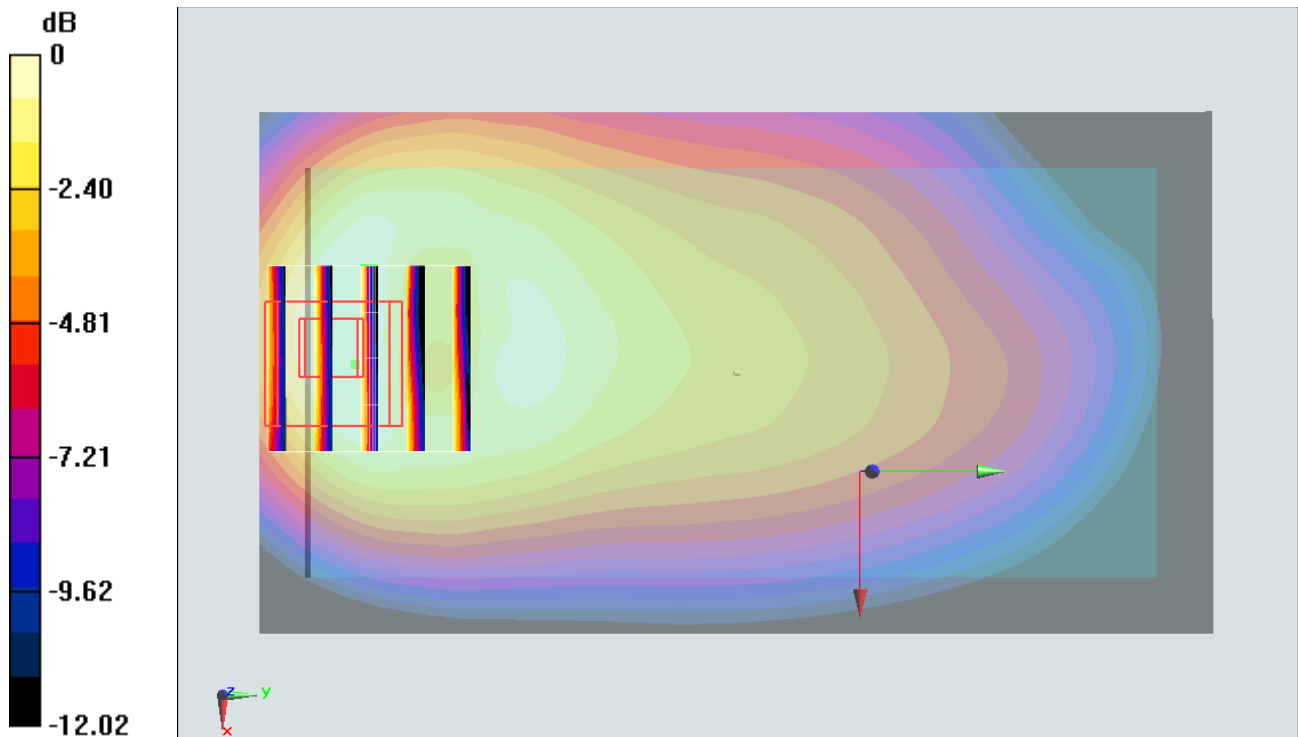
**Configuration/Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.291 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.622 W/kg

**SAR(1 g) = 0.360 W/kg; SAR(10 g) = 0.210 W/kg**

Maximum value of SAR (measured) = 0.487 W/kg



0 dB = 0.487 W/kg = -3.12 dBW/kg

## #20\_GSM1900\_GPRS (3 Tx slots)\_Front\_1cm\_Ch661;Ant 0

Communication System: PCS ; Frequency: 1880 MHz;Duty Cycle: 1:2.77

Medium: MSL\_1900\_150219 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.498$  S/m;  $\epsilon_r = 54.117$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.8, 7.8, 7.8); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch661/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.205 W/kg

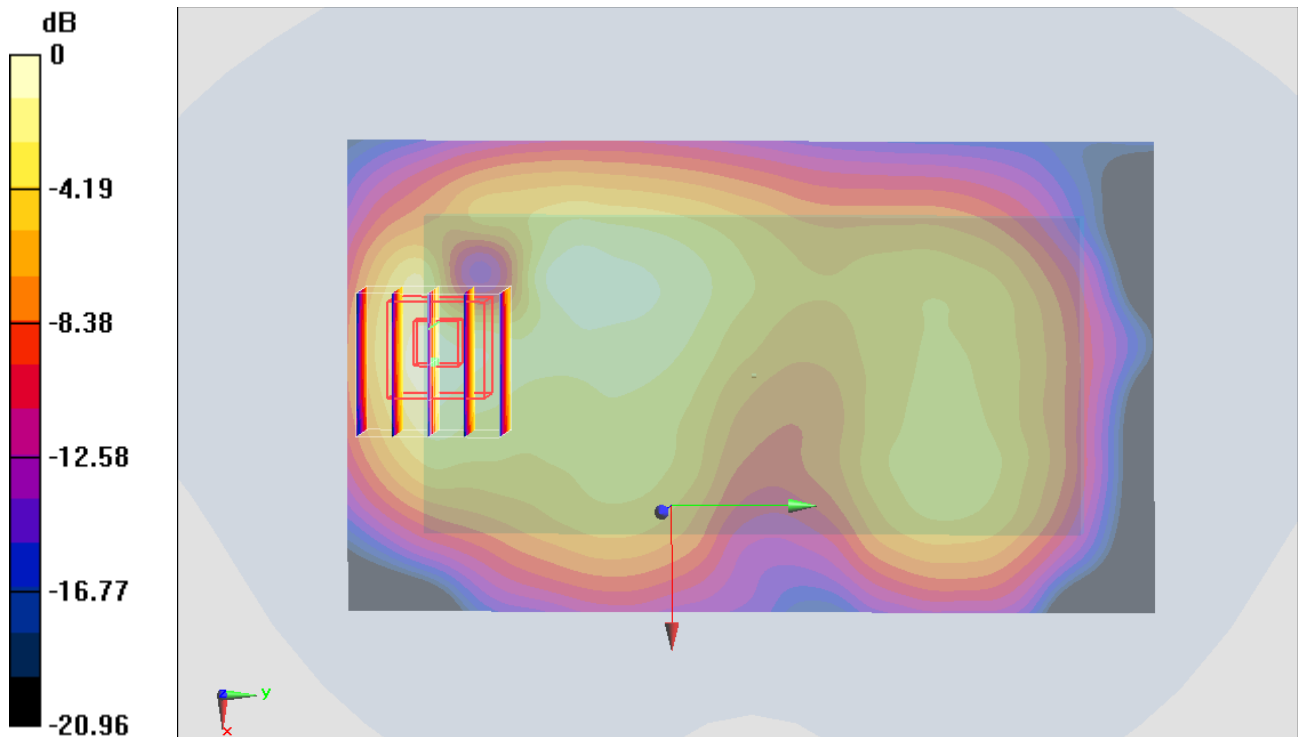
**Configuration/Ch661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.042 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.253 W/kg

**SAR(1 g) = 0.147 W/kg; SAR(10 g) = 0.081 W/kg**

Maximum value of SAR (measured) = 0.217 W/kg



0 dB = 0.217 W/kg = -6.64 dBW/kg



### #21\_WCDMA V\_RMC 12.2Kbps\_Back\_1cm\_Ch4182;Ant 0

Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1  
 Medium: MSL\_850\_150219 Medium parameters used:  $f = 836.4$  MHz;  $\sigma = 0.939$  S/m;  $\epsilon_r = 53.703$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3931; ConvF(10.13, 10.13, 10.13); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Right; Type: QD000P40CC; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch4182/Area Scan (61x111x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.198 W/kg

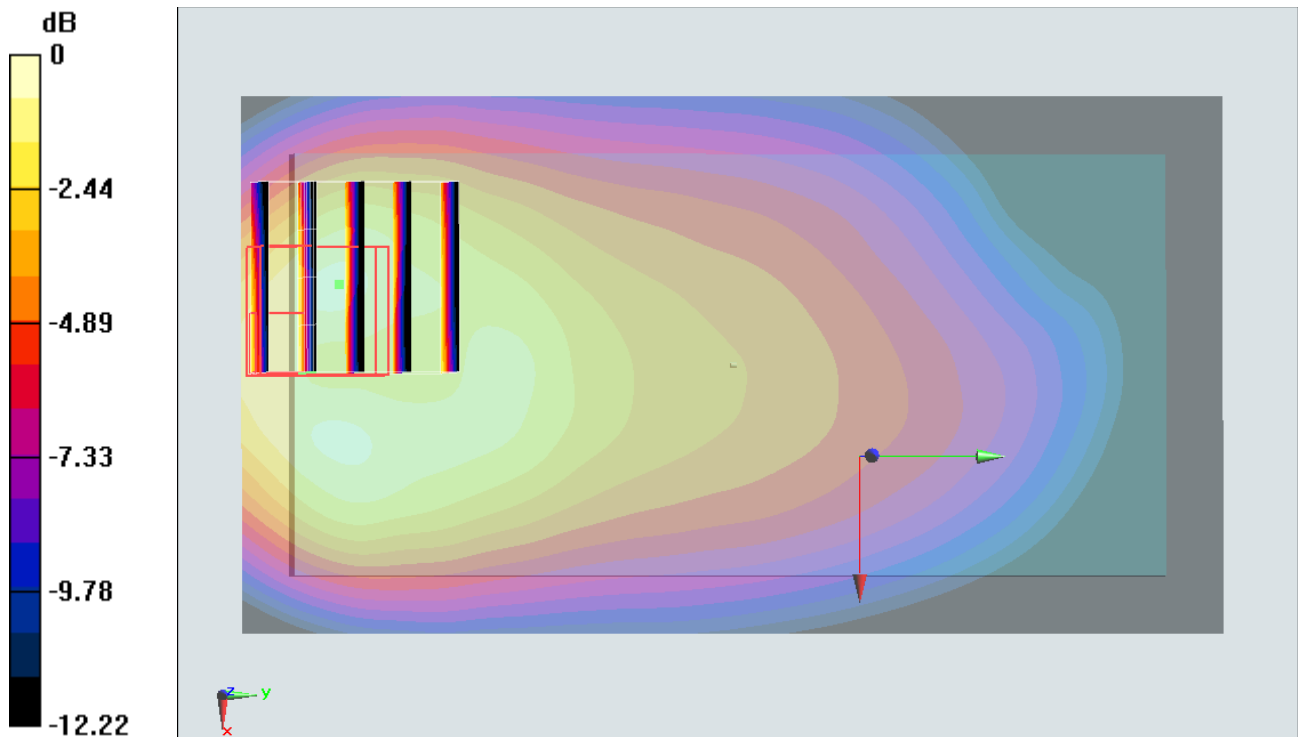
**Configuration/Ch4182/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.602 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.271 W/kg

**SAR(1 g) = 0.147 W/kg; SAR(10 g) = 0.084 W/kg**

Maximum value of SAR (measured) = 0.220 W/kg



0 dB = 0.220 W/kg = -6.58 dBW/kg

## #22\_WCDMA II\_RMC 12.2Kbps\_Front\_1cm\_Ch9400;Ant 0

Communication System: WCDMA ; Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: MSL\_1900\_150219 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.498$  S/m;  $\epsilon_r = 54.117$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3931; ConvF(7.8, 7.8, 7.8); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

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

Maximum value of SAR (interpolated) = 0.229 W/kg

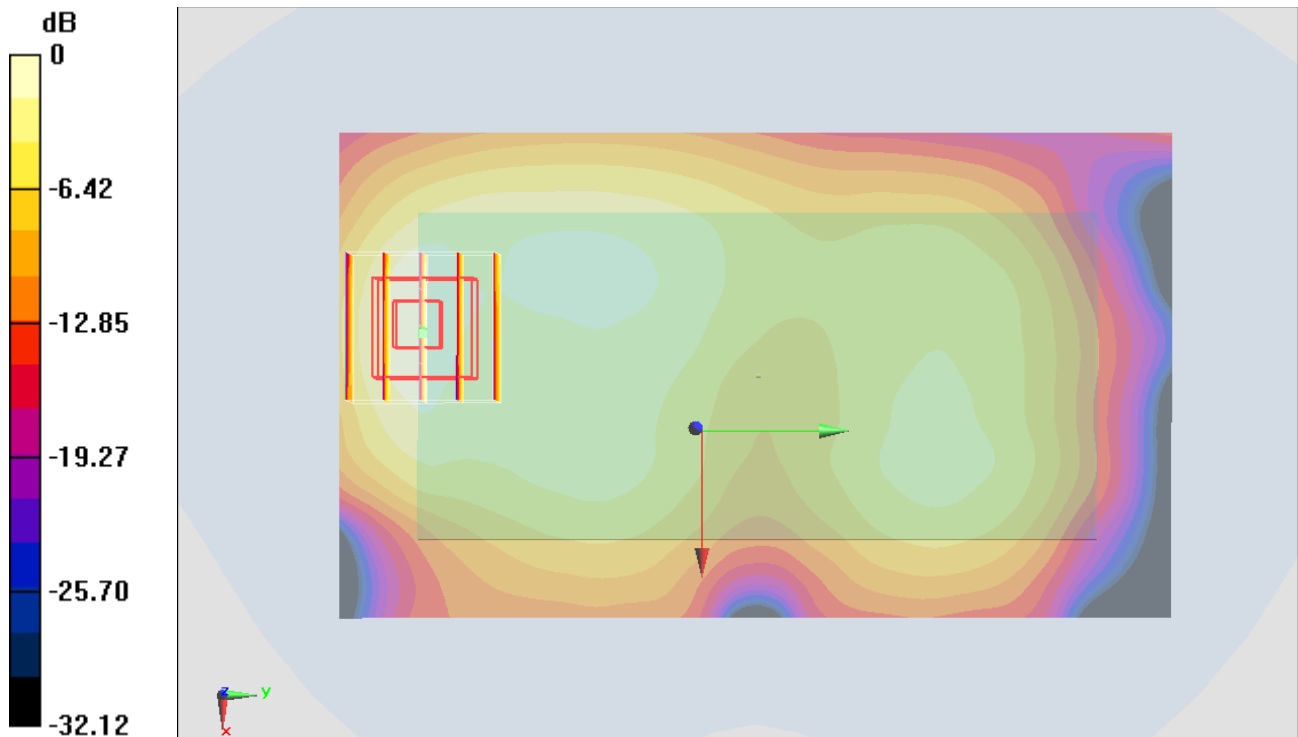
**Configuration/Ch9400/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.863 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.277 W/kg

**SAR(1 g) = 0.161 W/kg; SAR(10 g) = 0.087 W/kg**

Maximum value of SAR (measured) = 0.239 W/kg



0 dB = 0.239 W/kg = -6.22 dBW/kg

**#23\_LTE Band 5\_10M\_QPSK\_1RB\_0offset\_Back\_1cm\_Ch20450;Ant 0**

Communication System: LTE ; Frequency: 829 MHz;Duty Cycle: 1:1

Medium: MSL\_850\_150303 Medium parameters used:  $f = 829 \text{ MHz}$ ;  $\sigma = 0.967 \text{ S/m}$ ;  $\epsilon_r = 54.371$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $23.4 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $22.4 \text{ }^\circ\text{C}$

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3697; ConvF(8.75, 8.75, 8.75); Calibrated: 2014/9/29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2014/9/24
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1446
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Configuration/Ch20450/Area Scan (71x121x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.255 \text{ W/kg}$

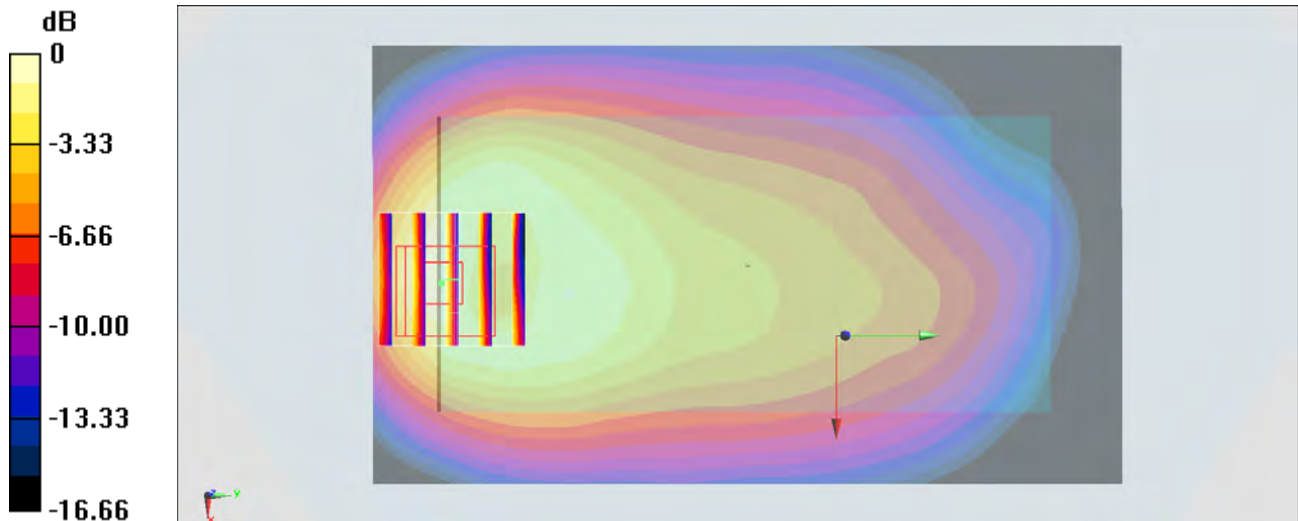
**Configuration/Ch20450/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $17.06 \text{ V/m}$ ; Power Drift =  $-0.01 \text{ dB}$

Peak SAR (extrapolated) =  $0.319 \text{ W/kg}$

**SAR(1 g) =  $0.179 \text{ W/kg}$ ; SAR(10 g) =  $0.102 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.272 \text{ W/kg}$



$0 \text{ dB} = 0.272 \text{ W/kg} = -5.65 \text{ dBW/kg}$

**#24\_LTE Band 7\_20M\_QPSK\_1RB\_0offset\_Back\_1cm\_Ch20850;Ant 0**

Communication System: LTE ; Frequency: 2510 MHz;Duty Cycle: 1:1

Medium: MSL2600\_150220 Medium parameters used:  $f = 2510$  MHz;  $\sigma = 2.104$  S/m;  $\epsilon_r = 51.343$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3931; ConvF(7.2, 7.2, 7.2); Calibrated: 2014/9/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/10/6
- Phantom: SAM\_Left; Type: QD000P40CD; Serial: TP:1542
- Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch20850/Area Scan (81x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.245 W/kg

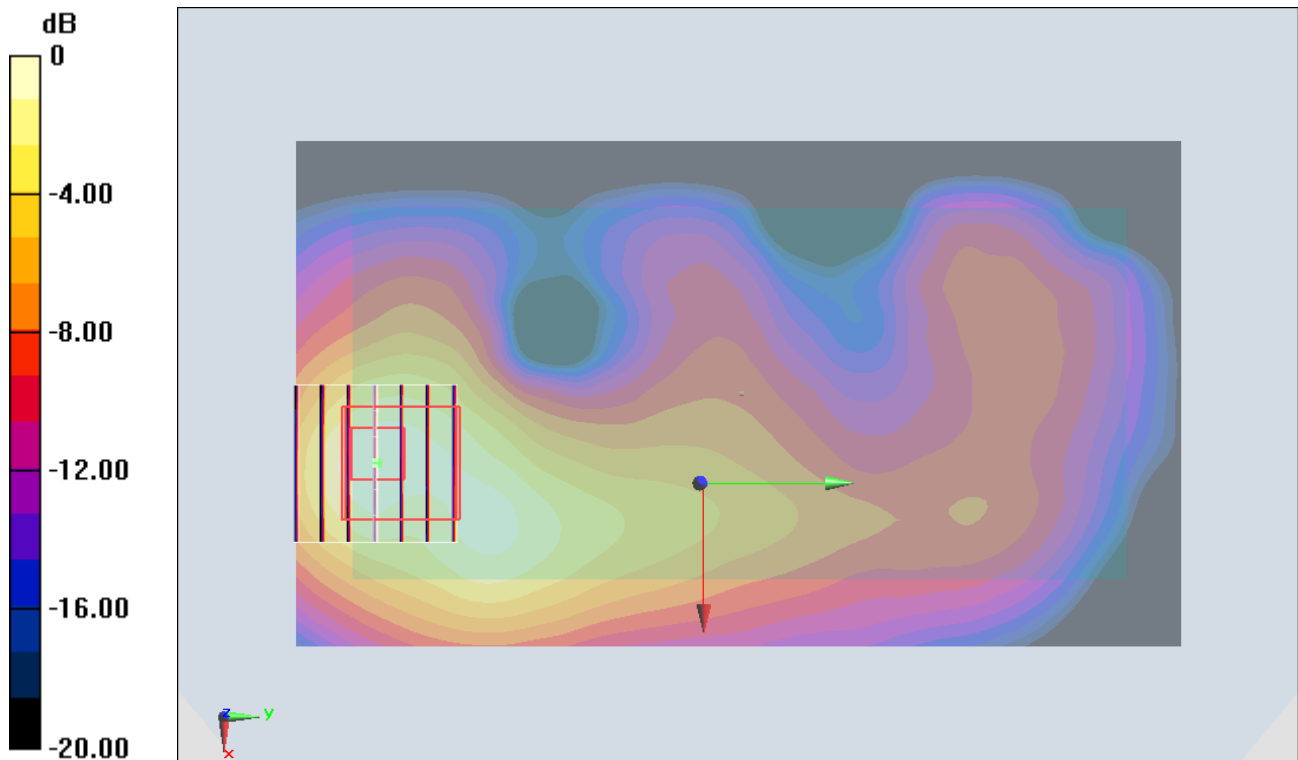
**Configuration/Ch20850/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.324 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.312 W/kg

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

Maximum value of SAR (measured) = 0.245 W/kg



0 dB = 0.245 W/kg = -6.11 dBW/kg

## #25\_WLAN2.4GHz\_802.11b 1Mbps\_Front\_1cm\_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.024

Medium: MSL\_2450\_150220 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 2.008$  S/m;  $\epsilon_r = 51.608$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

### DASY5 Configuration:

- Probe: EX3DV4 - SN3955; ConvF(7.32, 7.32, 7.32); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2014/11/13
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1478
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Configuration/Ch6/Area Scan (71x141x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
 Maximum value of SAR (interpolated) = 0.0392 W/kg

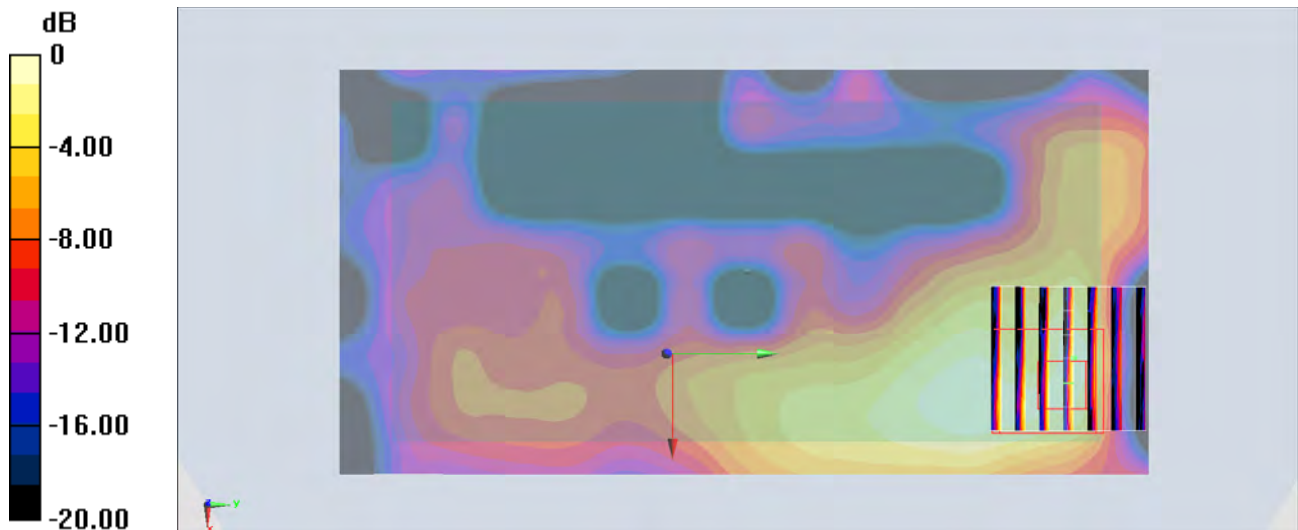
**Configuration/Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.209 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.0440 W/kg

**SAR(1 g) = 0.021 W/kg; SAR(10 g) = 0.00861 W/kg**

Maximum value of SAR (measured) = 0.0350 W/kg



0 dB = 0.0350 W/kg = -14.56 dBW/kg

## #26\_WLAN5GHz\_802.11a\_6Mbps\_Back\_1cm\_Ch48

Communication System: 802.11a ; Frequency: 5240 MHz;Duty Cycle: 1:1.146

Medium: MSL\_5G\_150221 Medium parameters used :  $f = 5240$  MHz;  $\sigma = 5.457$  S/m;  $\epsilon_r = 47.67$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.32, 4.32, 4.32); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch48/Area Scan (101x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
 Maximum value of SAR (interpolated) = 0.00640 W/kg

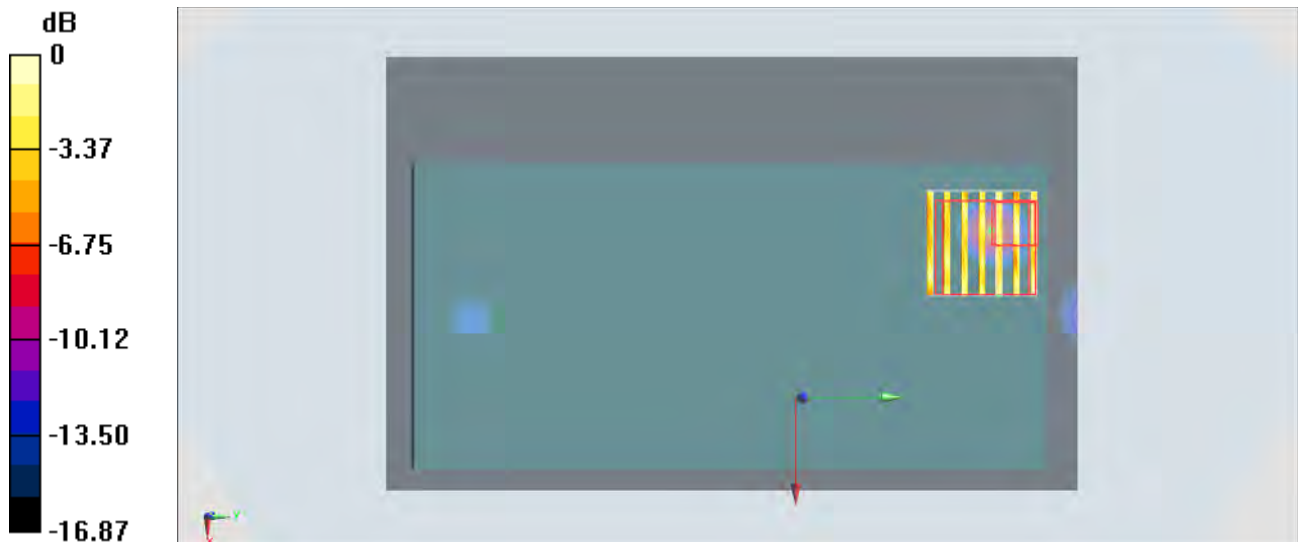
**Configuration/Ch48/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 1.123 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.0290 W/kg

**SAR(1 g) = 0.014 W/kg; SAR(10 g) = 0.00853 W/kg**

Maximum value of SAR (measured) = 0.0266 W/kg



0 dB = 0.0266 W/kg = -15.75 dBW/kg

### #27\_WLAN5GHz\_802.11a\_6Mbps\_Front\_1cm\_Ch60

Communication System: 802.11a ; Frequency: 5300 MHz;Duty Cycle: 1:1.146

Medium: MSL\_5G\_150221 Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.549$  S/m;  $\epsilon_r = 47.628$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

#### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(4.15, 4.15, 4.15); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch60/Area Scan (101x161x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
 Maximum value of SAR (interpolated) = 0.0612 W/kg

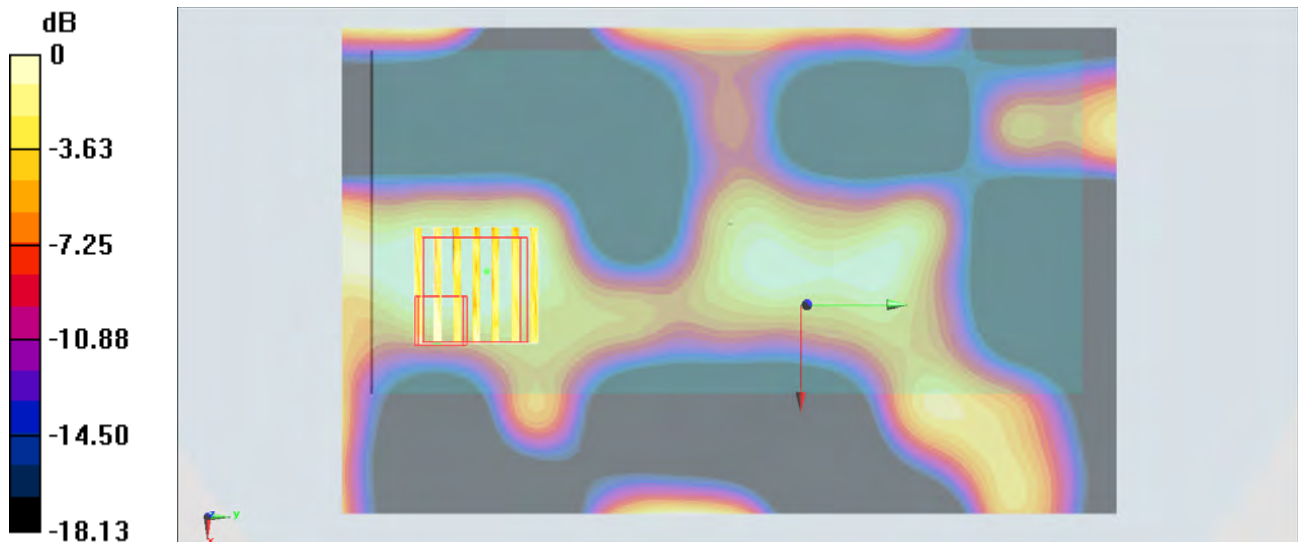
**Configuration/Ch60/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 1.952 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.0320 W/kg

**SAR(1 g) = 0.020 W/kg; SAR(10 g) = 0.012 W/kg**

Maximum value of SAR (measured) = 0.0288 W/kg



0 dB = 0.0288 W/kg = -15.41 dBW/kg

## #28\_WLAN5GHz\_802.11a 6Mbps\_Back\_1cm\_Ch140

Communication System: 802.11a ; Frequency: 5700 MHz; Duty Cycle: 1:1.146

Medium: MSL\_5G\_150221 Medium parameters used:  $f = 5700$  MHz;  $\sigma = 6.059$  S/m;  $\epsilon_r = 46.88$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(3.96, 3.96, 3.96); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch140/Area Scan (101x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0287 W/kg

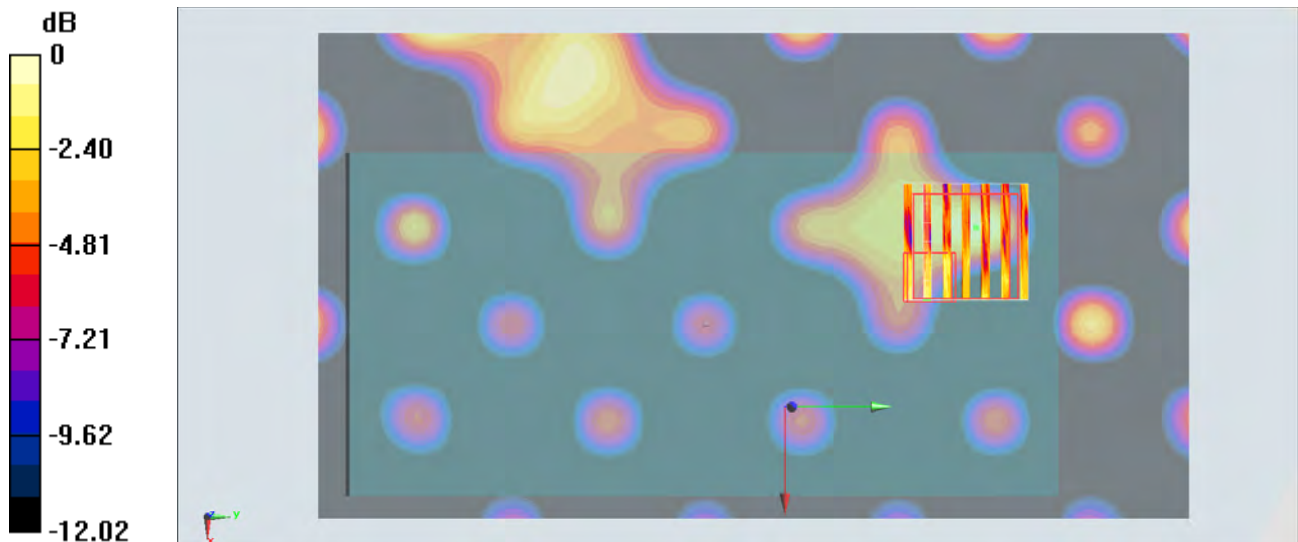
**Configuration/Ch140/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 2.369 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.0350 W/kg

**SAR(1 g) = 0.020 W/kg; SAR(10 g) = 0.00919 W/kg**

Maximum value of SAR (measured) = 0.0327 W/kg



0 dB = 0.0327 W/kg = -14.85 dBW/kg



## #29\_WLAN5GHz\_802.11a\_6Mbps\_Back\_1cm\_Ch157

Communication System: 802.11a ; Frequency: 5785 MHz; Duty Cycle: 1:1.146

Medium: MSL\_5G\_150221 Medium parameters used :  $f = 5785$  MHz;  $\sigma = 6.173$  S/m;  $\epsilon_r = 46.795$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

### DASY5 Configuration

- Probe: EX3DV4 - SN3954; ConvF(3.96, 3.96, 3.96); Calibrated: 2014/11/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2014/7/23
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Configuration/Ch157/Area Scan (101x181x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0265 W/kg

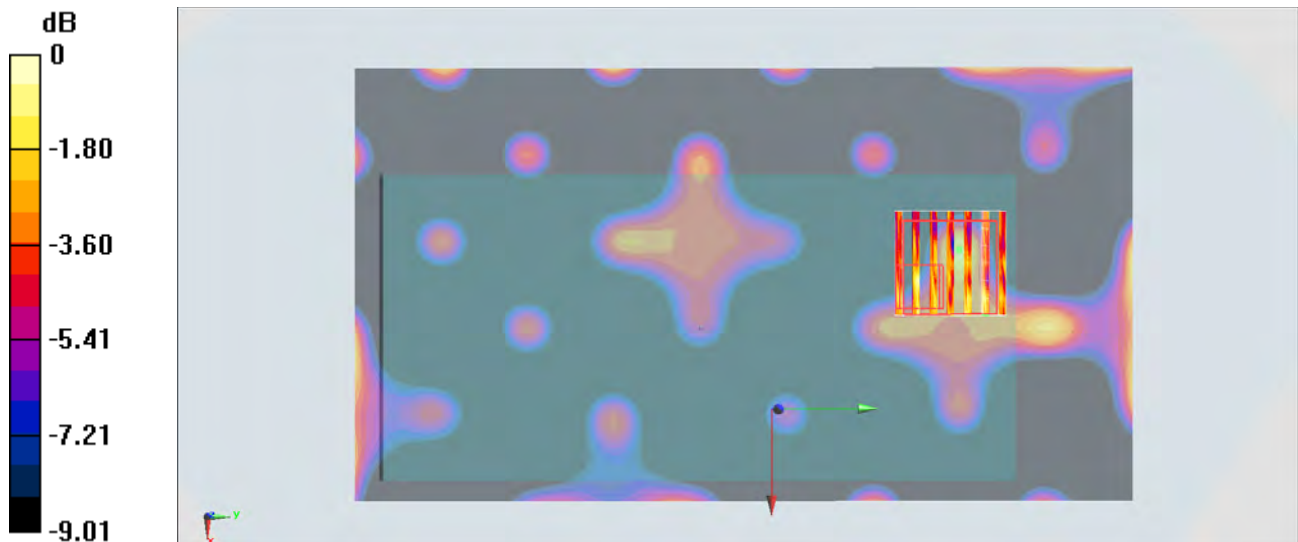
**Configuration/Ch157/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 2.241 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.0420 W/kg

**SAR(1 g) = 0.020 W/kg; SAR(10 g) = 0.011 W/kg**

Maximum value of SAR (measured) = 0.0328 W/kg



0 dB = 0.0328 W/kg = -14.84 dBW/kg



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**Appendix C. DAS Y Calibration Certificate**

The DAS Y calibration certificates are shown as follows.



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **D835V2-4d162\_Nov14**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d162**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-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.

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

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	41.5	0.90 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	41.2 ± 6 %	0.91 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.15 W/kg ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	1.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>5.99 W/kg ± 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.2	0.97 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	54.5 ± 6 %	1.01 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	2.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.56 W/kg ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	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 ± 16.5 % (k=2)</b>

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

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 $\Omega$ - 2.6 j $\Omega$
Return Loss	- 28.2 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 $\Omega$ - 5.0 j $\Omega$
Return Loss	- 24.9 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.439 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	December 28, 2012

## DASY5 Validation Report for Head TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162**

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:

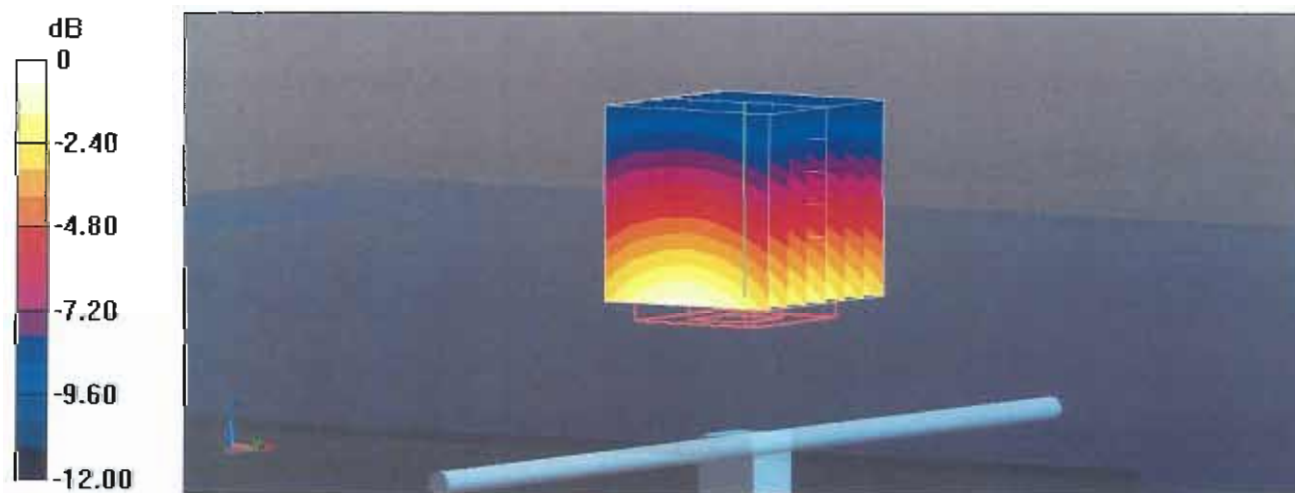
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.48 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.44 W/kg

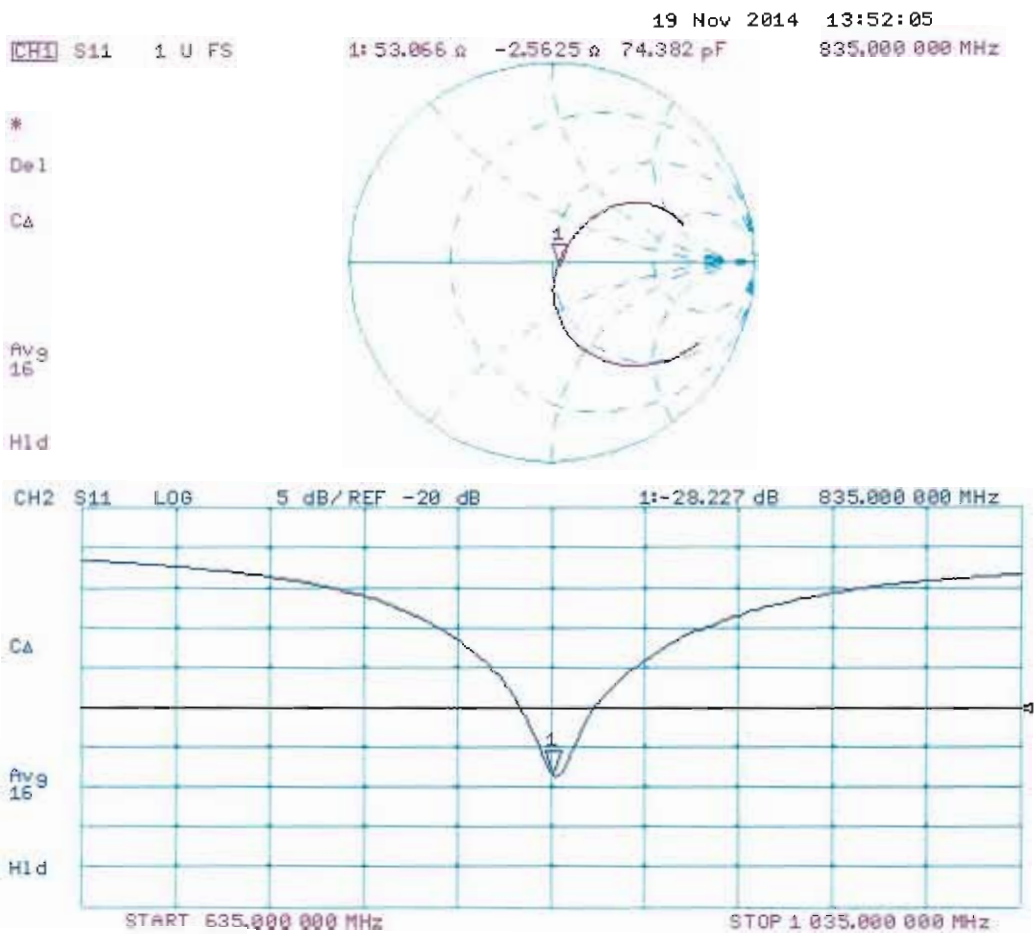
**SAR(1 g) = 2.31 W/kg; SAR(10 g) = 1.51 W/kg**

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



0 dB = 2.70 W/kg = 4.31 dBW/kg

# Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 18.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162**

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

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

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: 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:

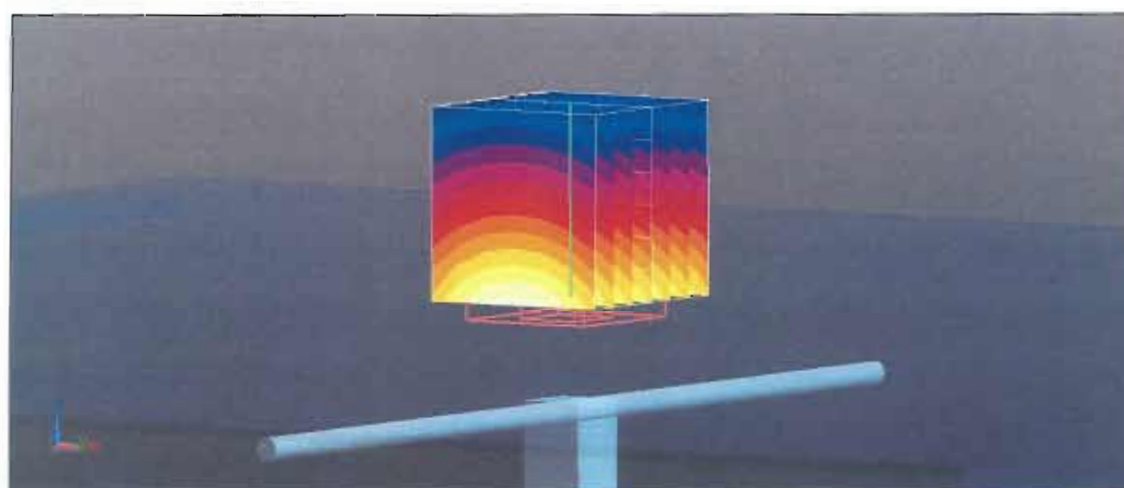
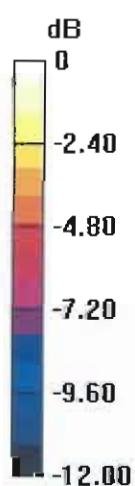
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.47 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.66 W/kg

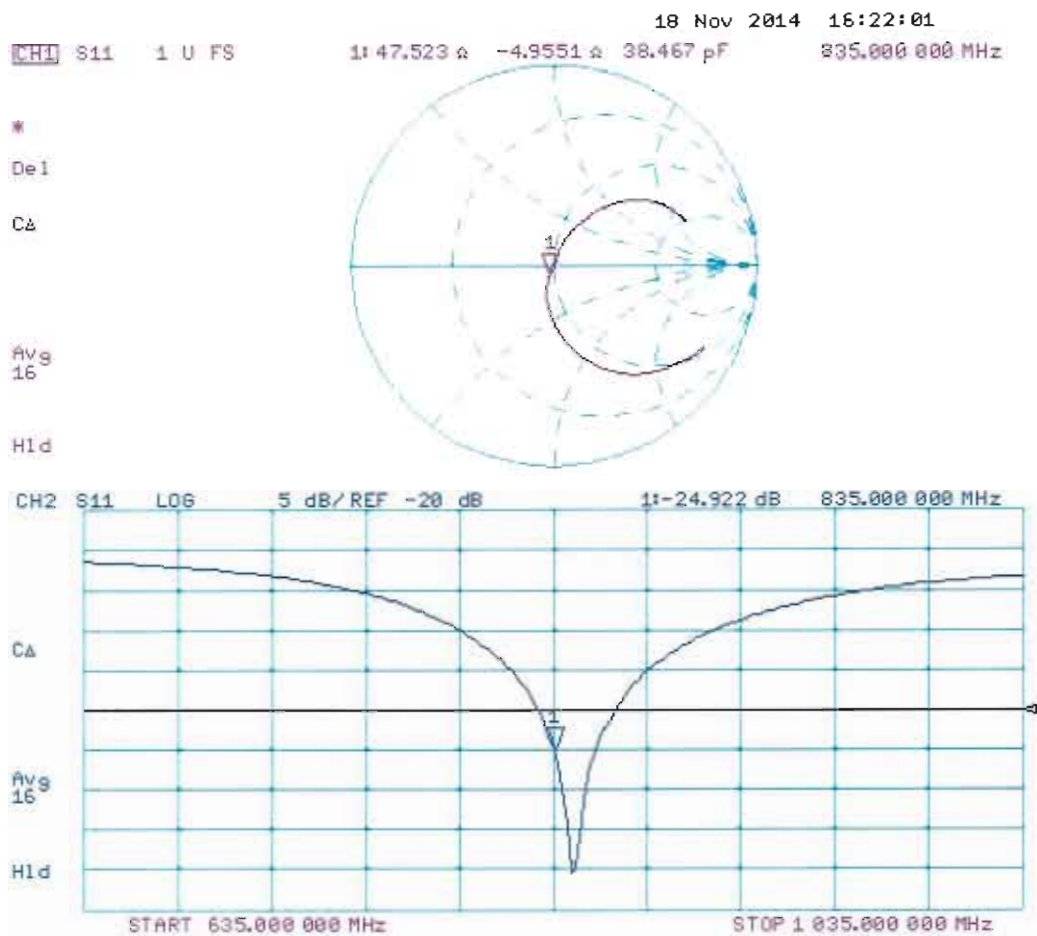
**SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.62 W/kg**

Maximum value of SAR (measured) = 2.90 W/kg



0 dB = 2.90 W/kg = 4.62 dBW/kg

# Impedance Measurement Plot for Body TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **D1900V2-5d182\_Nov14**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d182**

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

Calibration date: **November 14, 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 Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 17, 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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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.

<b>DASY Version</b>	DASY5	V52.8.8
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1900 MHz ± 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	40.1 ± 6 %	1.39 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	9.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>39.8 W/kg ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	5.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>20.8 W/kg ± 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	53.3	1.52 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	53.3 ± 6 %	1.52 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	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 ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	5.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.3 W/kg ± 16.5 % (k=2)</b>

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

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 $\Omega$ + 4.5 j $\Omega$
Return Loss	- 24.8 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.3 $\Omega$ + 5.7 j $\Omega$
Return Loss	- 24.8 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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 23, 2013

## DASY5 Validation Report for Head TSL

Date: 14.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182**

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:

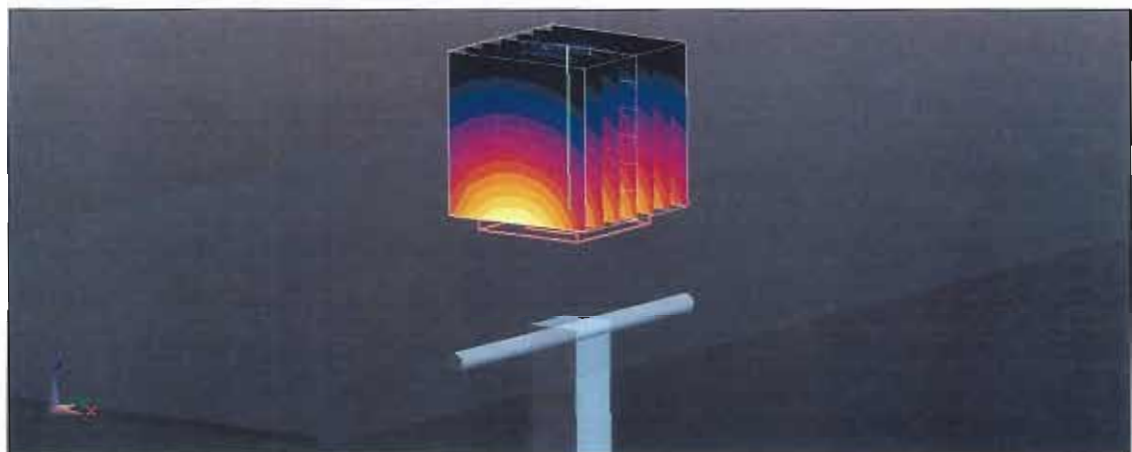
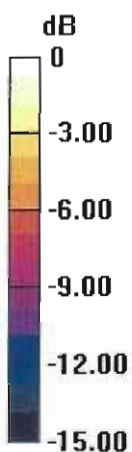
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.52 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 18.1 W/kg

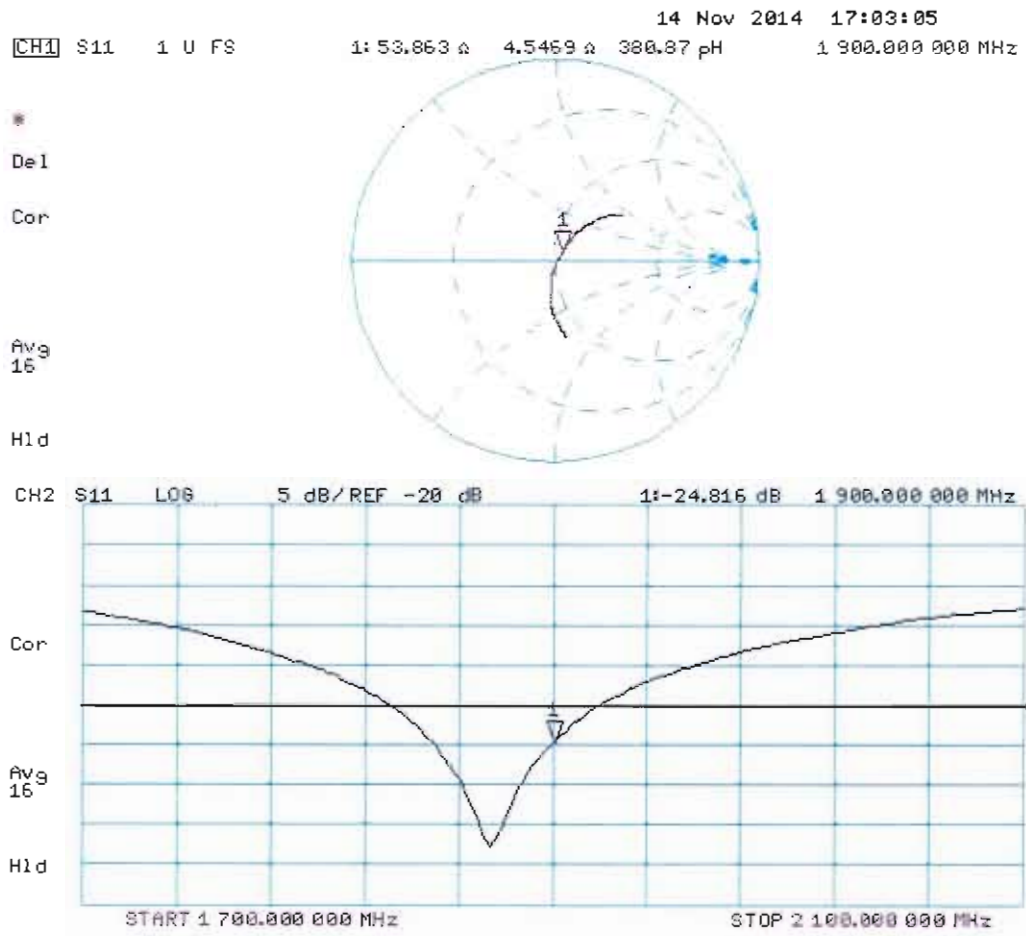
**SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.19 W/kg**

Maximum value of SAR (measured) = 12.5 W/kg



0 dB = 12.5 W/kg = 10.97 dBW/kg

# Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 14.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182**

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:

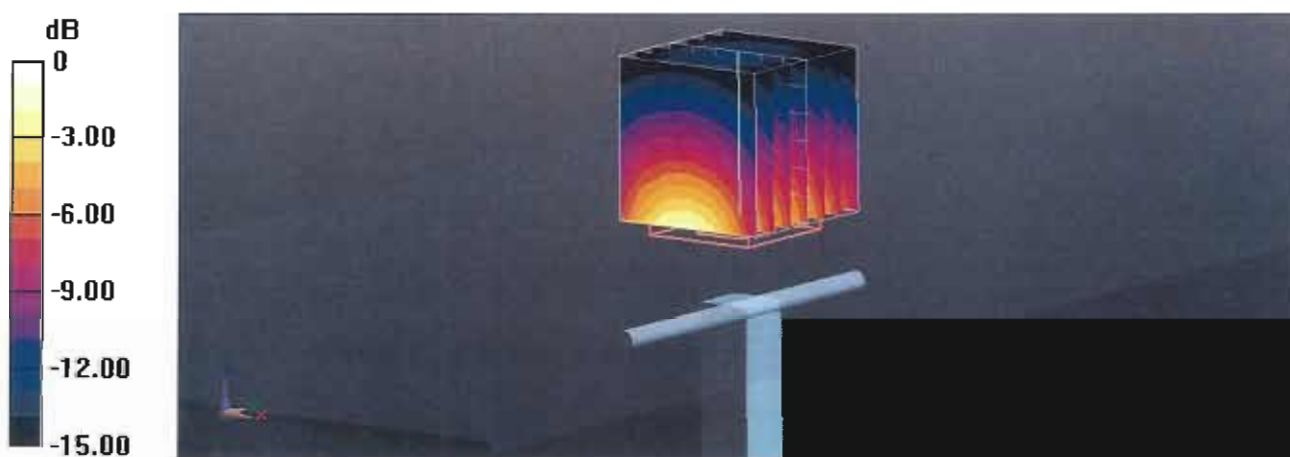
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.38 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 17.5 W/kg

**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.32 W/kg**

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



0 dB = 12.6 W/kg = 11.00 dBW/kg

# Impedance Measurement Plot for Body TSL

14 Nov 2014 17:01:36

CH1 S11 1 U FS

1: 49.299  $\Delta$  5.6582  $\Delta$  473.96  $\mu$ H

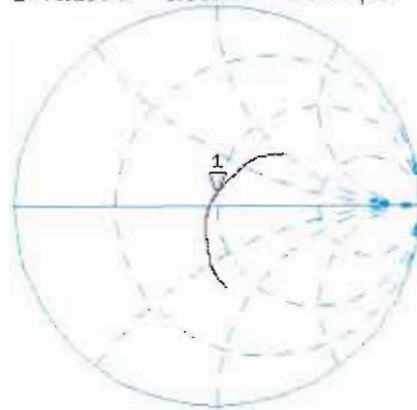
1 900.000 000 MHz

De1

Cor

Avg  
16

H1d



CH2 S11 L06

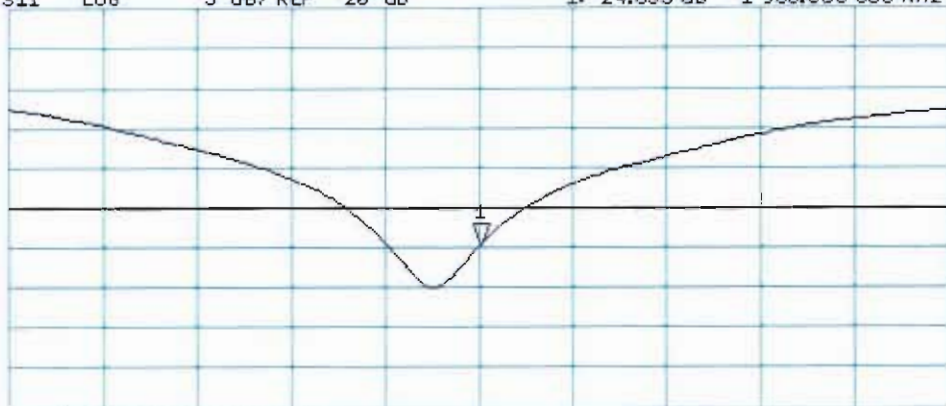
5 dB/REF -20 dB

1: -24.833 dB 1 900.000 000 MHz

Cor

Avg  
16

H1d



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz



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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **D2450V2-924\_Nov14**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 924**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-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 20, 2014

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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:

- 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.

<b>DASY Version</b>	DASY5	V52.8.8
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	2450 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	39.2	1.80 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	39.0 $\pm$ 6 %	1.86 mho/m $\pm$ 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>51.9 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	6.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>24.3 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	52.7	1.95 mho/m
<b>Measured Body TSL parameters</b>	(22.0 $\pm$ 0.2) °C	50.9 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>51.4 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	6.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>23.8 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	$54.8 \Omega + 3.2 j\Omega$
Return Loss	- 25.3 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.3 \Omega + 4.6 j\Omega$
Return Loss	- 26.8 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 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 26, 2013

## DASY5 Validation Report for Head TSL

Date: 18.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.86$  S/m;  $\epsilon_r = 39$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); 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:

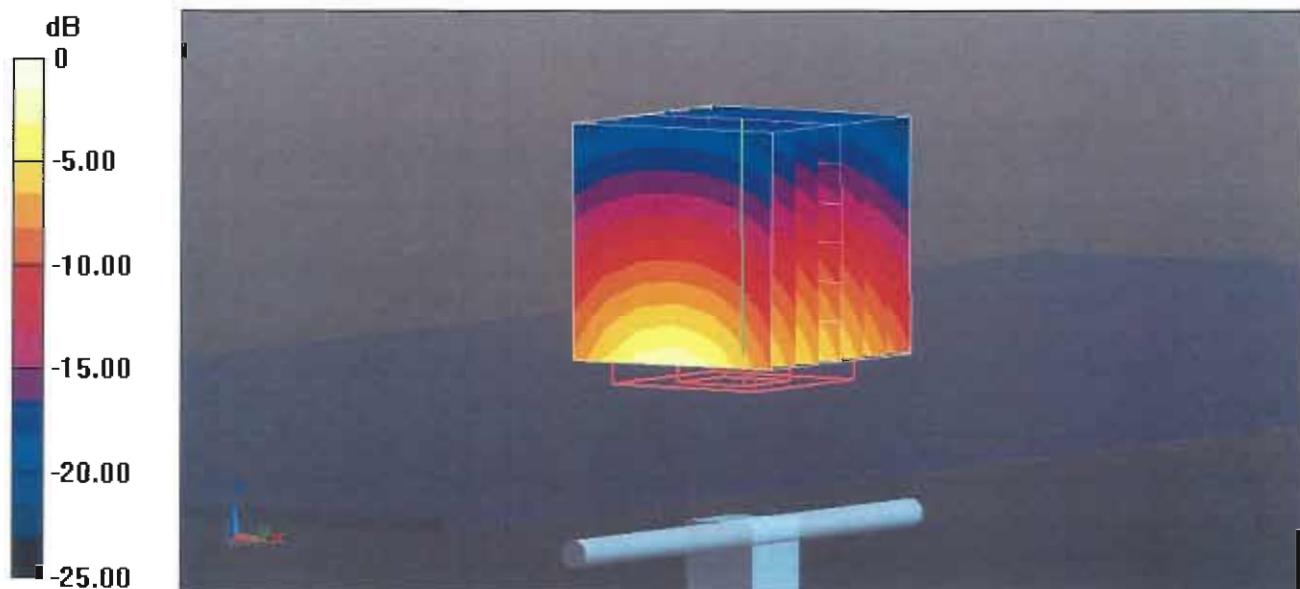
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.6 V/m; Power Drift = -0.00 dB

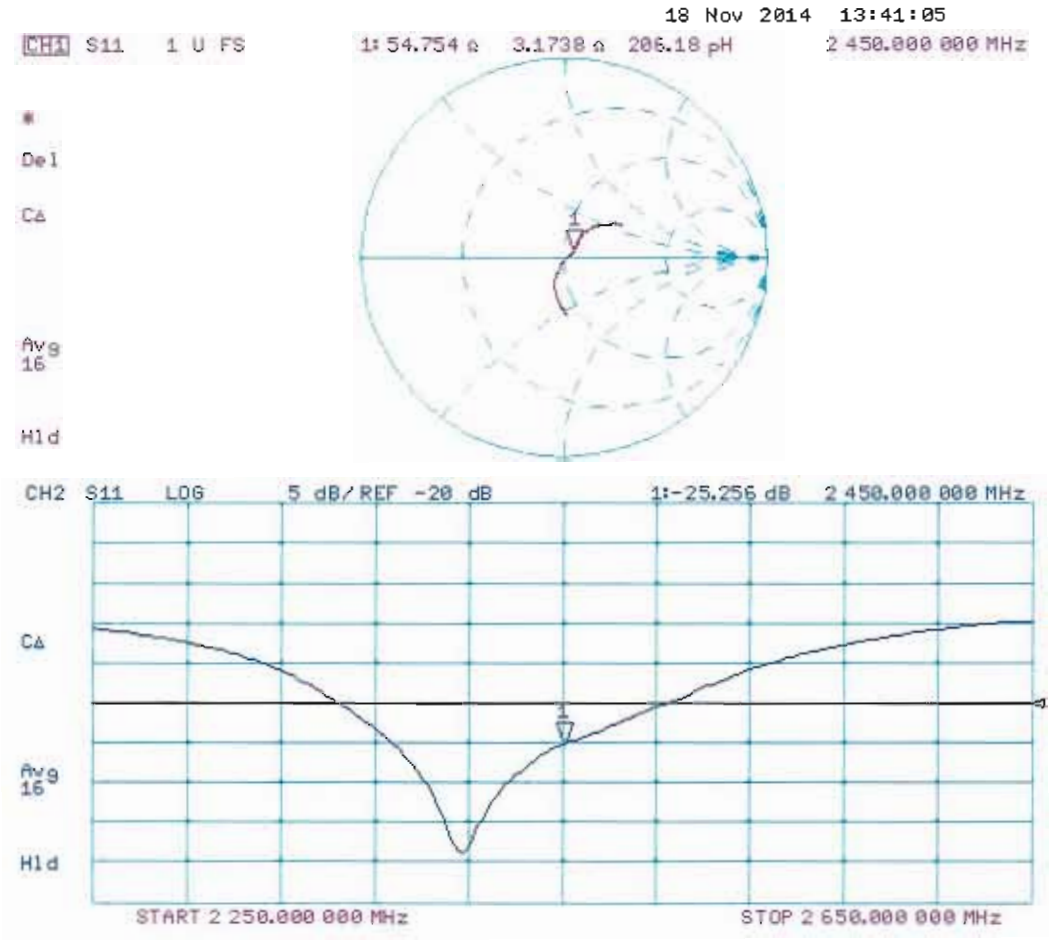
Peak SAR (extrapolated) = 27.1 W/kg

**SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.14 W/kg**

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



# Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.03$  S/m;  $\epsilon_r = 50.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); 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:

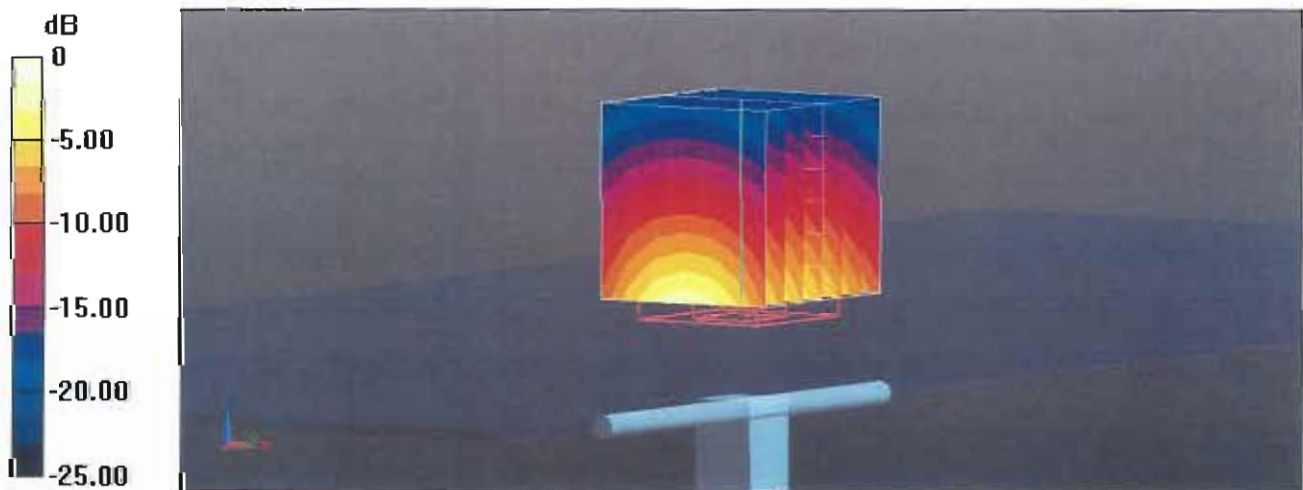
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.44 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 27.9 W/kg

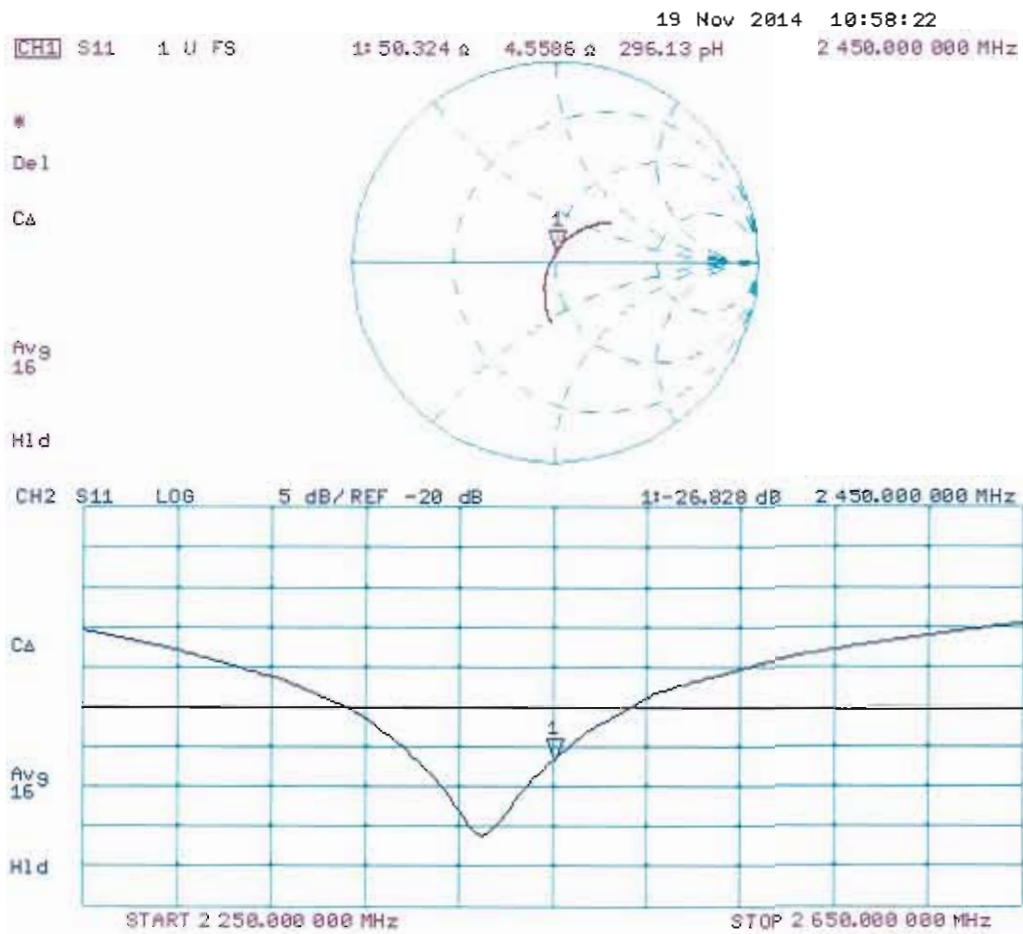
**SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.05 W/kg**

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



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

# Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **D2600V2-1070\_Nov14**

## CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1070**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-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:	Katja Pokovic	Technical Manager	

Issued: November 20, 2014

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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.

<b>DASY Version</b>	DASY5	V52.8.8
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	2600 MHz ± 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	39.0	1.96 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	38.4 ± 6 %	2.03 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>56.9 W/kg ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	6.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>25.6 W/kg ± 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	52.5	2.16 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	50.5 ± 6 %	2.21 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>55.3 W/kg ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>24.5 W/kg ± 16.5 % (k=2)</b>

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

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.9 $\Omega$ - 5.2 j $\Omega$
Return Loss	- 25.8 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 $\Omega$ - 4.4 j $\Omega$
Return Loss	- 24.4 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.146 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	July 17, 2013

## DASY5 Validation Report for Head TSL

Date: 18.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1070**

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.03$  S/m;  $\epsilon_r = 38.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.46, 4.46, 4.46); 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:

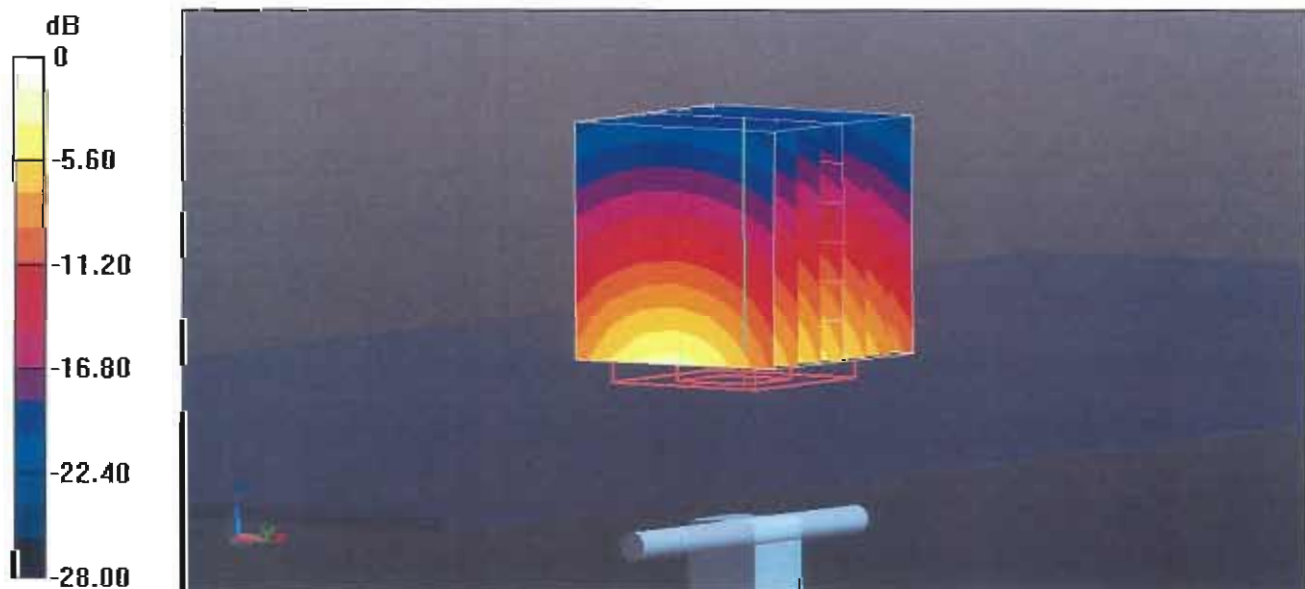
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.6 V/m; Power Drift = 0.00 dB

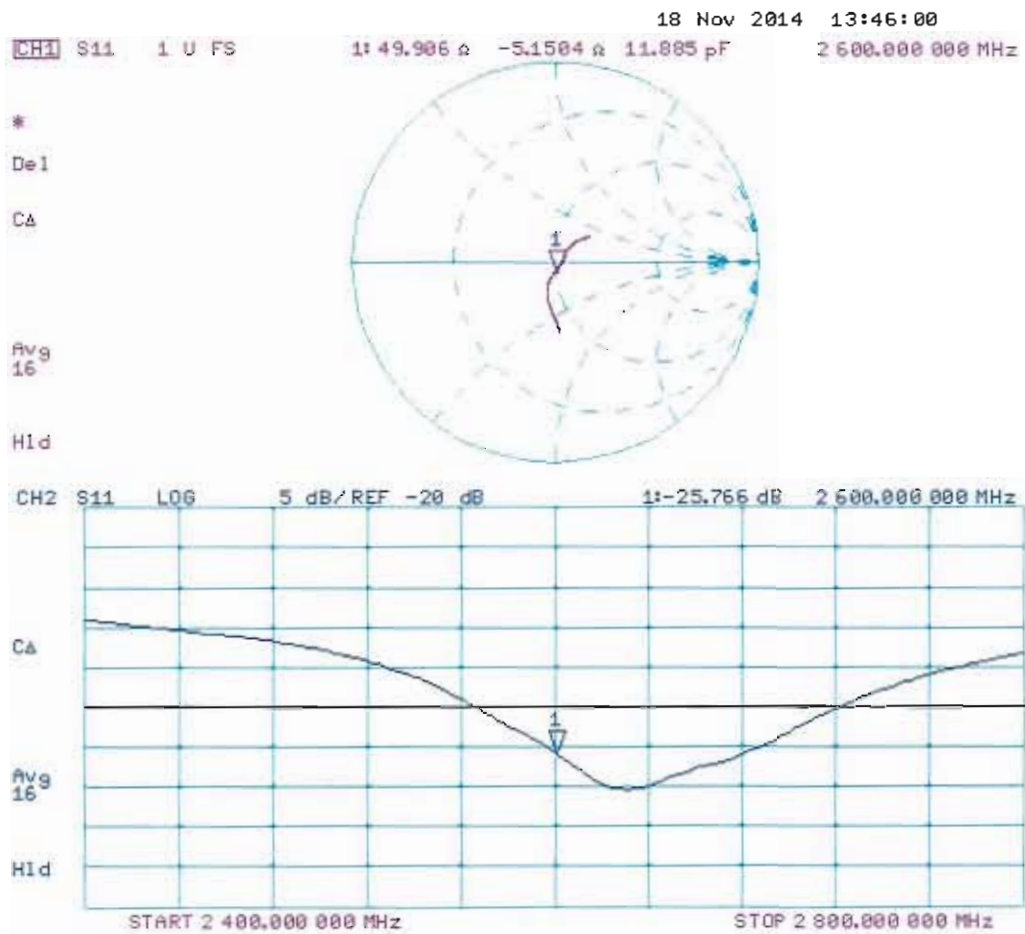
Peak SAR (extrapolated) = 30.7 W/kg

**SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.47 W/kg**

Maximum value of SAR (measured) = 19.5 W/kg



# Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1070**

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.21$  S/m;  $\epsilon_r = 50.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.24, 4.24, 4.24); 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:

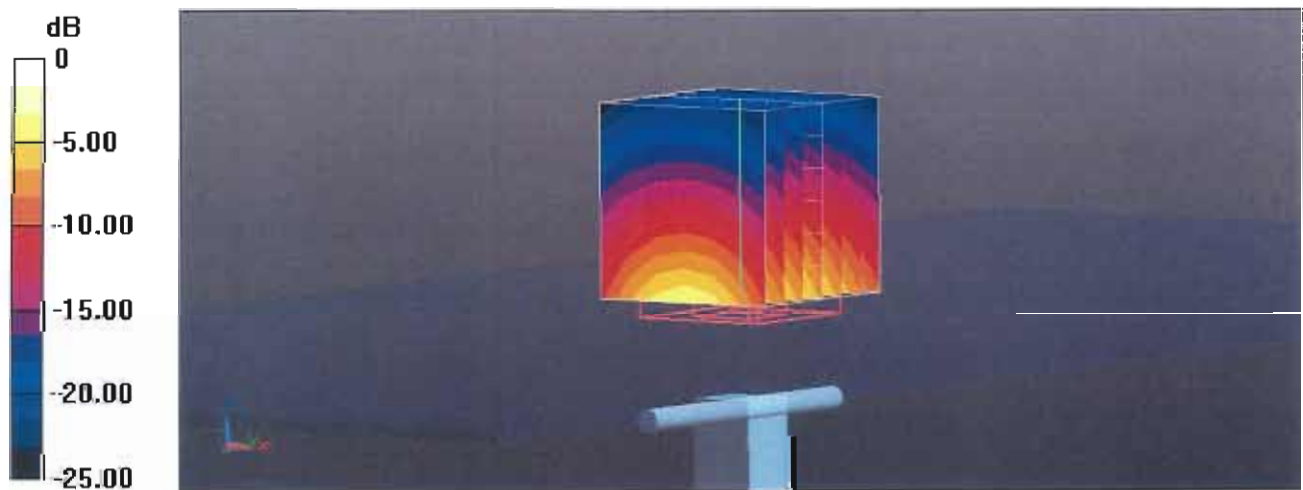
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.43 V/m; Power Drift = -0.03 dB

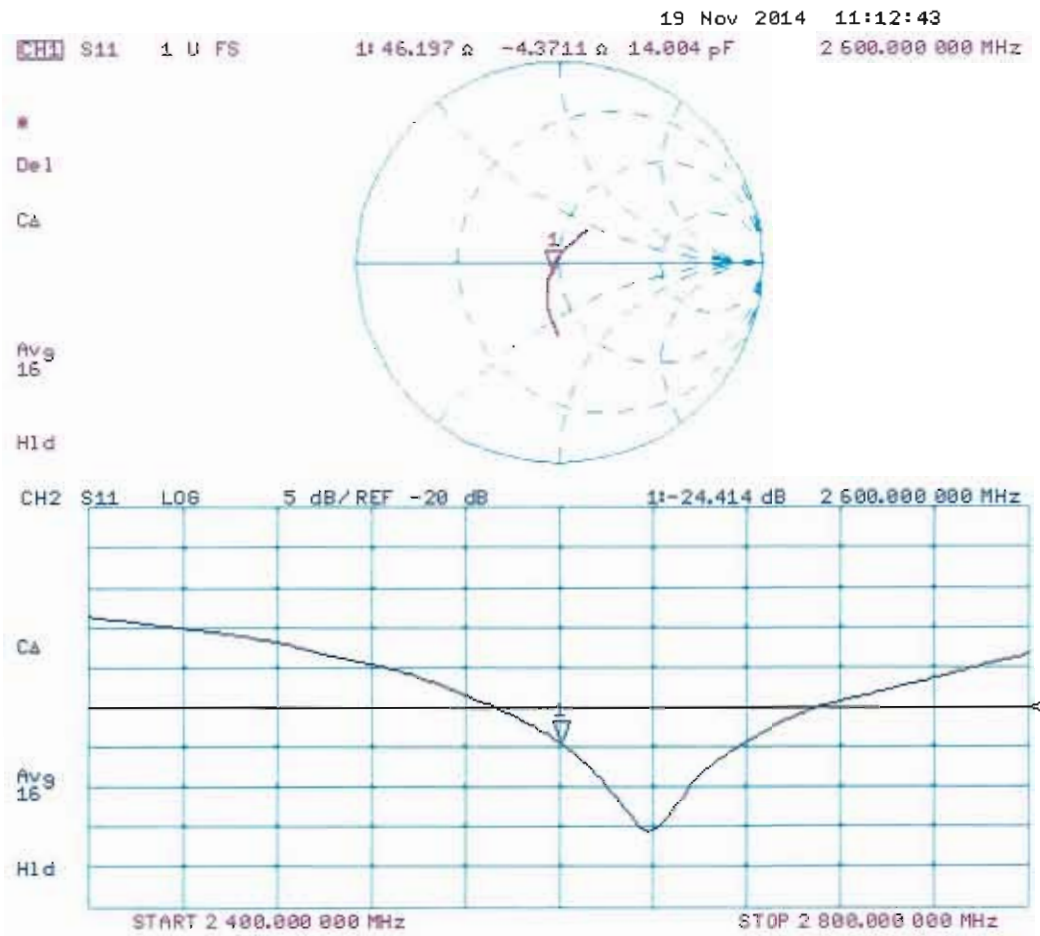
Peak SAR (extrapolated) = 30.7 W/kg

**SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.2 W/kg**

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



# Impedance Measurement Plot for Body TSL





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-TW (Auden)**

Certificate No: **D5GHzV2-1006\_Sep14**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1006**

Calibration procedure(s) **QA CAL-22.v2**  
**Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **September 25, 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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
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 EX3DV4	SN: 3503	30-Dec-13 (No. EX3-3503_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-13)	In house check: Oct-14

Calibrated by: **Claudio Leubler**      Function: **Laboratory Technician**

Approved by: **Katja Pokovic**      Technical Manager

Signature   


Issued: September 25, 2014

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



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The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

### 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:

- IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- 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

### 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 V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>81.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>23.0 W/kg ± 19.5 % (k=2)</b>

### Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.72 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>86.6 W / kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>24.7 W/kg ± 19.5 % (k=2)</b>

### Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.65 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>85.8 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>24.4 W/kg ± 19.5 % (k=2)</b>

## Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	5.14 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>82.9 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>23.5 W/kg ± 19.5 % (k=2)</b>

### Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.40 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.81 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>77.5 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.6 W/kg ± 19.5 % (k=2)</b>

### Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>80.0 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>22.3 W/kg ± 19.5 % (k=2)</b>



### Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.93 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>85.2 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>23.6 W/kg ± 19.5 % (k=2)</b>

### Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.21 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>78.4 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.6 W/kg ± 19.5 % (k=2)</b>

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

### Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.5 $\Omega$ - 9.1 j $\Omega$
Return Loss	- 20.8 dB

### Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	52.1 $\Omega$ - 2.3 j $\Omega$
Return Loss	- 30.3 dB

### Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 $\Omega$ - 3.5 j $\Omega$
Return Loss	- 26.0 dB

### Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.3 $\Omega$ + 1.1 j $\Omega$
Return Loss	- 25.7 dB

### Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.9 $\Omega$ - 9.4 j $\Omega$
Return Loss	- 20.5 dB

### Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	55.5 $\Omega$ + 0.7 j $\Omega$
Return Loss	- 25.6 dB

### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.1 $\Omega$ - 4.5 j $\Omega$
Return Loss	- 22.1 dB

### Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.1 $\Omega$ + 7.0 j $\Omega$
Return Loss	- 20.6 dB

## General Antenna Parameters and Design

Electrical Delay (one direction)	1.200 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 28, 2003

## DASY5 Validation Report for Head TSL

Date: 25.09.2014

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1006

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.54$  S/m;  $\epsilon_r = 34.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.64$  S/m;  $\epsilon_r = 34.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.93$  S/m;  $\epsilon_r = 34.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.14$  S/m;  $\epsilon_r = 34.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (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=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.07 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 30.0 W/kg

**SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.32 W/kg**

Maximum value of SAR (measured) = 18.5 W/kg

### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.19 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 33.0 W/kg

**SAR(1 g) = 8.72 W/kg; SAR(10 g) = 2.49 W/kg**

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

### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

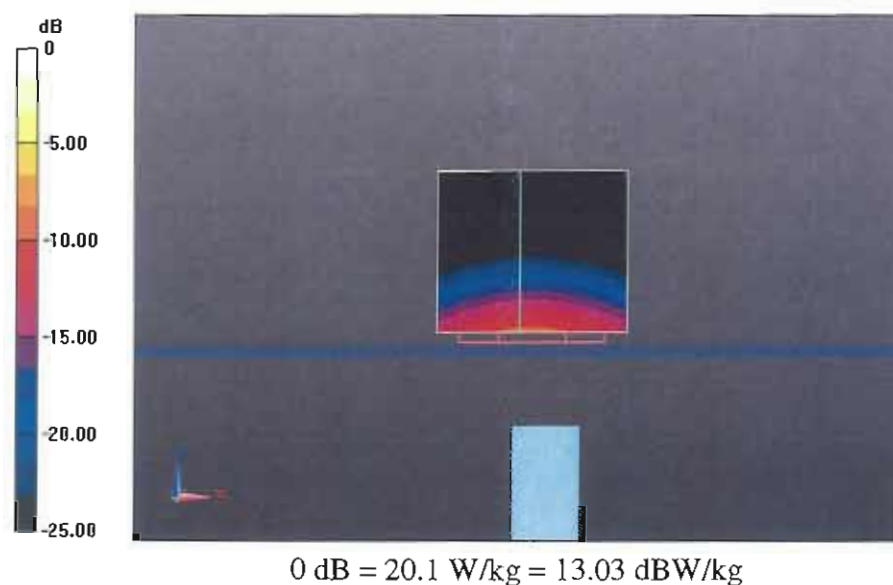
Reference Value = 64.89 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 34.6 W/kg

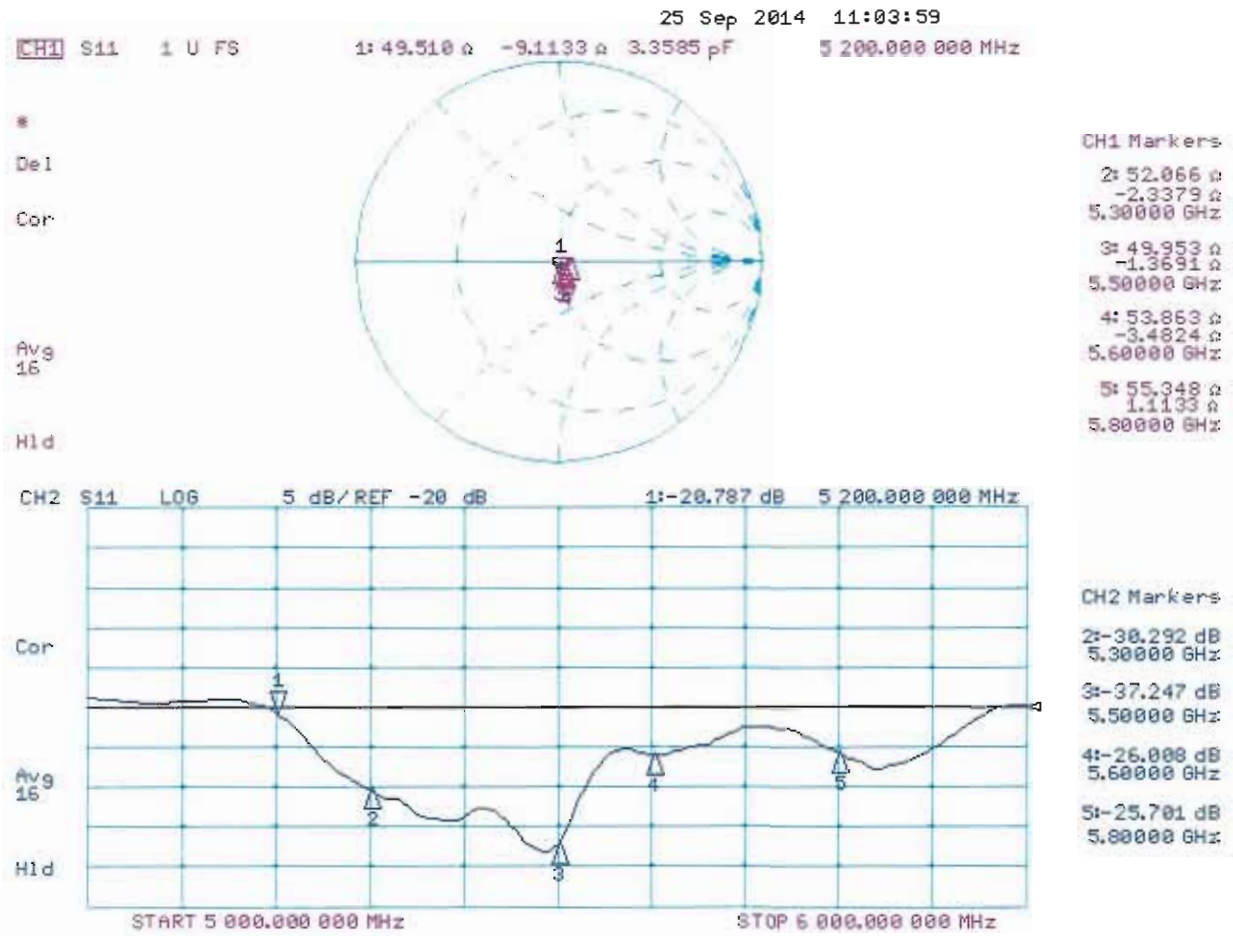
**SAR(1 g) = 8.65 W/kg; SAR(10 g) = 2.46 W/kg**

Maximum value of SAR (measured) = 20.5 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 62.52 V/m; Power Drift = 0.06 dB  
Peak SAR (extrapolated) = 34.8 W/kg  
**SAR(1 g) = 8.36 W/kg; SAR(10 g) = 2.37 W/kg**  
Maximum value of SAR (measured) = 20.1 W/kg



# Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 24.09.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1006**

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.4$  S/m;  $\epsilon_r = 47.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.53$  S/m;  $\epsilon_r = 46.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.93$  S/m;  $\epsilon_r = 46.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.21$  S/m;  $\epsilon_r = 46.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (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=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.30 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 30.7 W/kg

**SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.18 W/kg**

Maximum value of SAR (measured) = 18.4 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.98 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 32.5 W/kg

**SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.25 W/kg**

Maximum value of SAR (measured) = 19.2 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

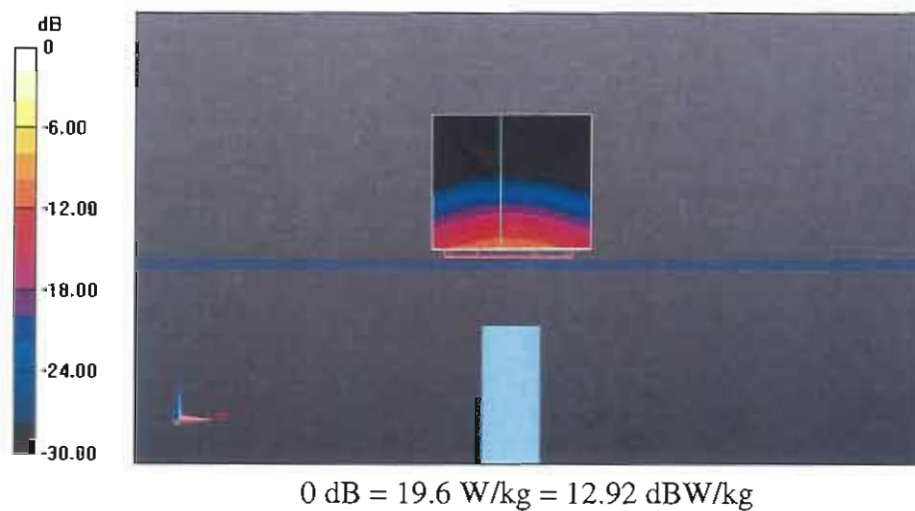
Reference Value = 60.91 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 37.8 W/kg

**SAR(1 g) = 8.59 W/kg; SAR(10 g) = 2.38 W/kg**

Maximum value of SAR (measured) = 21.0 W/kg

**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 57.36 V/m; Power Drift = -0.00 dB  
Peak SAR (extrapolated) = 36.5 W/kg  
**SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.18 W/kg**  
Maximum value of SAR (measured) = 19.6 W/kg



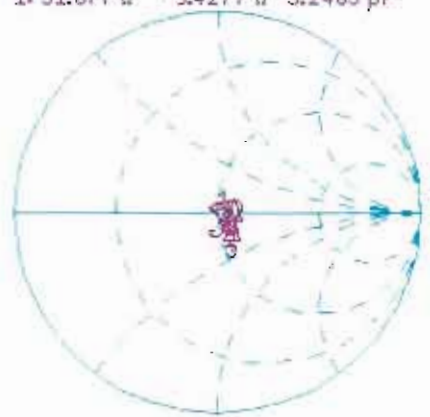


# Impedance Measurement Plot for Body TSL

24 Sep 2014 10:59:49

CH1 S11 1 U FS 1: 51.877  $\Omega$  -9.4277  $\Omega$  3.2465 pF 5 200.000 000 MHz

\*  
De1  
Cor  
Avg  
16  
H1d

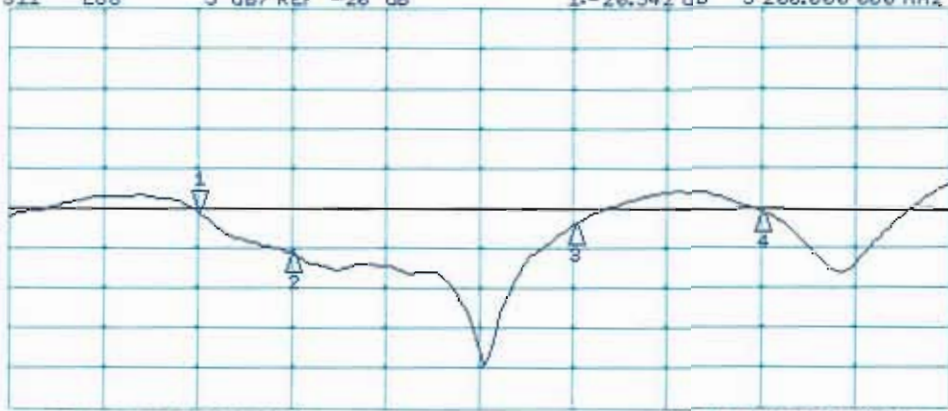


CH1 Markers

- 2: 55.475  $\Omega$   
8.7363  $\Omega$   
5.30000 GHz
- 3: 57.074  $\Omega$   
-4.4961  $\Omega$   
5.60000 GHz
- 4: 57.125  $\Omega$   
7.0313  $\Omega$   
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.542 dB 5 200.000 000 MHz

Cor  
Avg  
16  
H1d



CH2 Markers

- 2: -25.615 dB  
5.30000 GHz
- 3: -22.132 dB  
5.60000 GHz
- 4: -20.608 dB  
5.80000 GHz

START 5 000.000 000 MHz

STOP 6 000.000 000 MHz



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **DAE4-778\_Aug14**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 778**

Calibration procedure(s) **QA CAL-06.v26  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **August 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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: August 21, 2014

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

## Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement.* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.660 $\pm$ 0.02% (k=2)	403.462 $\pm$ 0.02% (k=2)	405.008 $\pm$ 0.02% (k=2)
Low Range	3.98608 $\pm$ 1.50% (k=2)	3.96528 $\pm$ 1.50% (k=2)	3.99925 $\pm$ 1.50% (k=2)

## Connector Angle

Connector Angle to be used in DASY system	283.5 $^{\circ}$ $\pm$ 1 $^{\circ}$
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## Appendix (Additional assessments outside the scope of SCS108)

### 1. DC Voltage Linearity

High Range		Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X	+ Input	199995.84	-1.56	-0.00
Channel X	+ Input	20003.72	2.74	0.01
Channel X	- Input	-19999.08	1.97	-0.01
Channel Y	+ Input	199996.07	-1.42	-0.00
Channel Y	+ Input	20001.31	0.31	0.00
Channel Y	- Input	-20000.87	0.11	-0.00
Channel Z	+ Input	199998.93	0.77	0.00
Channel Z	+ Input	19999.69	-1.30	-0.01
Channel Z	- Input	-20003.57	-2.56	0.01

Low Range		Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X	+ Input	2001.21	0.06	0.00
Channel X	+ Input	202.70	1.25	0.62
Channel X	- Input	-197.74	0.80	-0.40
Channel Y	+ Input	2001.16	0.12	0.01
Channel Y	+ Input	201.92	0.49	0.24
Channel Y	- Input	-200.16	-1.65	0.83
Channel Z	+ Input	2000.68	-0.34	-0.02
Channel Z	+ Input	200.74	-0.52	-0.26
Channel Z	- Input	-200.20	-1.64	0.82

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-4.66	-5.89
	- 200	7.17	5.70
Channel Y	200	-2.41	-2.68
	- 200	-1.01	-0.40
Channel Z	200	-9.89	-9.65
	- 200	7.53	7.85

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	-1.80	-2.22
Channel Y	200	9.60	-	0.93
Channel Z	200	3.92	6.62	-

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16054	16785
Channel Y	16177	16252
Channel Z	16434	15484

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.87	-0.07	1.83	0.47
Channel Y	-0.91	-2.65	0.63	0.61
Channel Z	-0.54	-1.74	0.70	0.54

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **DAE4-1388\_Sep14**

**CALIBRATION CERTIFICATE**

Object **DAE4 - SD 000 D04 BM - SN: 1388**

Calibration procedure(s) **QA CAL-06.v28**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **September 24, 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
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

Calibrated by:	Name Dominique Steffen	Function Technician	Signature 
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: September 29, 2014

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

## Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity*: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity*: Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation*: Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted*: Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current*: Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance*: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage*: Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption*: Typical value for information. Supply currents in various operating modes.



## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.505 $\pm$ 0.02% (k=2)	403.402 $\pm$ 0.02% (k=2)	403.189 $\pm$ 0.02% (k=2)
Low Range	3.97195 $\pm$ 1.50% (k=2)	3.98797 $\pm$ 1.50% (k=2)	3.99129 $\pm$ 1.50% (k=2)

## Connector Angle

Connector Angle to be used in DASY system	154.5 $^{\circ}$ $\pm$ 1 $^{\circ}$
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## Appendix (Additional assessments outside the scope of SCS108)

### 1. DC Voltage Linearity

High Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	199997.40	0.80	0.00
Channel X + Input	20002.38	0.99	0.00
Channel X - Input	-19999.01	1.55	-0.01
Channel Y + Input	199996.91	0.18	0.00
Channel Y + Input	19998.73	-2.53	-0.01
Channel Y - Input	-20002.98	-2.36	0.01
Channel Z + Input	199996.26	-0.88	-0.00
Channel Z + Input	19999.38	-1.82	-0.01
Channel Z - Input	-20002.39	-1.63	0.01

Low Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2001.55	0.25	0.01
Channel X + Input	201.98	0.28	0.14
Channel X - Input	-197.54	0.60	-0.30
Channel Y + Input	2001.08	-0.22	-0.01
Channel Y + Input	200.78	-1.00	-0.50
Channel Y - Input	-199.21	-0.99	0.50
Channel Z + Input	2000.84	-0.28	-0.01
Channel Z + Input	200.93	-0.65	-0.32
Channel Z - Input	-199.11	-0.76	0.38

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-0.64	-2.30
	- 200	3.99	2.37
Channel Y	200	7.98	7.61
	- 200	-10.72	-11.07
Channel Z	200	-1.38	-1.31
	- 200	-0.23	-0.43

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	0.91	-4.13
Channel Y	200	8.73	-	3.62
Channel Z	200	9.79	6.21	-

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15951	16480
Channel Y	15998	15585
Channel Z	16182	16535

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	-1.16	-1.93	-0.45	0.28
Channel Y	-1.08	-1.92	0.20	0.36
Channel Z	-0.59	-1.64	0.63	0.36

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **DAE3-577\_Oct14**

## CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AA - SN: 577**

Calibration procedure(s) **QA CAL-06.v28  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **October 06, 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
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: October 6, 2014

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

## Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V , full range = -100...+300 mV  
Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.482 $\pm$ 0.02% (k=2)	403.471 $\pm$ 0.02% (k=2)	403.779 $\pm$ 0.02% (k=2)
Low Range	3.91221 $\pm$ 1.50% (k=2)	3.94944 $\pm$ 1.50% (k=2)	3.96413 $\pm$ 1.50% (k=2)

## Connector Angle

Connector Angle to be used in DASY system	190.0 $\pm$ 1 $^{\circ}$
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## Appendix (Additional assessments outside the scope of SCS108)

### 1. DC Voltage Linearity

High Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	200032.88	-1.99	-0.00
Channel X + Input	20008.32	4.67	0.02
Channel X - Input	-20001.95	3.91	-0.02
Channel Y + Input	200034.36	-0.48	-0.00
Channel Y + Input	20004.96	1.49	0.01
Channel Y - Input	-20005.18	0.80	-0.00
Channel Z + Input	200033.48	-1.14	-0.00
Channel Z + Input	20005.14	1.72	0.01
Channel Z - Input	-20006.62	-0.60	0.00

Low Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000.31	0.11	0.01
Channel X + Input	200.48	0.24	0.12
Channel X - Input	-199.49	0.14	-0.07
Channel Y + Input	1999.98	-0.10	-0.01
Channel Y + Input	199.48	-0.67	-0.34
Channel Y - Input	-200.14	-0.32	0.16
Channel Z + Input	1999.95	-0.08	-0.00
Channel Z + Input	199.09	-0.96	-0.48
Channel Z - Input	-201.17	-1.27	0.64

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-1.95	-3.98
	- 200	5.57	3.77
Channel Y	200	-13.96	-14.08
	- 200	13.30	13.19
Channel Z	200	2.29	2.64
	- 200	-5.81	-5.27

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	0.37	-3.20
Channel Y	200	9.80	-	0.72
Channel Z	200	6.30	6.84	-

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16130	15294
Channel Y	16097	15352
Channel Z	16126	12399

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.41	-0.20	1.04	0.30
Channel Y	-0.55	-1.63	1.48	0.44
Channel Z	-0.30	-1.93	0.42	0.40

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9





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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **DAE4-1279\_Jul14**

**CALIBRATION CERTIFICATE**

Object: **DAE4 - SD 000 D04 BM - SN: 1279**

Calibration procedure(s): **QA CAL-06.v26**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **July 23, 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
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

Calibrated by:	Name Dominique Steffen	Function Technician	Signature 
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: July 23, 2014

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Accreditation No.: **SCS 108**

## Glossary

**DAE** data acquisition electronics  
**Connector angle** information used in DASY system to align probe sensor X to the robot coordinate system.

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV  
Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.154 $\pm$ 0.02% (k=2)	404.952 $\pm$ 0.02% (k=2)	404.290 $\pm$ 0.02% (k=2)
Low Range	3.96895 $\pm$ 1.50% (k=2)	3.97337 $\pm$ 1.50% (k=2)	3.99665 $\pm$ 1.50% (k=2)

## Connector Angle

Connector Angle to be used in DASY system	233.0 $\pm$ 1 $^{\circ}$
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## Appendix (Additional assessments outside the scope of SCS108)

### 1. DC Voltage Linearity

High Range		Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X	+ Input	199996.28	-0.75	-0.00
Channel X	+ Input	20002.78	2.04	0.01
Channel X	- Input	-20000.20	0.82	-0.00
Channel Y	+ Input	199997.56	0.25	0.00
Channel Y	+ Input	20000.12	-0.56	-0.00
Channel Y	- Input	-20001.15	0.01	-0.00
Channel Z	+ Input	199998.60	1.26	0.00
Channel Z	+ Input	20000.98	0.35	0.00
Channel Z	- Input	-20000.67	0.58	-0.00

Low Range		Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X	+ Input	1999.93	-0.74	-0.04
Channel X	+ Input	202.16	1.13	0.56
Channel X	- Input	-198.59	0.25	-0.12
Channel Y	+ Input	1999.39	-1.09	-0.05
Channel Y	+ Input	199.68	-1.31	-0.65
Channel Y	- Input	-199.90	-1.07	0.54
Channel Z	+ Input	2000.69	0.25	0.01
Channel Z	+ Input	200.64	-0.19	-0.09
Channel Z	- Input	-200.22	-1.14	0.57

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	18.54	17.03
	- 200	-15.78	-17.00
Channel Y	200	8.16	8.41
	- 200	-10.99	-11.31
Channel Z	200	-1.02	-1.23
	- 200	0.05	-0.13

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	1.69	-2.74
Channel Y	200	7.73	-	3.46
Channel Z	200	9.61	5.39	-

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15684	16014
Channel Y	16466	15878
Channel Z	15939	15766

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	1.40	0.19	2.56	0.57
Channel Y	-1.38	-3.08	1.77	0.77
Channel Z	0.15	-1.11	1.52	0.50

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **DAE4-1399\_Nov14**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1399**

Calibration procedure(s) **QA CAL-06.v28**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **November 13, 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
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

Calibrated by:	Name Dominique Steffen	Function Technician	Signature 
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: November 13, 2014

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Accreditation No.: **SCS 108**

## Glossary

DAE data acquisition electronics  
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity*: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity*: Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation*: Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted*: Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current*: Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance*: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage*: Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption*: Typical value for information. Supply currents in various operating modes.

## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.595 $\pm$ 0.02% (k=2)	403.856 $\pm$ 0.02% (k=2)	403.711 $\pm$ 0.02% (k=2)
Low Range	3.99125 $\pm$ 1.50% (k=2)	3.98907 $\pm$ 1.50% (k=2)	3.95088 $\pm$ 1.50% (k=2)

## Connector Angle

Connector Angle to be used in DASY system	303.0 $^{\circ}$ $\pm$ 1 $^{\circ}$
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## Appendix (Additional assessments outside the scope of SCS108)

### 1. DC Voltage Linearity

High Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	199994.98	-1.69	-0.00
Channel X + Input	20001.44	0.30	0.00
Channel X - Input	-19999.26	1.43	-0.01
Channel Y + Input	199999.25	1.98	0.00
Channel Y + Input	19999.03	-2.18	-0.01
Channel Y - Input	-20001.89	-1.19	0.01
Channel Z + Input	199997.44	0.45	0.00
Channel Z + Input	19998.57	-2.49	-0.01
Channel Z - Input	-20002.47	-1.62	0.01

Low Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2001.40	0.25	0.01
Channel X + Input	202.15	0.53	0.26
Channel X - Input	-197.74	0.52	-0.26
Channel Y + Input	2001.28	0.25	0.01
Channel Y + Input	200.41	-1.14	-0.57
Channel Y - Input	-199.61	-1.35	0.68
Channel Z + Input	2000.99	0.04	0.00
Channel Z + Input	200.81	-0.68	-0.34
Channel Z - Input	-199.21	-0.81	0.41

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-5.17	-6.60
	- 200	8.22	6.53
Channel Y	200	-6.32	-6.77
	- 200	4.36	4.06
Channel Z	200	-7.31	-7.07
	- 200	5.86	5.56

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	4.40	-1.63
Channel Y	200	9.43	-	6.68
Channel Z	200	8.64	6.47	-

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15820	17016
Channel Y	16103	16959
Channel Z	15890	15243

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.27	-0.44	1.00	0.35
Channel Y	-1.31	-2.29	-0.54	0.36
Channel Z	-1.04	-2.25	1.02	0.47

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **ES3-3270\_Sep14**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3270**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 26, 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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 27, 2014

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### Glossary:

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

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

- 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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A, B, C, D** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

# Probe ES3DV3

## SN:3270

Manufactured: February 25, 2010  
Calibrated: September 26, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3270

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	1.11	1.20	1.22	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	101.5	103.0	103.0	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	197.5	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		208.9	
		Z	0.0	0.0	1.0		208.1	

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

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

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

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3270

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	6.62	6.62	6.62	0.25	2.10	± 12.0 %
835	41.5	0.90	6.43	6.43	6.43	0.45	1.43	± 12.0 %
900	41.5	0.97	6.27	6.27	6.27	0.23	2.15	± 12.0 %
1750	40.1	1.37	5.25	5.25	5.25	0.66	1.26	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.65	1.29	± 12.0 %
2000	40.0	1.40	5.05	5.05	5.05	0.57	1.40	± 12.0 %
2450	39.2	1.80	4.52	4.52	4.52	0.80	1.24	± 12.0 %

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

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

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3270

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	6.17	6.17	6.17	0.43	1.56	± 12.0 %
835	55.2	0.97	6.15	6.15	6.15	0.80	1.17	± 12.0 %
1750	53.4	1.49	4.95	4.95	4.95	0.41	1.78	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.61	1.47	± 12.0 %
2450	52.7	1.95	4.29	4.29	4.29	0.79	1.08	± 12.0 %

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

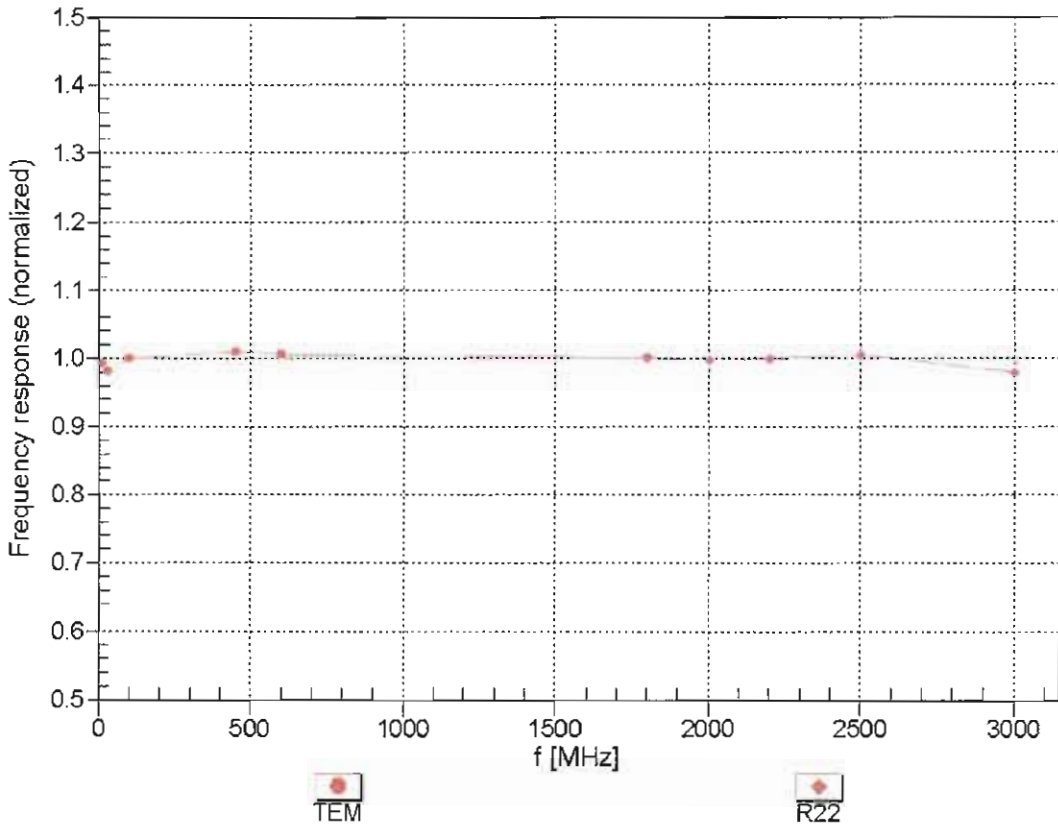
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of SAR parameters ( $\epsilon$  and  $\sigma$ ) is restricted to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

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



# Frequency Response of E-Field

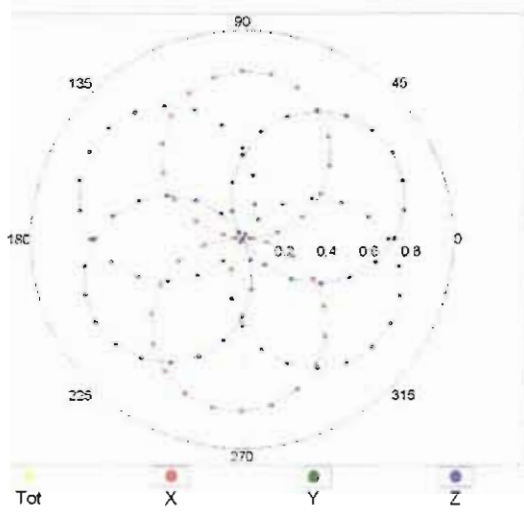
(TEM-Cell:ifi110 EXX, Waveguide: R22)



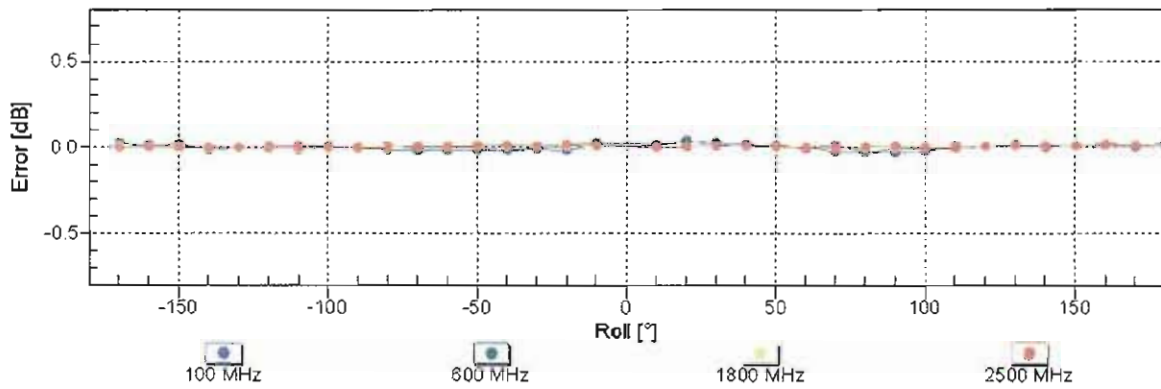
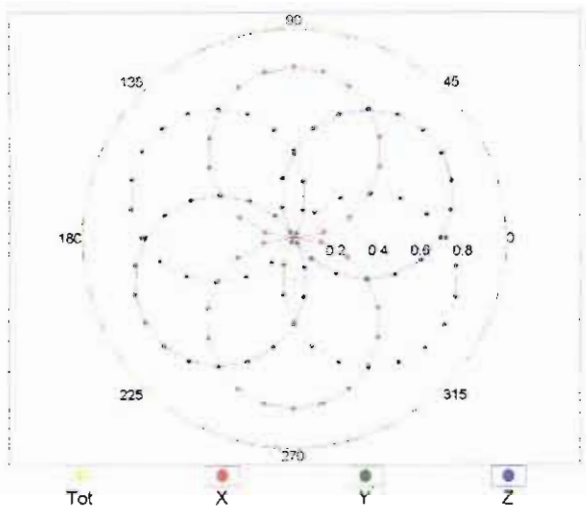
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz,TEM

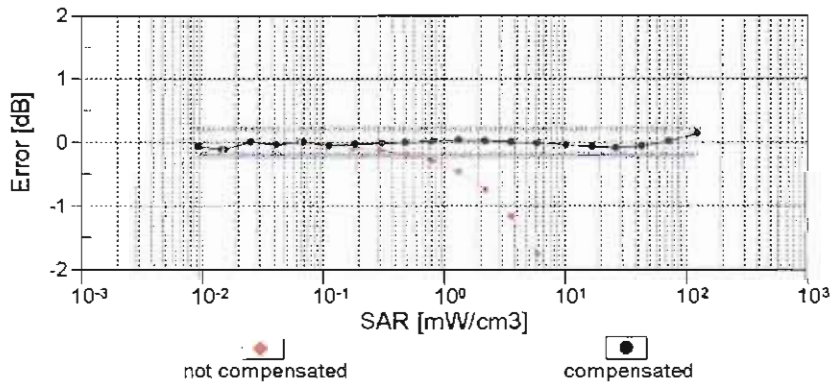
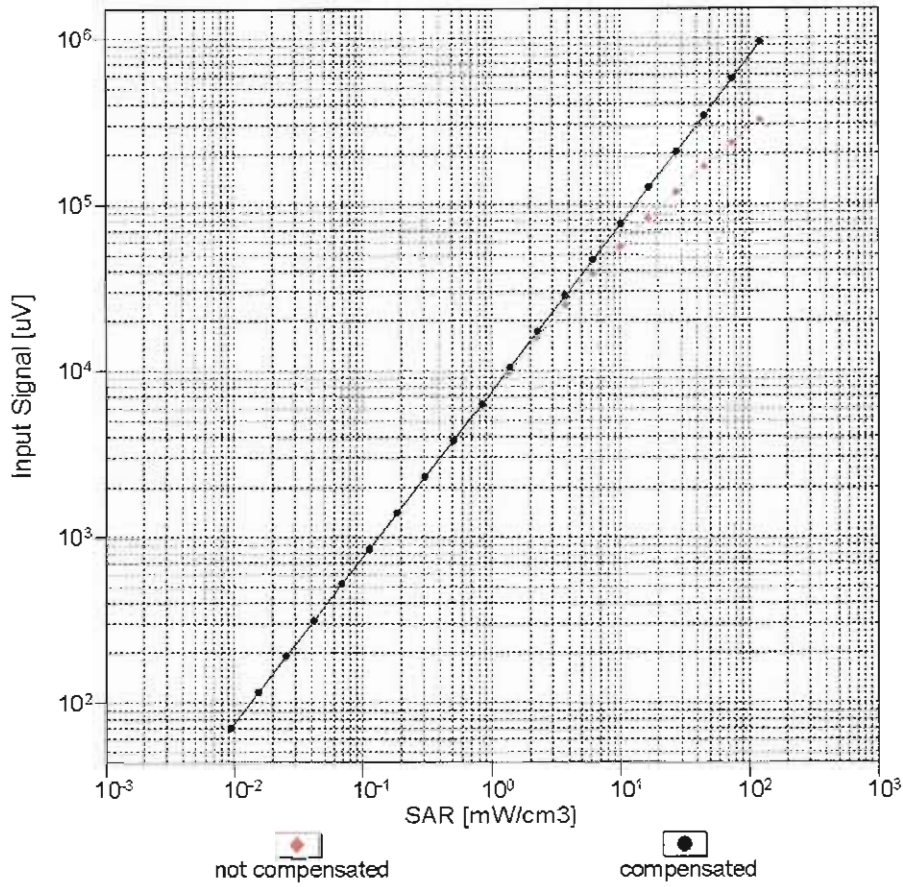


f=1800 MHz,R22



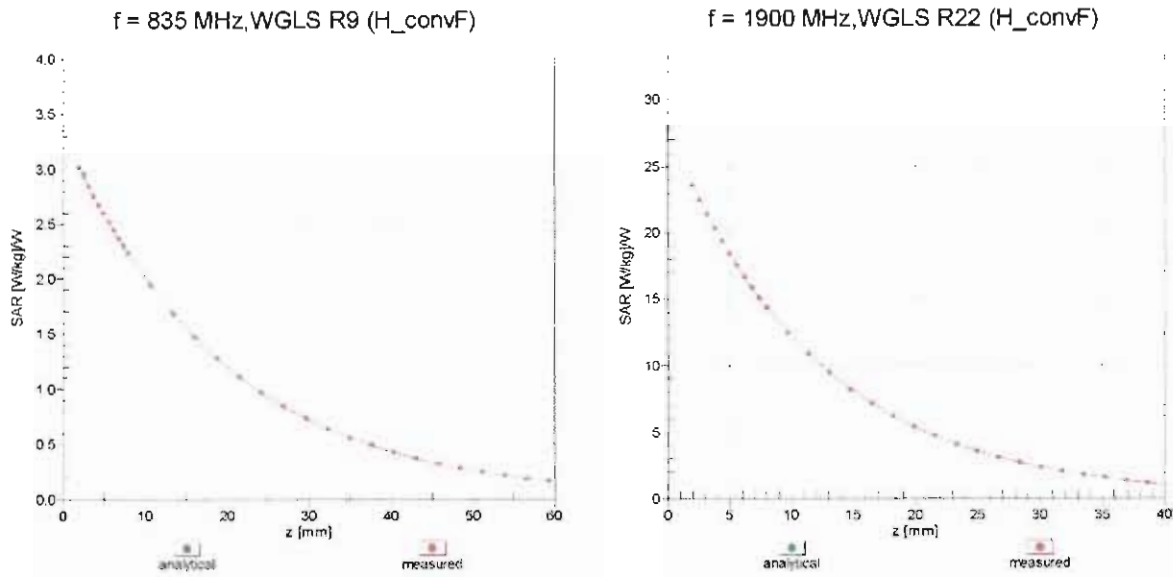
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

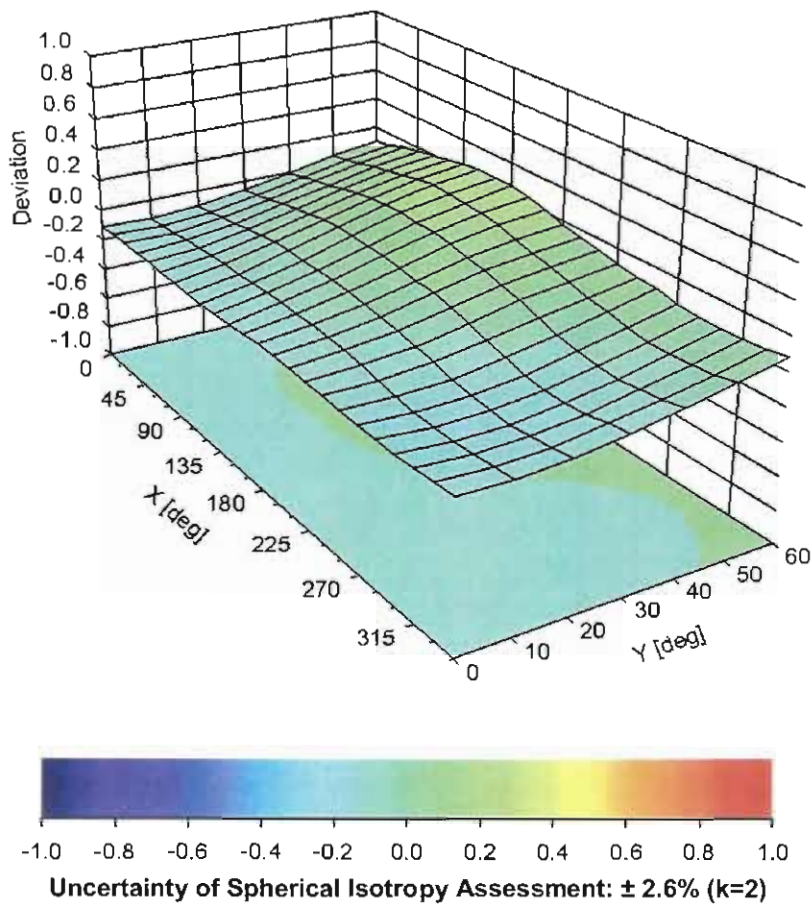


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

# Conversion Factor Assessment



## Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), f = 900 MHz



## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3270

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-20
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	2 mm



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-CN (Auden)**

Certificate No: **EX3-3697\_Sep14**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3697**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 29, 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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 29, 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**

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### Glossary:

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

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

- 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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

# Probe EX3DV4

## SN:3697

Manufactured: April 22, 2009  
Calibrated: September 29, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.35	0.39	0.34	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	97.3	100.9	105.5	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	129.6	$\pm 3.8 \%$
		Y	0.0	0.0	1.0		131.5	
		Z	0.0	0.0	1.0		139.5	

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

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	9.35	9.35	9.35	0.80	0.61	± 12.0 %
835	41.5	0.90	8.93	8.93	8.93	0.41	0.85	± 12.0 %
900	41.5	0.97	8.77	8.77	8.77	0.44	0.80	± 12.0 %
1750	40.1	1.37	7.98	7.98	7.98	0.53	0.72	± 12.0 %
1900	40.0	1.40	7.71	7.71	7.71	0.62	0.67	± 12.0 %
2300	39.5	1.67	7.34	7.34	7.34	0.58	0.67	± 12.0 %
2450	39.2	1.80	6.92	6.92	6.92	0.35	0.87	± 12.0 %
2600	39.0	1.96	6.71	6.71	6.71	0.43	0.81	± 12.0 %
5200	36.0	4.66	4.79	4.79	4.79	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.66	4.66	4.66	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.34	4.34	4.34	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.34	4.34	4.34	0.40	1.80	± 13.1 %

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	8.83	8.83	8.83	0.46	0.81	± 12.0 %
835	55.2	0.97	8.75	8.75	8.75	0.72	0.66	± 12.0 %
1750	53.4	1.49	7.38	7.38	7.38	0.72	0.63	± 12.0 %
1900	53.3	1.52	7.06	7.06	7.06	0.69	0.66	± 12.0 %
2300	52.9	1.81	6.96	6.96	6.96	0.80	0.58	± 12.0 %
2450	52.7	1.95	6.78	6.78	6.78	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.63	6.63	6.63	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.25	4.25	4.25	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.04	4.04	4.04	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.79	3.79	3.79	0.40	1.90	± 13.1 %
5800	48.2	6.00	3.93	3.93	3.93	0.45	1.90	± 13.1 %

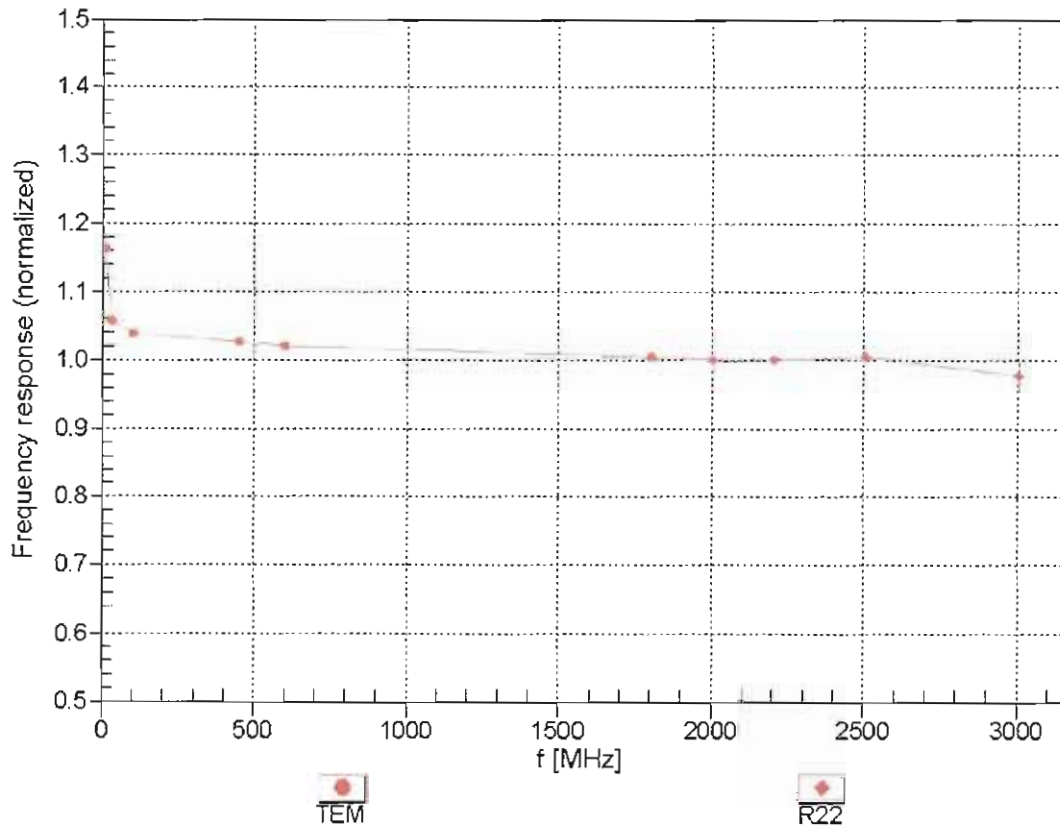
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below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

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

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

# Frequency Response of E-Field

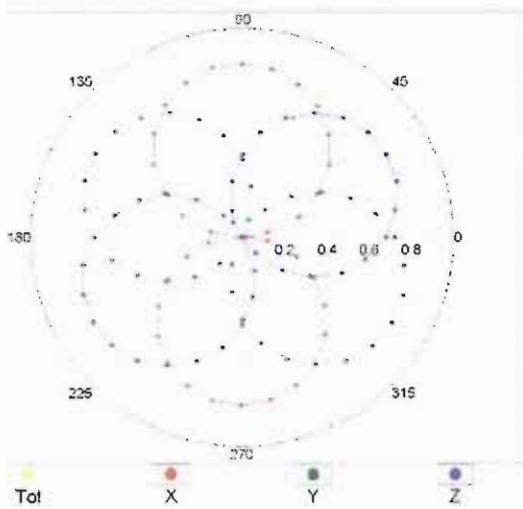
(TEM-Cell:ifi110 EXX, Waveguide: R22)



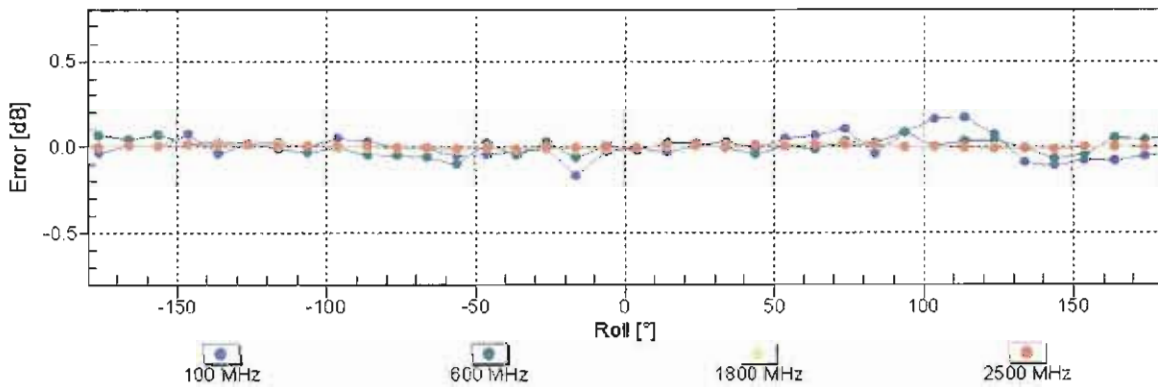
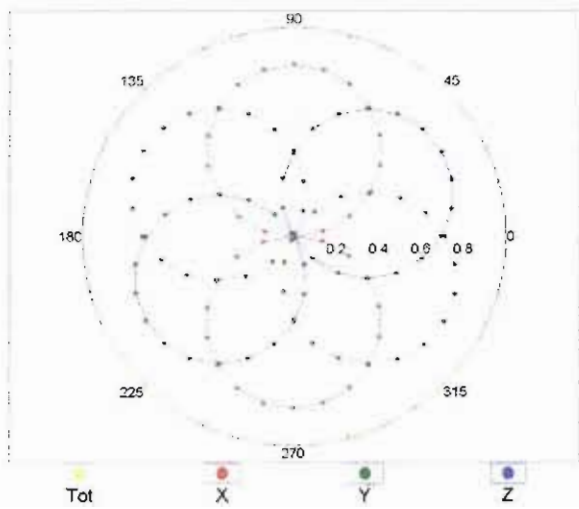
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

### Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$

f=600 MHz,TEM

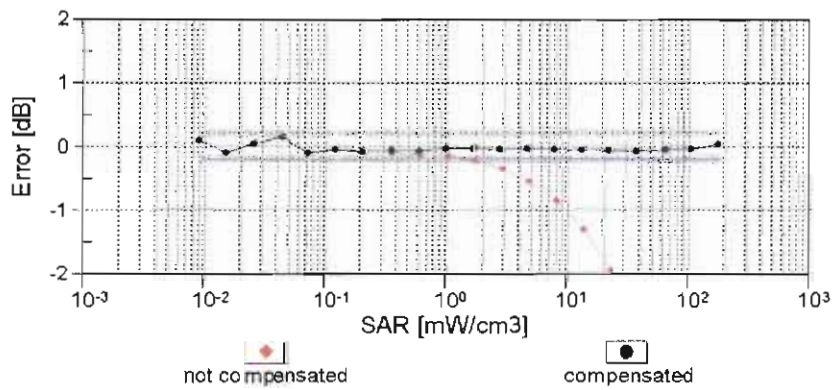
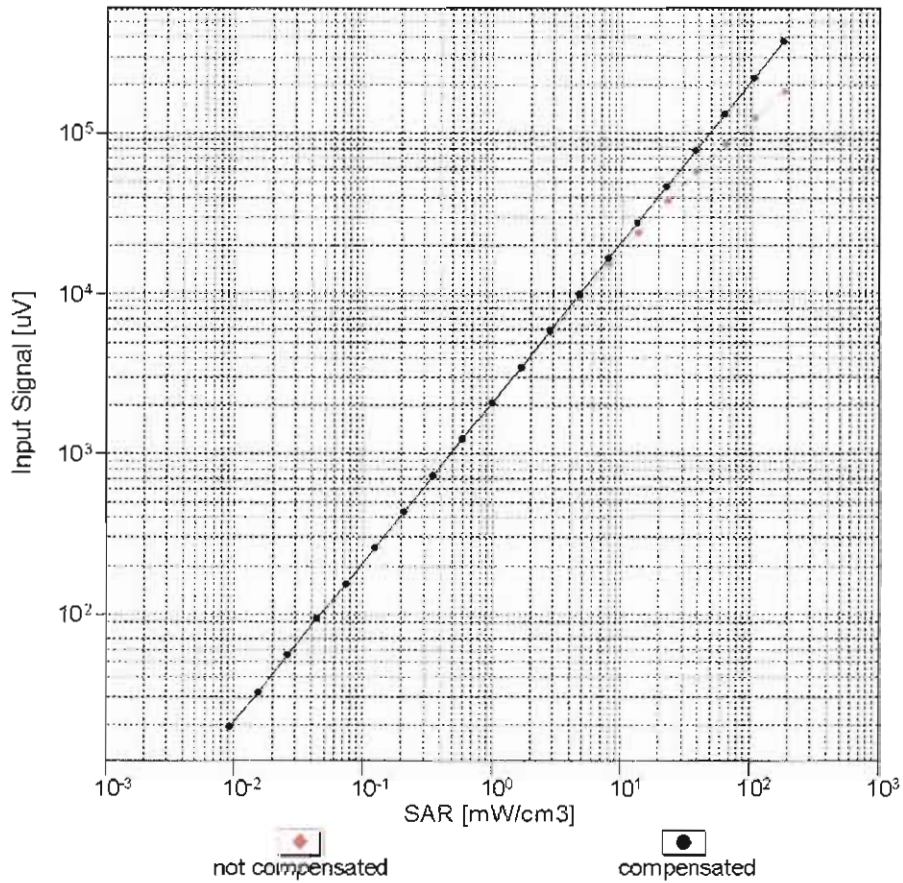


f=1800 MHz,R22



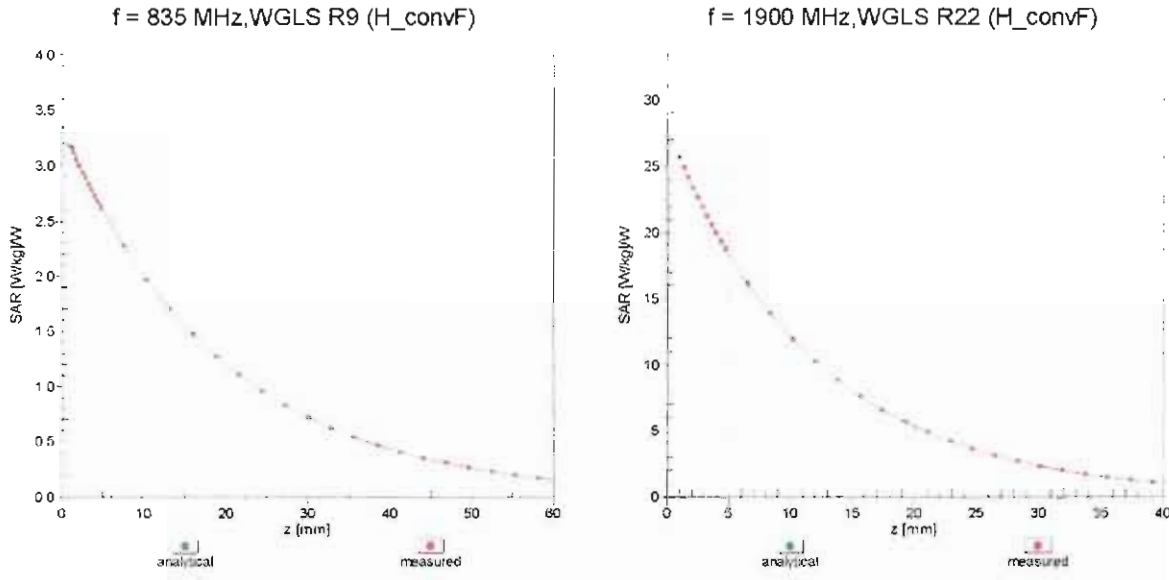
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

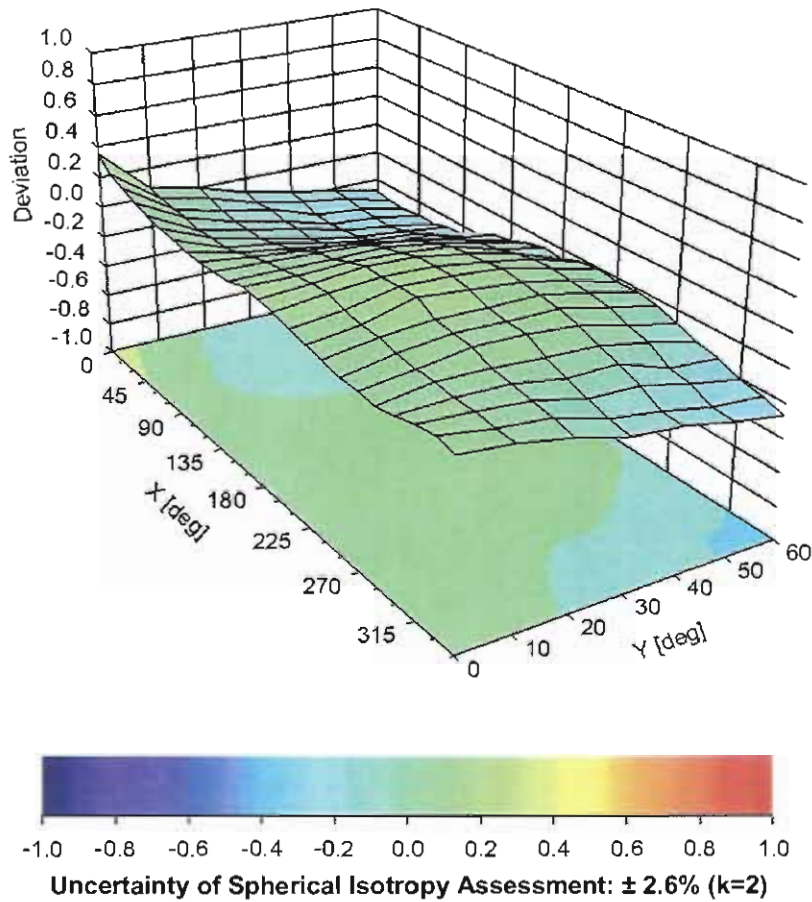


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

# Conversion Factor Assessment



## Deviation from Isotropy in Liquid Error ( $\phi, \vartheta$ ), f = 900 MHz



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-25.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm





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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **EX3-3820\_May14**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3820**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 15, 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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 17, 2014

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**Glossary:**

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

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

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

**Methods Applied and Interpretation of Parameters:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- **NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- **DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- **PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- **A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A, B, C, D** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- **ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- **Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- **Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- **Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

# Probe EX3DV4

## SN:3820

Manufactured:	September 2, 2011
Repaired:	April 28, 2014
Calibrated:	May 15, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.41	0.48	0.51	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	101.9	94.0	97.6	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	144.8	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		131.9	
		Z	0.0	0.0	1.0		142.9	

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

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	9.55	9.55	9.55	0.41	0.88	± 12.0 %
835	41.5	0.90	9.22	9.22	9.22	0.30	1.08	± 12.0 %
900	41.5	0.97	9.23	9.23	9.23	0.47	0.78	± 12.0 %
1450	40.5	1.20	<b>8.49</b>	<b>8.49</b>	<b>8.49</b>	<b>0.27</b>	<b>1.21</b>	± 12.0 %
1750	40.1	1.37	8.26	8.26	8.26	0.80	0.59	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.58	0.68	± 12.0 %
2100	39.8	1.49	7.71	7.71	7.71	0.75	0.58	± 12.0 %
2450	39.2	1.80	6.85	6.85	6.85	0.41	0.85	± 12.0 %
2600	39.0	1.96	6.73	6.73	6.73	<b>0.40</b>	0.85	± 12.0 %
5200	36.0	4.66	4.94	4.94	4.94	<b>0.35</b>	1.80	± 13.1 %
<b>5300</b>	<b>35.9</b>	4.76	4.66	4.66	4.66	0.35	1.80	± 13.1 %
<b>5500</b>	<b>35.6</b>	4.96	4.70	4.70	4.70	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.47	4.47	4.47	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.29	4.29	4.29	0.40	1.80	± 13.1 %

<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	9.12	9.12	9.12	0.42	0.92	± 12.0 %
835	55.2	0.97	9.01	9.01	9.01	<b>0.37</b>	0.97	± 12.0 %
900	55.0	1.05	8.83	8.83	8.83	0.59	0.73	± 12.0 %
1450	54.0	<b>1.30</b>	<b>7.88</b>	7.88	7.88	0.58	0.73	± 12.0 %
1750	53.4	1.49	7.48	7.48	7.48	0.80	0.61	± 12.0 %
1900	53.3	1.52	<b>7.23</b>	<b>7.23</b>	<b>7.23</b>	0.63	0.70	± 12.0 %
2100	53.2	1.62	7.54	7.54	7.54	0.53	0.75	± 12.0 %
2450	52.7	1.95	6.87	6.87	6.87	0.80	0.58	± 12.0 %
2600	52.5	2.16	6.63	6.63	6.63	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.44	4.44	4.44	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.25	4.25	4.25	0.40	1.90	± 13.1 %
5500	48.6	5.65	3.99	3.99	3.99	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.83	3.83	3.83	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.00	4.00	4.00	0.50	1.90	± 13.1 %

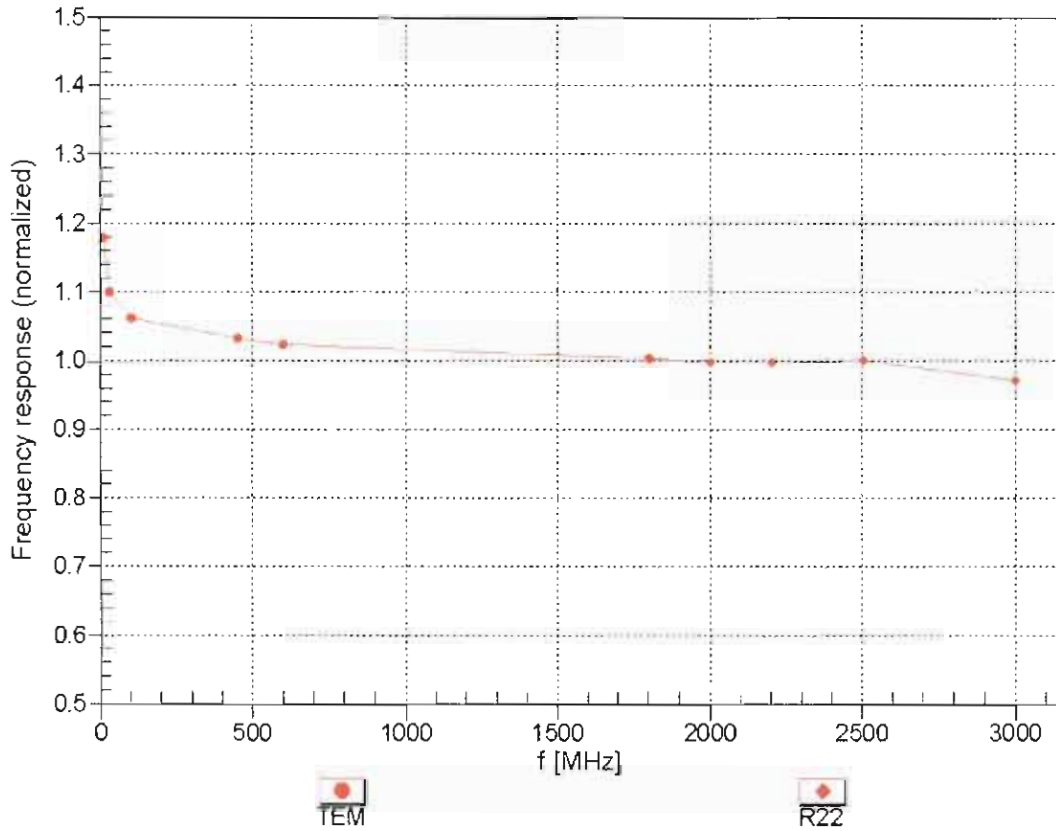
<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

# Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

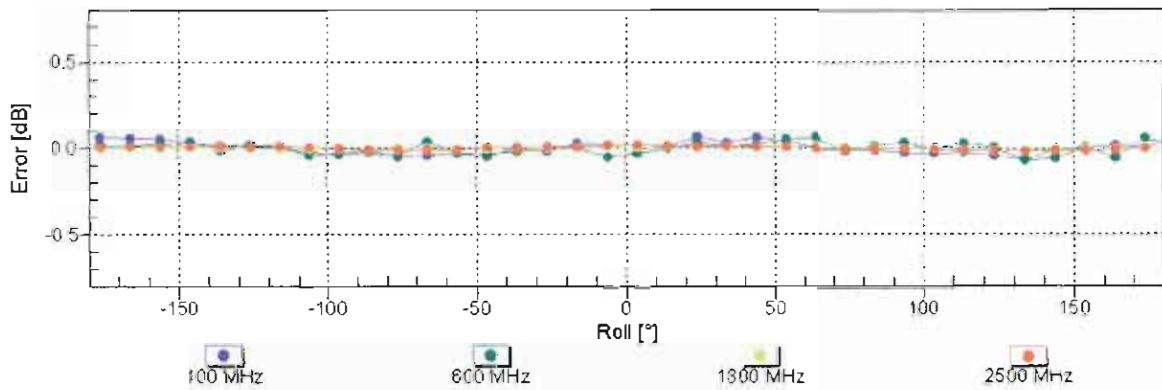
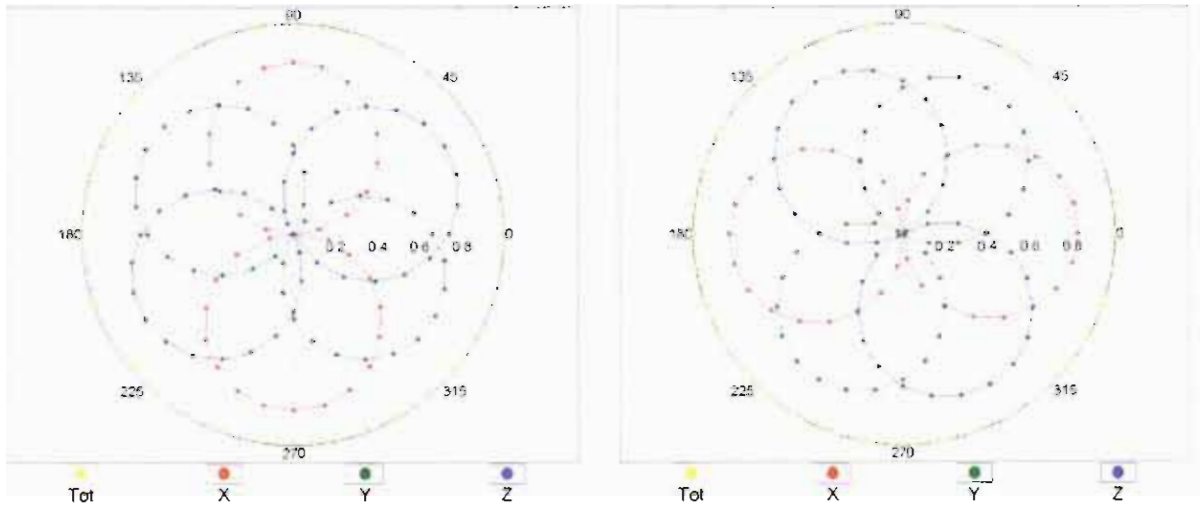


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

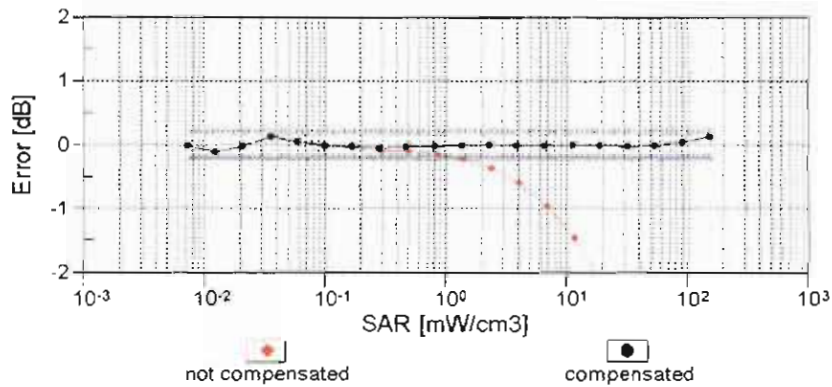
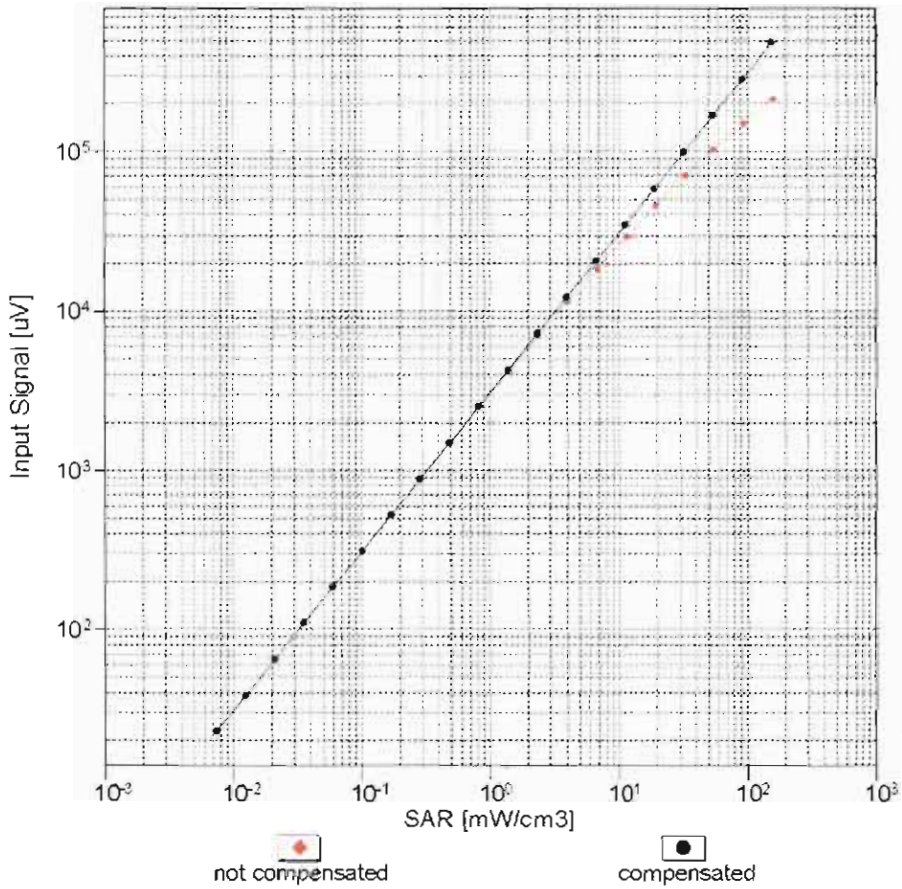
f=1800 MHz,R22



Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

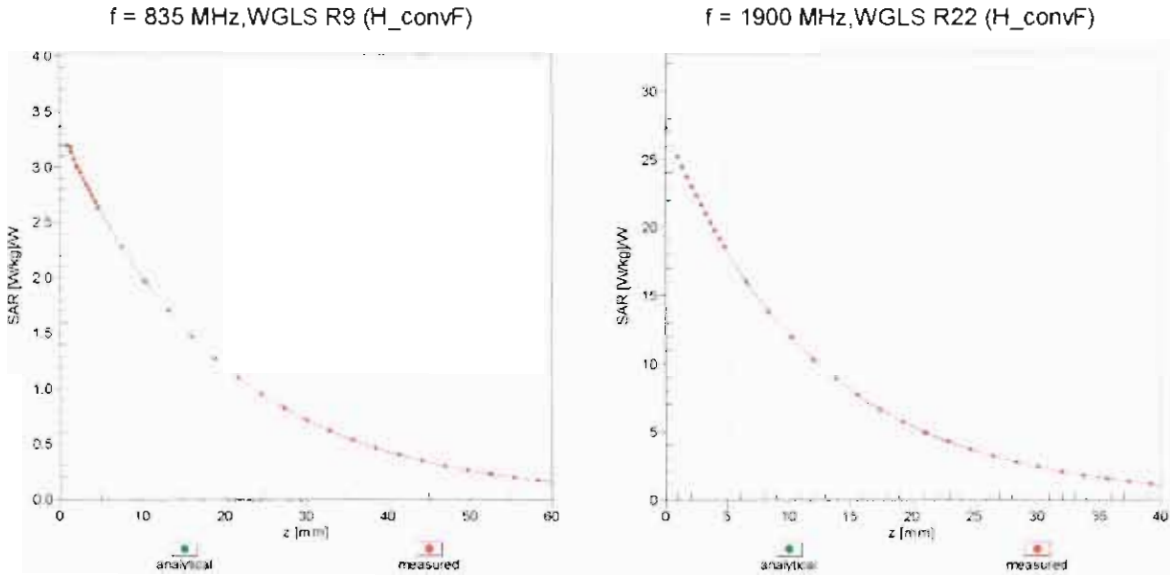


### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

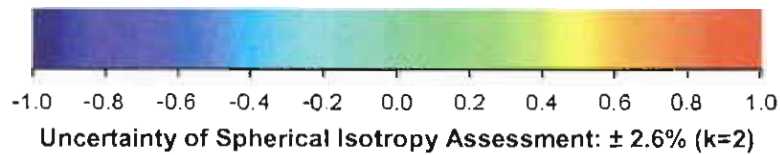
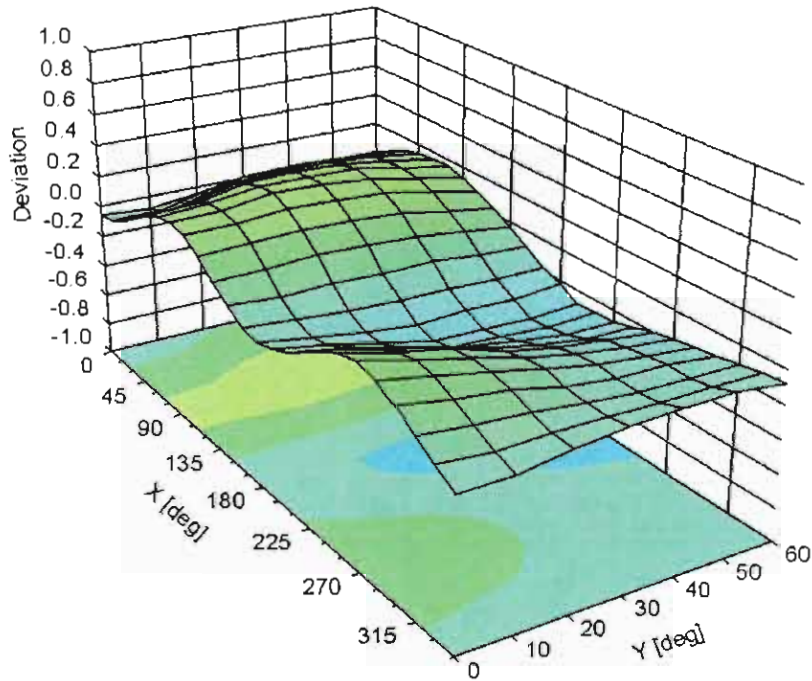


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

# Conversion Factor Assessment



## Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), f = 900 MHz



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-56
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3931\_Sep14**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3931**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 25, 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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: September 25, 2014
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

### Glossary:

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

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

- 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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* *frequency\_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

# Probe EX3DV4

## SN:3931

Manufactured: July 24, 2013  
Calibrated: September 25, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.42	0.58	0.49	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	99.9	96.9	99.9	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	149.1	$\pm 3.8 \%$
		Y	0.0	0.0	1.0		132.9	
		Z	0.0	0.0	1.0		145.1	

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

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth (mm) <sup>G</sup>	Unct. (k=2)
750	41.9	0.89	10.75	10.75	10.75	0.41	0.79	± 12.0 %
835	41.5	0.90	10.32	10.32	10.32	0.20	1.13	± 12.0 %
900	41.5	0.97	10.07	10.07	10.07	0.52	0.72	± 12.0 %
1450	40.5	1.20	8.74	8.74	8.74	0.20	1.48	± 12.0 %
1750	40.1	1.37	8.48	8.48	8.48	0.57	0.69	± 12.0 %
1900	40.0	1.40	8.17	8.17	8.17	0.31	0.96	± 12.0 %
2000	40.0	1.40	8.10	8.10	8.10	0.43	0.77	± 12.0 %
2450	39.2	1.80	7.29	7.29	7.29	0.33	0.88	± 12.0 %
2600	39.0	1.96	7.09	7.09	7.09	0.37	0.86	± 12.0 %

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

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

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



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

### Calibration Parameter Determined in Body Tissue Simulating Media

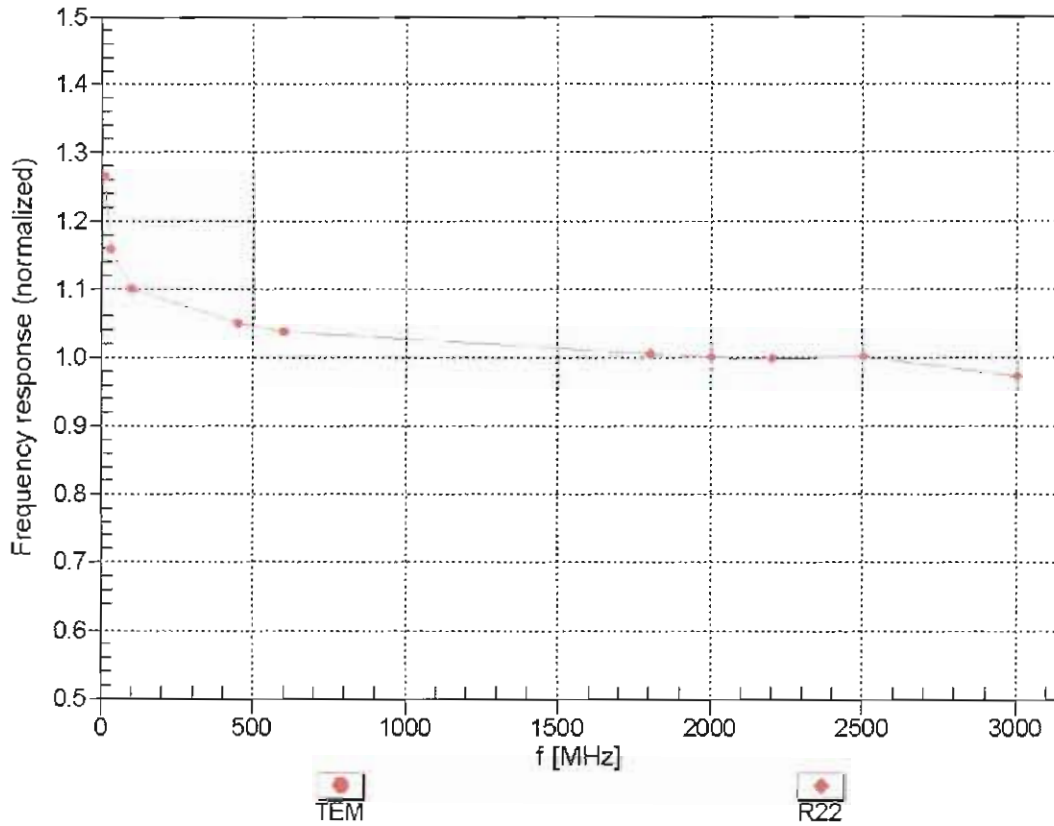
f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	10.10	10.10	10.10	0.27	1.14	± 12.0 %
835	55.2	0.97	10.13	10.13	10.13	0.40	0.93	± 12.0 %
1450	54.0	1.30	8.72	8.72	8.72	0.24	1.22	± 12.0 %
1750	53.4	1.49	8.26	8.26	8.26	0.48	0.80	± 12.0 %
1900	53.3	1.52	7.80	7.80	7.80	0.38	0.89	± 12.0 %
2450	52.7	1.95	7.36	7.36	7.36	0.80	0.56	± 12.0 %
2600	52.5	2.16	7.20	7.20	7.20	0.76	0.58	± 12.0 %

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

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

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

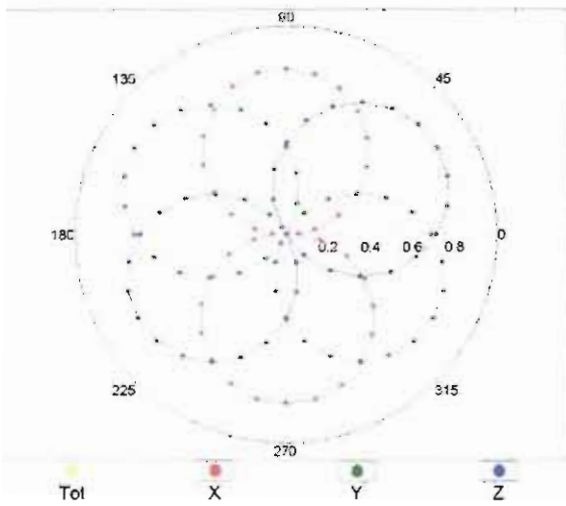
### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



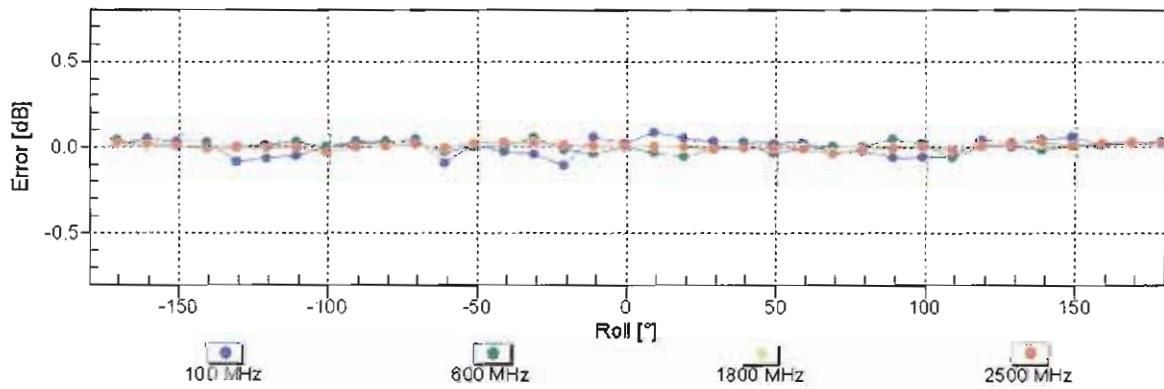
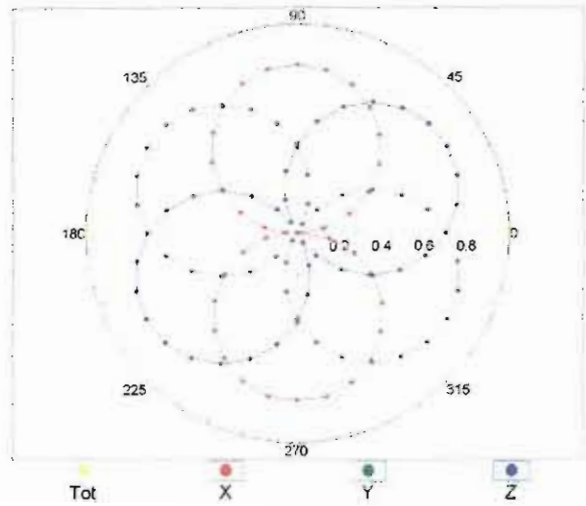
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

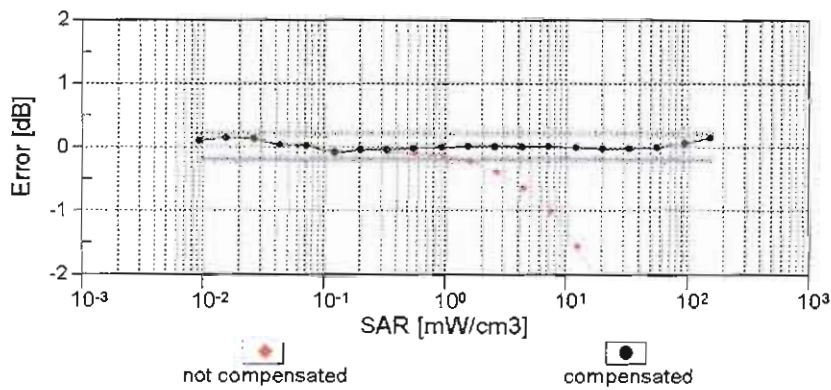
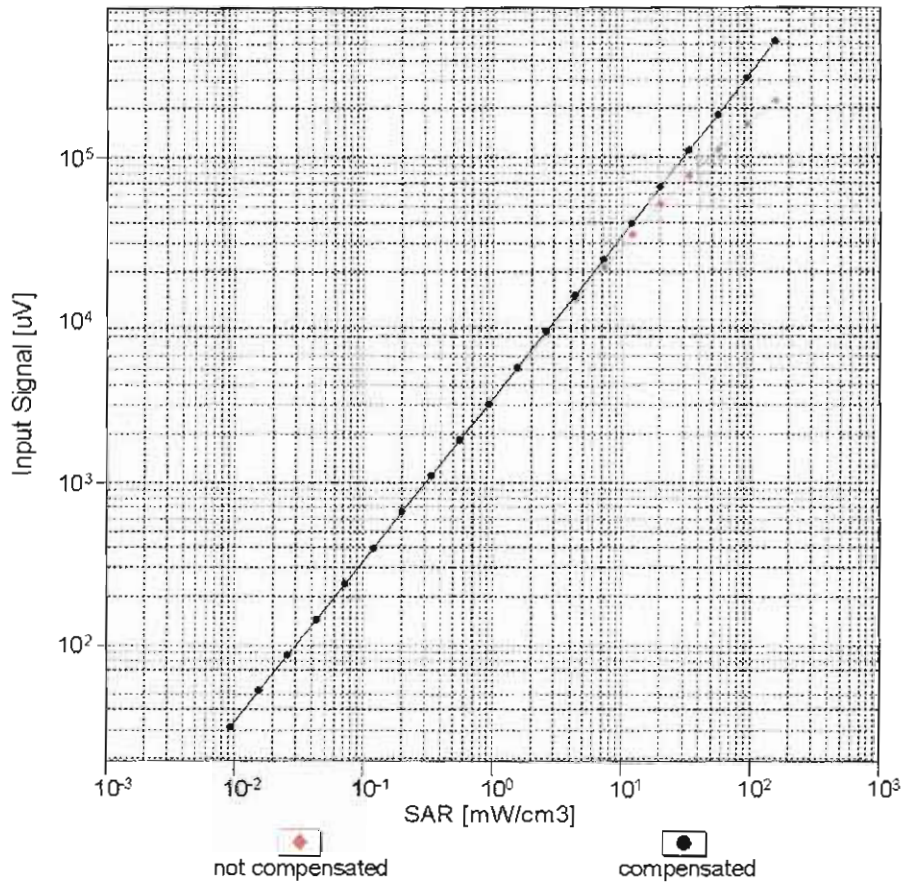


f=1800 MHz,R22



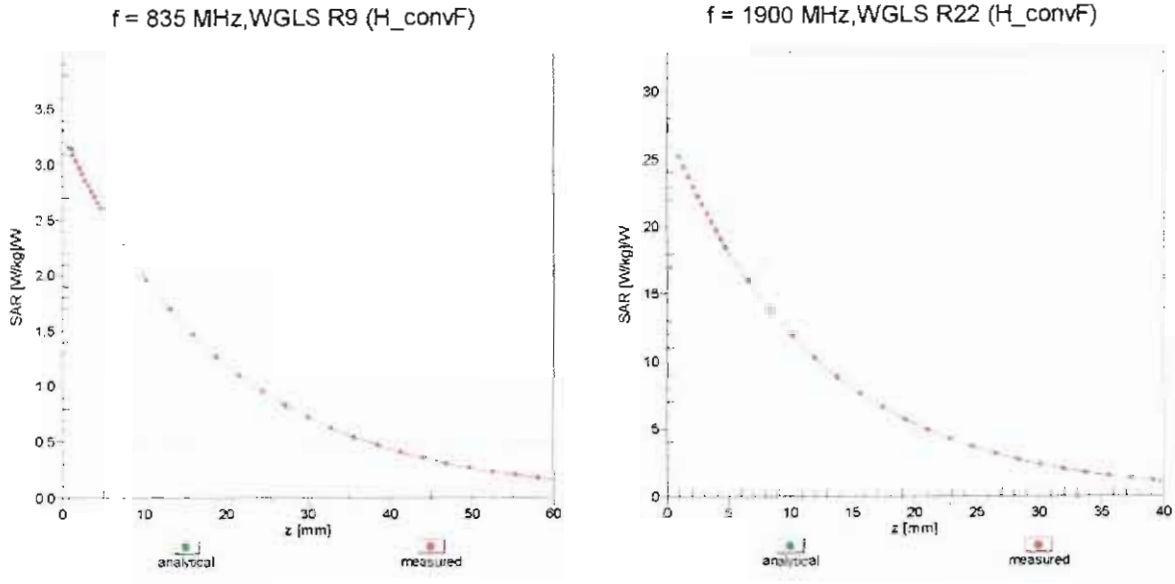
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)



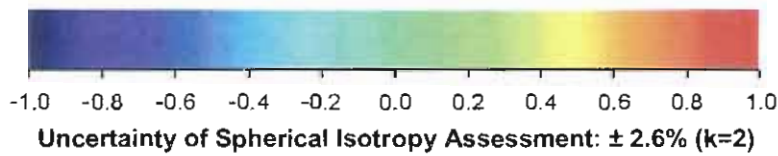
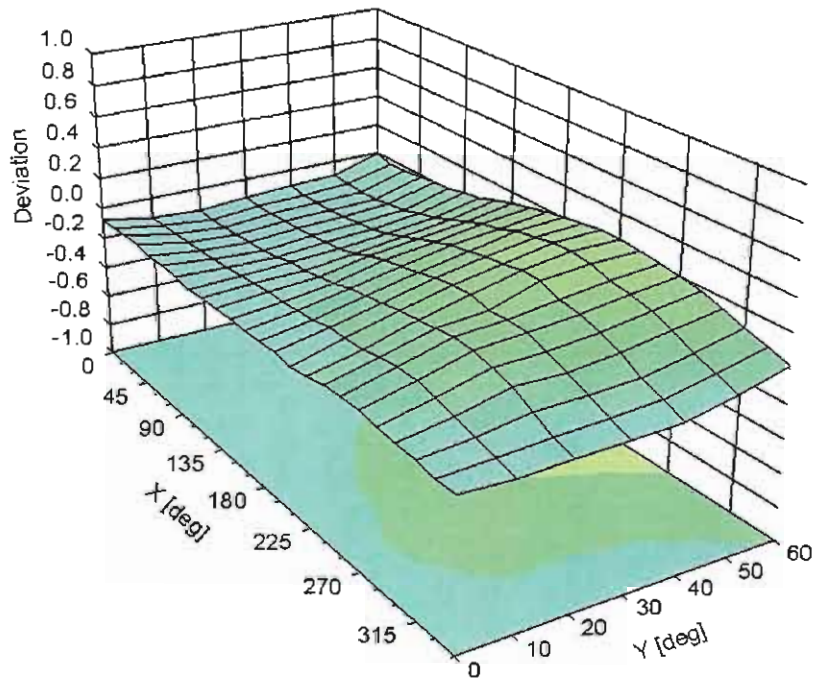
**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

# Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ), f = 900 MHz



**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931****Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	-11.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3954\_Nov14**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3954**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: November 24, 2014

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

### Glossary:

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

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

- 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

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A, B, C, D** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).



# Probe EX3DV4

## SN:3954

Manufactured: August 6, 2013  
Calibrated: November 21, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3954

## Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.55	0.46	0.54	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	95.3	97.2	103.0	

## Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	149.0	$\pm 2.7 \%$
		Y	0.0	0.0	1.0		155.9	
		Z	0.0	0.0	1.0		143.5	

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).  
<sup>B</sup> Numerical linearization parameter: uncertainty not required.  
<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3954

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	10.93	10.93	10.93	0.40	0.86	± 12.0 %
835	41.5	0.90	10.33	10.33	10.33	0.72	0.61	± 12.0 %
1750	40.1	1.37	8.35	8.35	8.35	0.46	0.74	± 12.0 %
1900	40.0	1.40	8.10	8.10	8.10	0.62	0.65	± 12.0 %
2450	39.2	1.80	7.25	7.25	7.25	0.40	0.80	± 12.0 %
2600	39.0	1.96	7.05	7.05	7.05	0.39	0.82	± 12.0 %
5200	36.0	4.66	5.17	5.17	5.17	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.92	4.92	4.92	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.83	4.83	4.83	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.60	4.60	4.60	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.64	4.64	4.64	0.40	1.80	± 13.1 %

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3954

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	10.07	10.07	10.07	0.53	0.75	± 12.0 %
835	55.2	0.97	10.01	10.01	10.01	0.26	1.20	± 12.0 %
1750	53.4	1.49	8.33	8.33	8.33	0.35	0.92	± 12.0 %
1900	53.3	1.52	7.93	7.93	7.93	0.42	0.83	± 12.0 %
2450	52.7	1.95	7.33	7.33	7.33	0.80	0.55	± 12.0 %
2600	52.5	2.16	7.07	7.07	7.07	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.32	4.32	4.32	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.15	4.15	4.15	0.45	1.90	± 13.1 %
5500	48.6	5.65	3.92	3.92	3.92	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.74	3.74	3.74	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.96	3.96	3.96	0.50	1.90	± 13.1 %

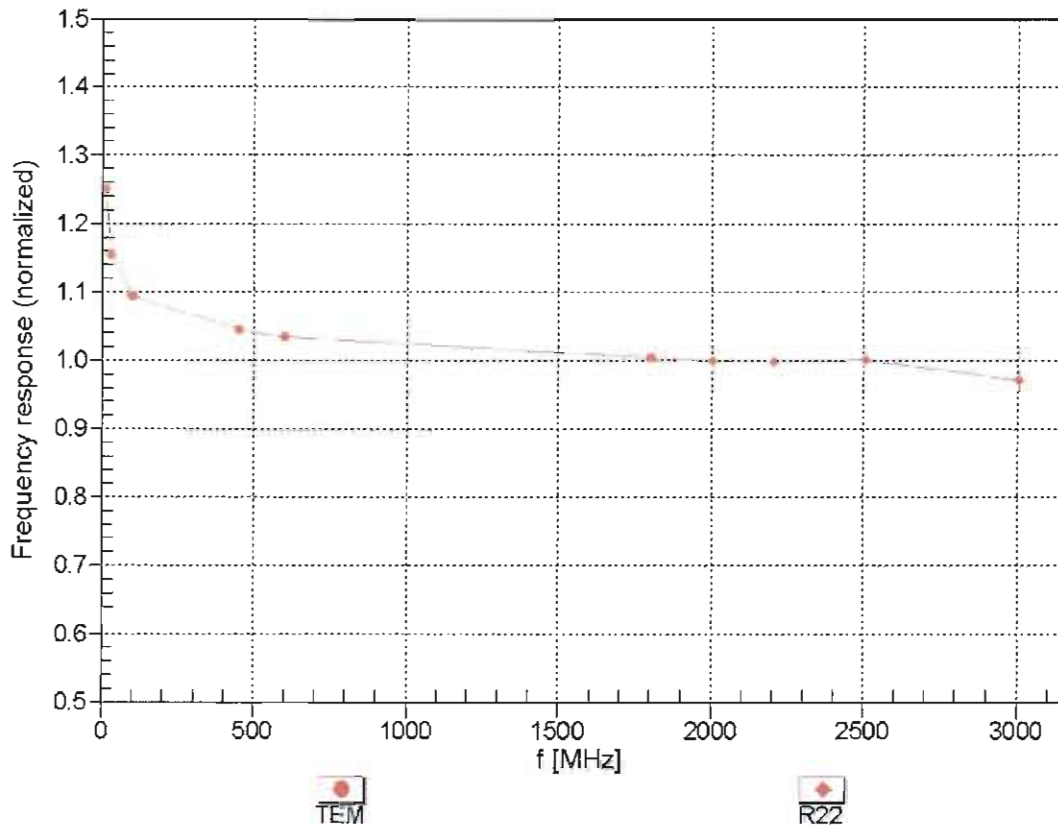
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below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

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

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

# Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

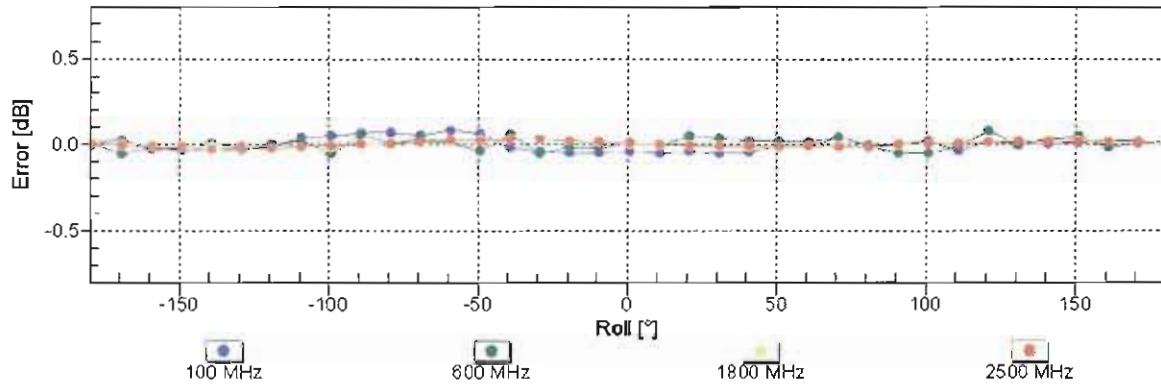
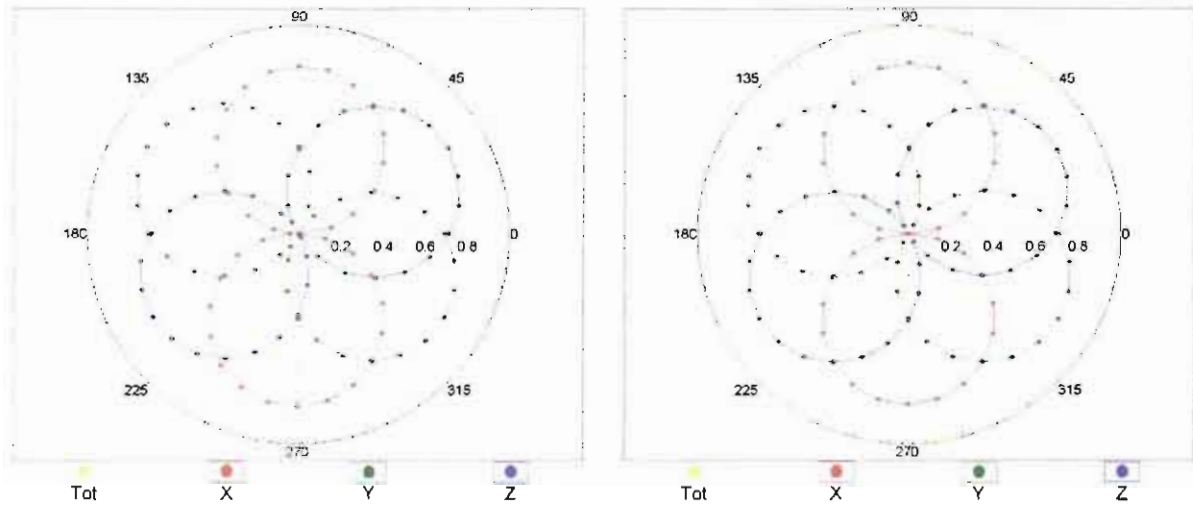


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

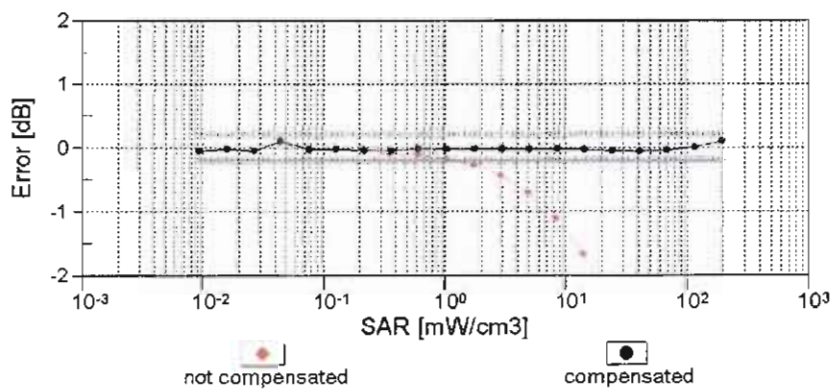
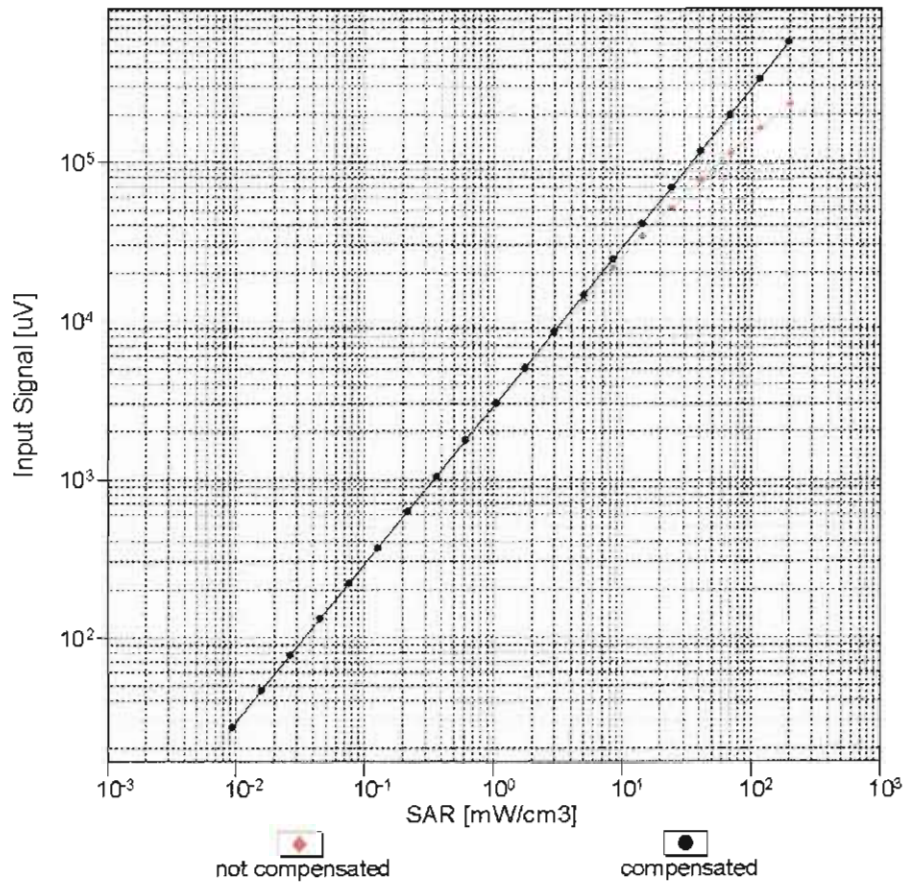
f=600 MHz,TEM

f=1800 MHz,R22



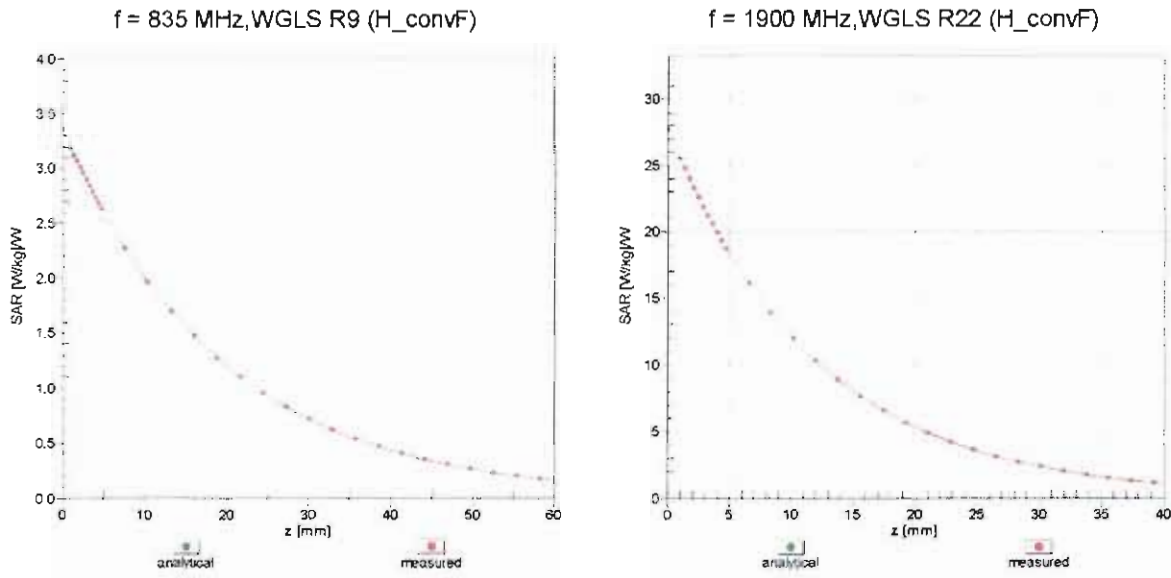
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

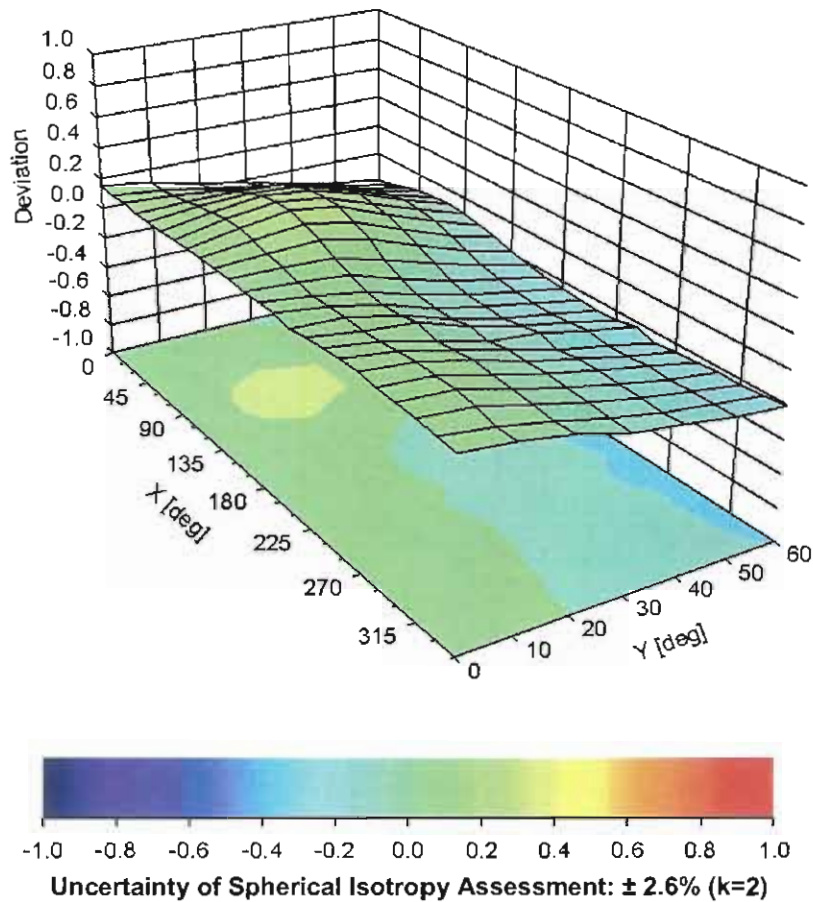


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

# Conversion Factor Assessment



## Deviation from Isotropy in Liquid Error ( $\phi, \vartheta$ ), f = 900 MHz





## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3954

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-119.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3955\_Nov14**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3955**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: November 24, 2014
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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**Glossary:**

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

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

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

**Methods Applied and Interpretation of Parameters:**

- *NORM<sub>x,y,z</sub>*: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). *NORM<sub>x,y,z</sub>* are only intermediate values, i.e., the uncertainties of *NORM<sub>x,y,z</sub>* does not affect the  $E^2$ -field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCP<sub>x,y,z</sub>*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORM<sub>x,y,z</sub> \* ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORM<sub>x</sub>* (no uncertainty required).

# Probe EX3DV4

## SN:3955

Manufactured: August 6, 2013  
Calibrated: November 21, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.35	0.42	0.31	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	98.0	100.8	98.7	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	135.4	$\pm 3.0 \%$
		Y	0.0	0.0	1.0		146.0	
		Z	0.0	0.0	1.0		136.4	

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

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	10.61	10.61	10.61	0.66	0.64	± 12.0 %
835	41.5	0.90	10.04	10.04	10.04	0.18	1.25	± 12.0 %
900	41.5	0.97	9.79	9.79	9.79	0.25	0.94	± 12.0 %
1750	40.1	1.37	8.90	8.90	8.90	0.46	0.75	± 12.0 %
1900	40.0	1.40	8.50	8.50	8.50	0.44	0.79	± 12.0 %
2000	40.0	1.40	8.34	8.34	8.34	0.51	0.70	± 12.0 %
2450	39.2	1.80	7.46	7.46	7.46	0.29	1.01	± 12.0 %
2600	39.0	1.96	7.21	7.21	7.21	0.39	0.88	± 12.0 %
5200	36.0	4.66	5.13	5.13	5.13	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.92	4.92	4.92	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.74	4.74	4.74	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.56	4.56	4.56	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.63	4.63	4.63	0.40	1.80	± 13.1 %

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

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

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	10.16	10.16	10.16	0.28	1.11	± 12.0 %
835	55.2	0.97	10.03	10.03	10.03	0.38	0.88	± 12.0 %
1750	53.4	1.49	8.34	8.34	8.34	0.35	0.99	± 12.0 %
1900	53.3	1.52	7.89	7.89	7.89	0.42	0.90	± 12.0 %
2450	52.7	1.95	7.32	7.32	7.32	0.76	0.62	± 12.0 %
2600	52.5	2.16	7.09	7.09	7.09	0.63	0.69	± 12.0 %
5200	49.0	5.30	4.61	4.61	4.61	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.44	4.44	4.44	0.45	1.90	± 13.1 %
5500	48.6	5.65	4.13	4.13	4.13	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.11	4.11	4.11	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.26	4.26	4.26	0.50	1.90	± 13.1 %

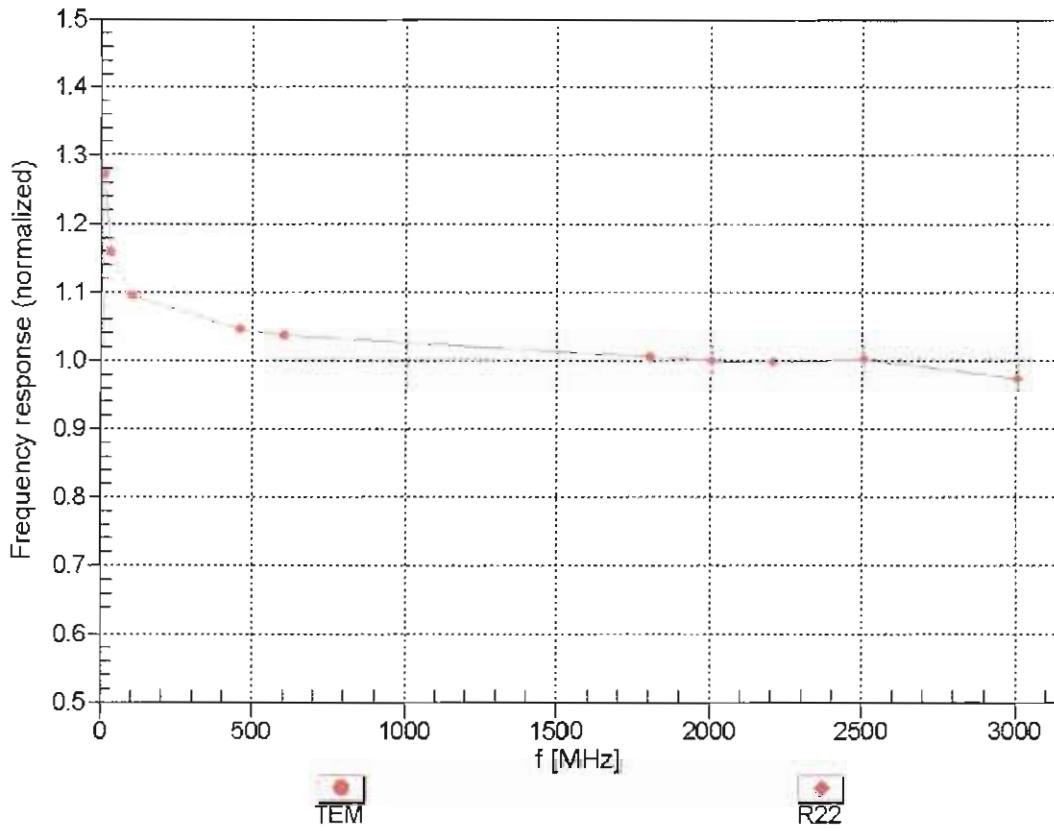
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below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

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

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

# Frequency Response of E-Field

(TEM-Cell: ifi110 EXX, Waveguide: R22)



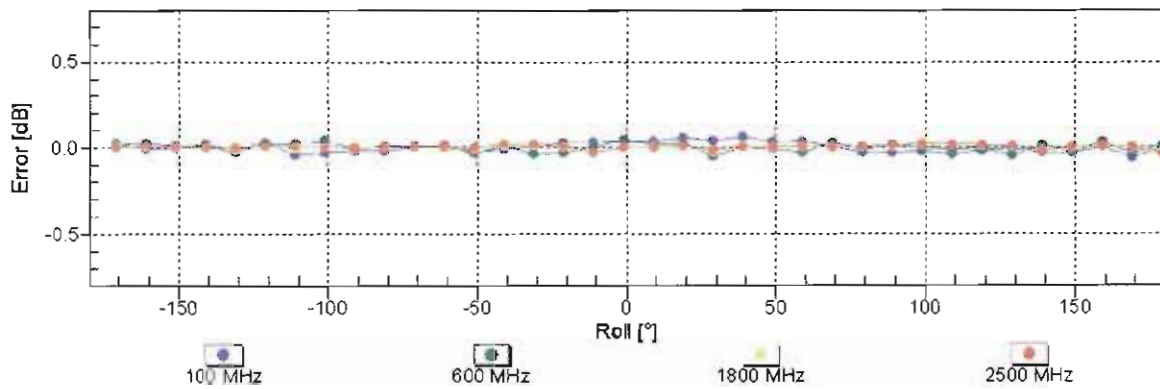
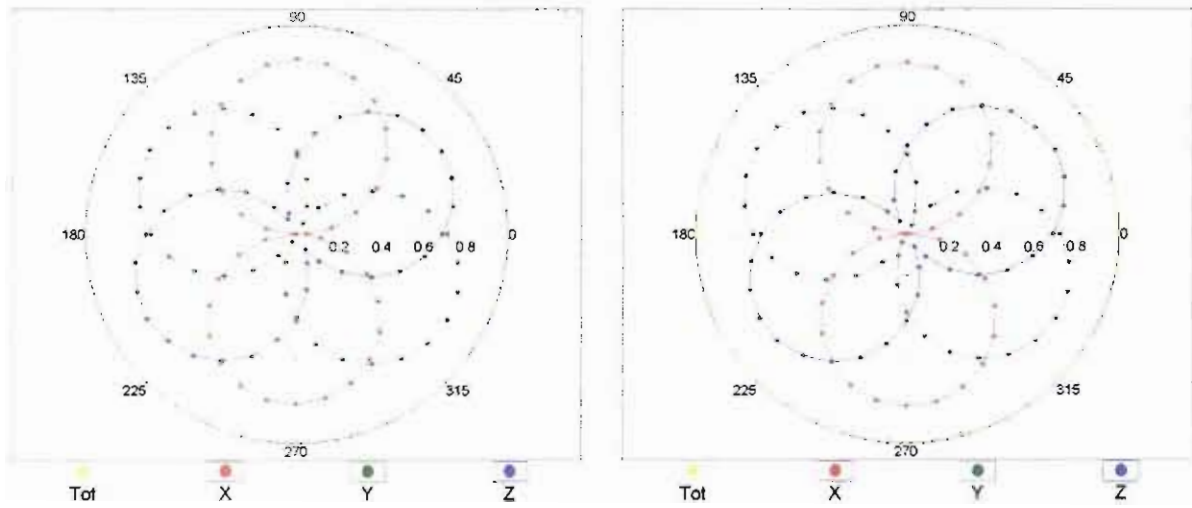
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)



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

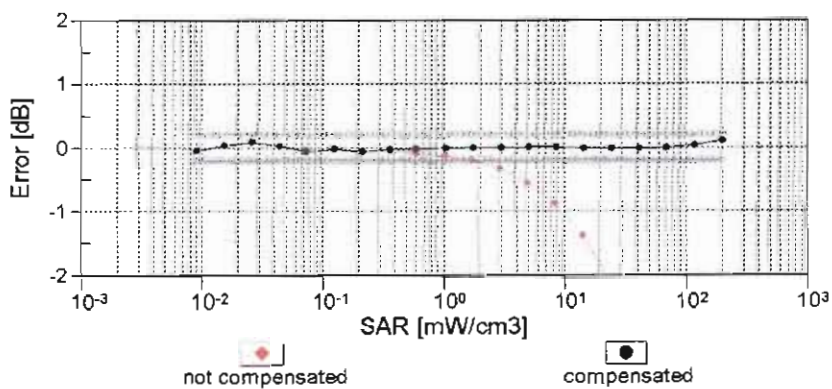
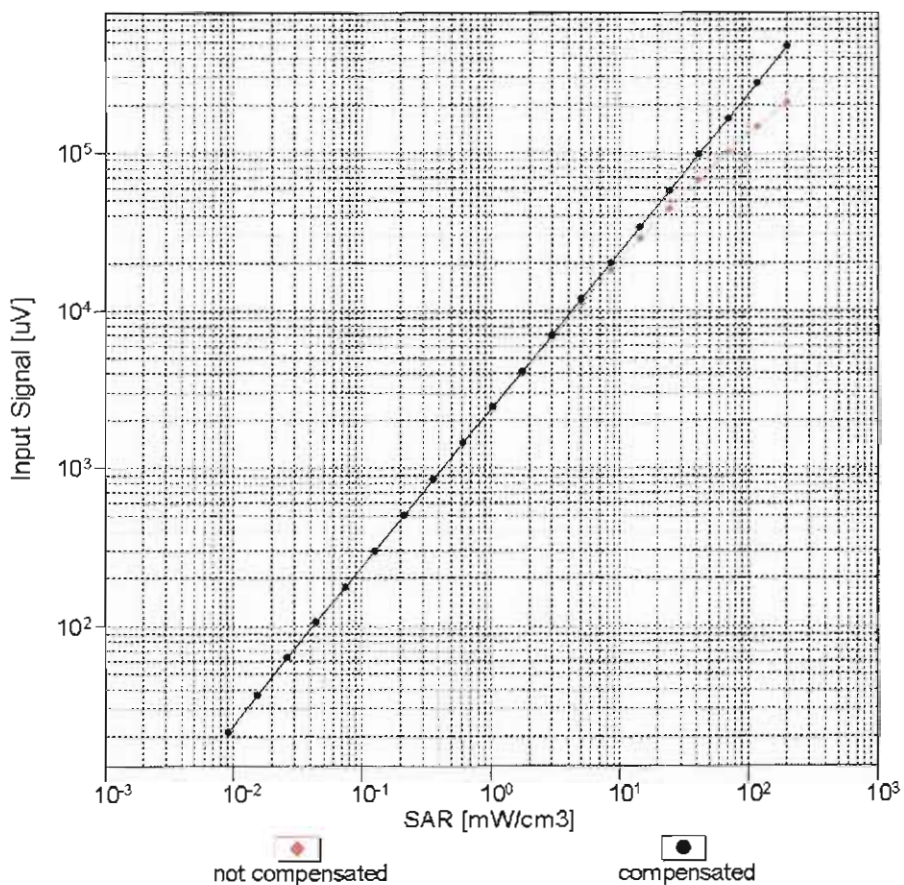
f=600 MHz,TEM

f=1800 MHz,R22



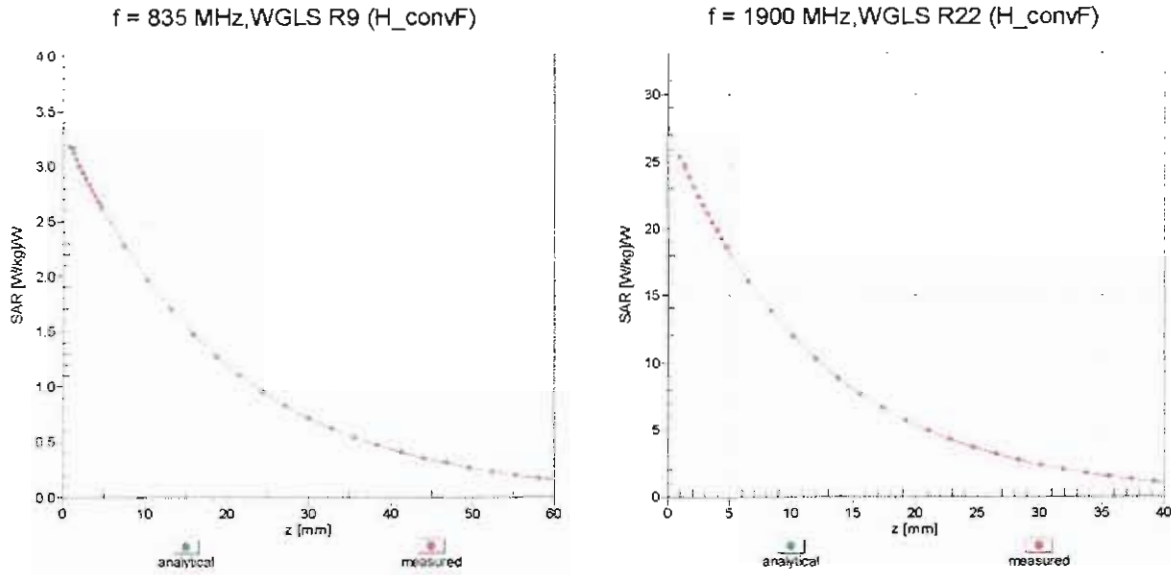
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

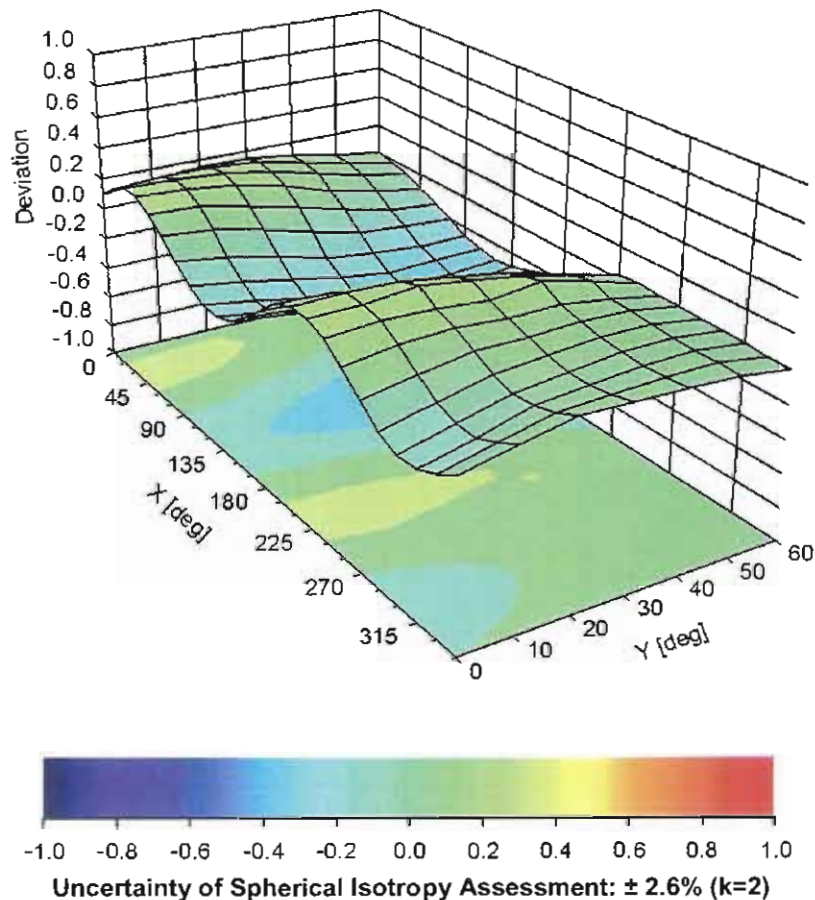


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

# Conversion Factor Assessment



## Deviation from Isotropy in Liquid Error ( $\phi, \vartheta$ ), f = 900 MHz



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-51
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm