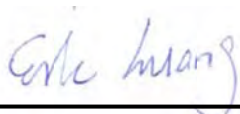


FCC SAR Test Report

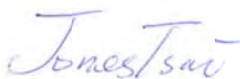
APPLICANT : ZTE CORPORATION
EQUIPMENT : LTE USB Modem
BRAND NAME : ZTE
MODEL NAME : MF823L
MARKETING NAME : MF823L LTE USB Modem
FCC ID : SRQ-MF823L
STANDARD : FCC 47 CFR Part 2 (2.1093)
ANSI/IEEE C95.1-1992
IEEE 1528-2003

The product was completely tested on Mar. 18, 2014. We, SPORTON INTERNATIONAL (XI'AN) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

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



Reviewed by: Eric Huang / Deputy Manager



Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL (XI'AN) INC.

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



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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA431701	Rev. 01	Initial issue of report	Apr. 17, 2014



1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION LTE USB Modem, ZTE, MF823L, MF823L LTE USB Modem** are as follows.

<Highest SAR Summary>

Exposure Position	Frequency Band	Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Body (Separation 0.5 cm)	GSM850	0.77	PCB	1.13
	GSM1900	0.92		
	WCDMA Band V	0.86		
	WCDMA Band II	1.13		
	LTE Band 7	0.76		

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

2.1 Testing Laboratory

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

2.2 Applicant

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

2.3 Manufacturer

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

2.4 Application Details

Date of Start during the Test	Mar. 17, 2014
Date of End during the Test	Mar. 18, 2014

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	LTE USB Modem
Brand Name	ZTE
Model Name	MF823L
Marketing Name	MF823L LTE USB Modem
FCC ID	SRQ-MF823L
IMEI Code	866948010488859
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 7: 2502.5 MHz ~ 2567.5 MHz
Mode	• GPRS/EGPRS • RMC 12.2Kbps Rel 99 • HSDPA Rel 8, Cat24 • HSUPA Rel 7, Cat7 • DC-HSDPA Rel 8, Cat24 • HSPA+ Rel 7, Cat14 • LTE: QPSK, 16QAM
Antenna Type	PCB Antenna
HW Version	xm6B
SW Version	EN_ZTE_MF823LV1.0.0B03
EUT Stage	Identical Prototype
Remark: 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description. 2. Voice call is not supported. 3. The device supports GPRS Class10 and EDGE Class12.	

3.2 Maximum RF output power among production units

Mode	GSM 850	GSM 1900
	Burst average power(dBm)	
GPRS (GMSK, 1 Tx slot)	33	30.5
GPRS (GMSK, 2 Tx slots)	32	29
EDGE (GMSK, 1 Tx slot)	28	26.5
EDGE (GMSK, 2 Tx slots)	25	24
EDGE (GMSK, 3 Tx slots)	23.5	22.5
EDGE (GMSK, 4 Tx slots)	22.5	22

Mode	WCDMA Band V	WCDMA Band II
	Average power(dBm)	
RMC 12.2Kbps	23	23
HSDPA Subtest-1	22	22
HSDPA Subtest-2	22	22
HSDPA Subtest-3	21.5	21.5
HSDPA Subtest-4	21.5	21.5
DC-HSDPA Subtest-1	22	22
DC-HSDPA Subtest-2	22	22
DC-HSDPA Subtest-3	21.5	21.5
DC-HSDPA Subtest-4	21.5	21.5
HSUPA Subtest-1	21.5	21.5
HSUPA Subtest-2	21	20.5
HSUPA Subtest-3	20.5	21
HSUPA Subtest-4	21.5	21.5
HSUPA Subtest-5	21	21.5
HSPA+ (16QAM) Subtest-1	21.5	22

LTE Band 7				
Modulation	BW (MHz)	RB size	Target MPR (dB)	Average power (dBm)
QPSK	20	≤ 18	0	23
QPSK	20	> 18	1	22
16QAM	20	≤ 18	1	22
16QAM	20	> 18	2	21
QPSK	15	≤ 16	0	23
QPSK	15	> 16	1	22
16QAM	15	≤ 16	1	22
16QAM	15	> 16	2	21
QPSK	10	≤ 12	0	23
QPSK	10	> 12	1	22
16QAM	10	≤ 12	1	22
16QAM	10	> 12	2	21
QPSK	5	≤ 8	0	23
QPSK	5	> 8	1	22
16QAM	5	≤ 8	1	22
16QAM	5	> 8	2	21

Remark:

1. By design, maximum LTE RF power of smaller supported bandwidth does not exceed the RF power of largest supported bandwidth; the information is included in "tune-up procedure" exhibit
2. LTE MPR implementation is the same for normal mode and power reduction mode.

The table below summarized necessary items addressed in KDB 941225 D05 v02r03.

FCC ID				SRQ-MF823L				
EUT				LTE USB Modem				
Operating Frequency Range of each LTE transmission band				LTE Band 7: 2502.5 MHz ~ 2567.5 MHz				
Channel Bandwidth				5MHz, 10MHz, 15MHz, 20MHz				
Transmission (H, M, L) channel numbers and frequencies in each LTE band								
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

E category, uplink modulations used	Category 3, QPSK, and 16QAM																																						
LTE transmitter and antenna implementation (standalone or sharing hardware components / antennas)	A primary antenna is used for LTE and other wireless interfaces (GSM /WCDMA) for transmitting and receiving A 2 nd antenna is used for LTE and other wireless interfaces (GSM/ /WCDMA) for receiving only																																						
LTE Voice / Data requirements	1. VoLTE not supported 2. Data only																																						
LTE MPR permanently built-in by design	Yes, per 3GPP TS 36.101 v11.0.0 Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3 <table><tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr><tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr><tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr></table>	Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)																																
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz																																	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1																																
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1																																
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2																																
LTE A-MPR	In the base simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing.																																						
Base station simulator used for Testing	Anritsu MT8820C																																						

3.3 Applied 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 447498 D02 SAR Procedures for Dongle Xmtr v02
- FCC KDB 941225 D01 SAR test for 3G devices v02
- FCC KDB 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB 941225 D05 SAR for LTE Devices v02r03

3.4 Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 °C
Humidity	< 60 %

3.5.2 Test Configuration

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT.

4. Specific Absorption Rate (SAR)

4.1 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.

4.2 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 measurement can be either related to the temperature elevation in tissue by

$$SAR = C \left(\frac{\delta T}{\delta t} \right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5. SAR Measurement System

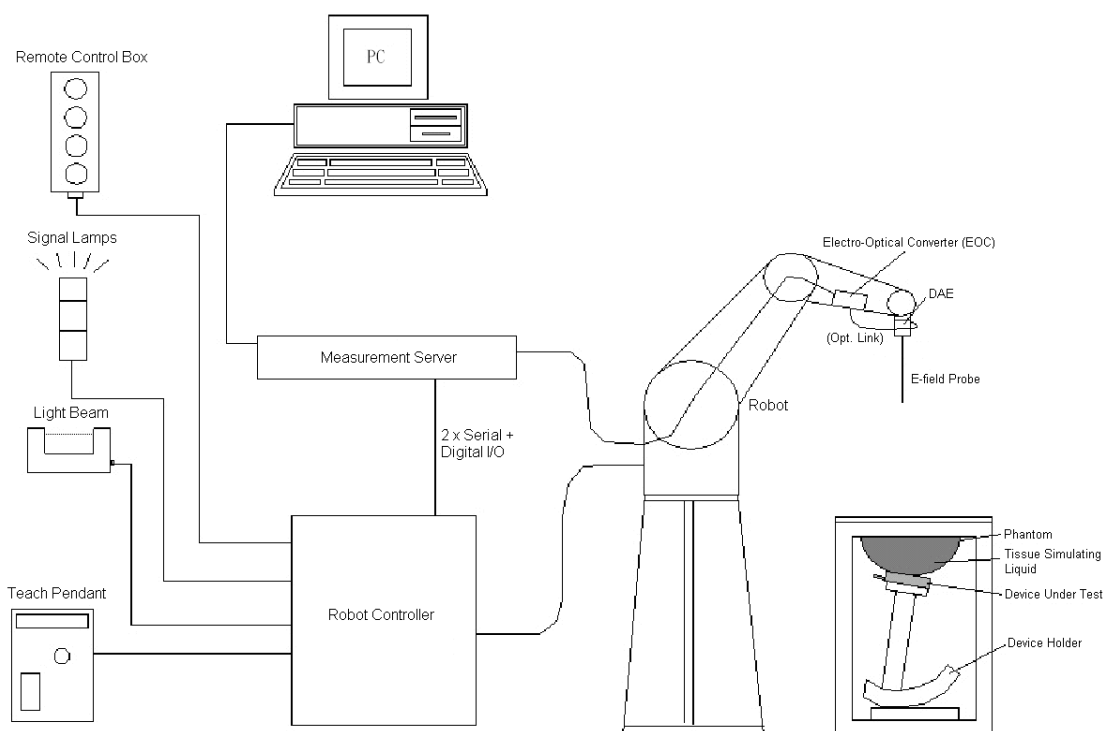


Fig 5.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

Component details are described in in the following sub-sections.

5.1 E-Field Probe

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

5.1.1 E-Field Probe Specification

<EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 μ W/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Fig 5.2 Photo of EX3DV4

5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

5.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



Fig 5.3 Photo of DAE

5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ± 0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)



Fig 5.4 Photo of DASY5

5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.



Fig 5.5 Photo of Server for DASY5

5.5 Phantom

<SAM Twin Phantom>

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

Fig 5.6 Photo of SAM Phantom

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

5.6 Device Holder

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



Fig 5.7 Device Holder

<Laptop Extension Kit>

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

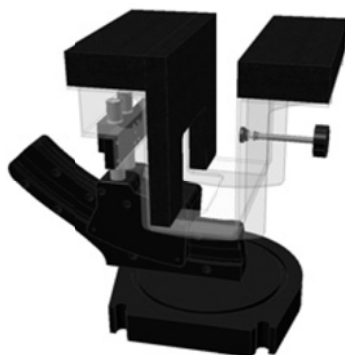


Fig 5.8 Laptop Extension Kit

5.7 Data Storage and Evaluation

5.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

5.7.2 Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software :

Probe parameters :	- Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
	- Conversion factor	ConvF _i
	- Diode compression point	dcp _i
Device parameters :	- Frequency	f
	- Crest factor	cf
Media parameters :	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as :

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = compensated signal of channel i, (i = x, y, z)
 U_i = input signal of channel i, (i = x, y, z)
 cf = crest factor of exciting field (DASY parameter)
 dcp_i = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated :

$$\text{E-field Probes : } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}}$$

$$\text{H-field Probes : } H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with V_i = compensated signal of channel i, (i = x, y, z)
 Norm_i = sensor sensitivity of channel i, (i = x, y, z), $\mu\text{V}/(\text{V/m})^2$ for E-field Probes
 ConvF = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = electric field strength of channel i in V/m
 H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude) :

$$E_{\text{tot}} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$\text{SAR} = E_{\text{tot}}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 ρ = equivalent tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5.8 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d151	Mar. 25, 2013	Mar. 24, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d170	Mar. 27, 2013	Mar. 26, 2014
SPEAG	2600MHz System Validation Kit	D2600V2	1061	Mar. 26, 2013	Mar. 25, 2014
SPEAG	Data Acquisition Electronics	DAE4	1358	Apr. 08, 2013	Apr. 07, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3911	Apr. 11, 2013	Apr. 10, 2014
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1754	NCR	NCR
Agilent	Dielectric Probe Kit	85070E	MY44300751	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	MY52102600	Nov. 17, 2012	Nov. 16, 2014
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	Apr. 22, 2013	Apr. 21, 2014
Anritsu	Radio communication analyzer	MT8820C	6201074235	Nov. 05, 2013	Nov. 04, 2014
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 06, 2013	May. 05, 2014
Anritsu	Power Meter	ML2495A	1218010	Mar. 28, 2013	Mar. 27, 2014
Anritsu	Power Sensor	MA2411B	1207253	Mar. 28, 2013	Mar. 27, 2014
Agilent	Dual Directional Coupler	778D	50422	Note 2	
Woken	Attenuator 1	WK0602-XX	N/A	Note 2	
PE	Attenuator 2	PE7005-10	N/A	Note 2	
PE	Attenuator 3	PE7005- 3	N/A	Note 2	
AR	Power Amplifier	5S1G4M2	328767	Note 3	
R&S	Spectrum Analyzer	FSP7	101045	Dec. 30, 2013	Dec. 29, 2014

Table 5.1 Test Equipment List

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
3. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it
4. Attenuator 1 insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.

6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.1.



Fig 6.1 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Table 6.1 Recipes of Tissue Simulating Liquid

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent 85070E Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
835	Body	22.7	0.974	54.111	0.97	55.2	0.41	-1.97	±5	Mar. 18, 2014
1900	Body	22.6	1.501	53.849	1.52	53.3	-1.25	1.03	±5	Mar. 17, 2014
2600	Body	22.5	2.201	52.823	2.16	52.5	1.90	0.62	±5	Mar. 18, 2014

Table 6.2 Measuring Results for Simulating Liquid

7. System Verification Procedures

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

7.1 Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

7.2 System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

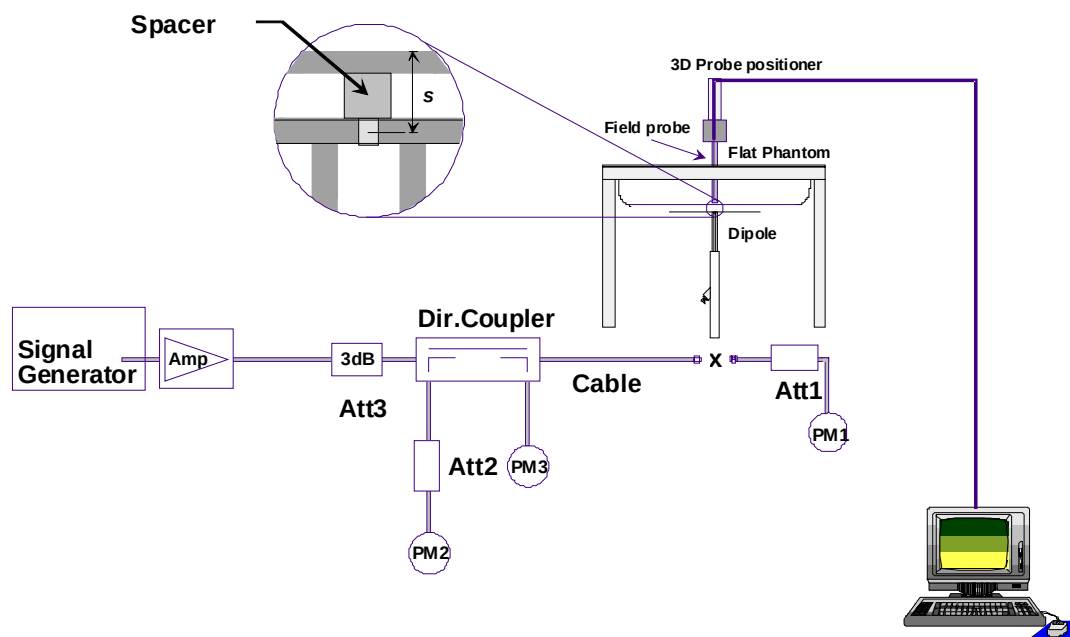


Fig 7.1 System Setup for System Evaluation

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole



Fig 7.2 Photo of Dipole Setup

7.3 SAR System Verification Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Table 7.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
Mar. 18, 2014	835	Body	250	4d151	3911	1358	2.35	9.43	9.4	-0.32
Mar. 17, 2014	1900	Body	250	5d170	3911	1358	9.87	41.20	39.48	-4.17
Mar. 18, 2014	2600	Body	250	1061	3911	1358	14.50	55.60	58	4.32

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

This EUT was tested in five different USB configurations. They are “direct laptop plug-in for configuration 2 and 4”, “USB cable plug-in for configuration 1 and 3”, and “USB cable plug-in for Tip Mode (the tip of the EUT)” shown as below. Both direct laptop plug-in and USB cable plug-in test configurations are tested with 5 mm separation between the particular dongle orientation and the flat phantom. Please refer to Appendix D for the test setup photos.

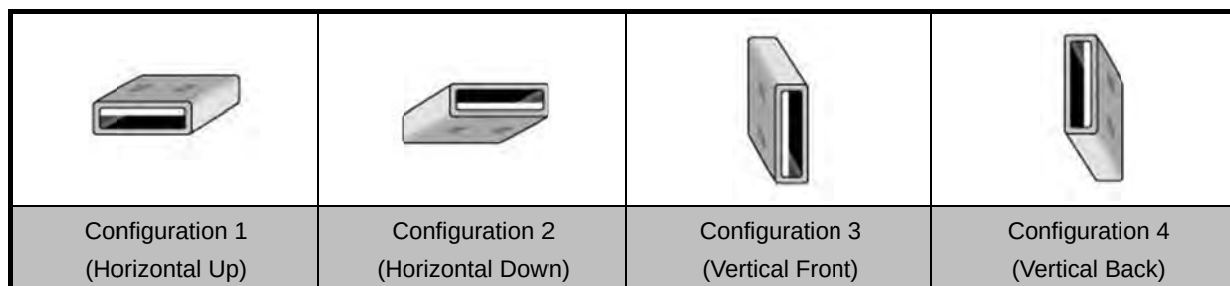


Fig 8.1 Illustration for USB Connector Orientations

9. 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.

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix E 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

9.1 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 form 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

9.2 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.

9.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r03 quoted below.

For any secondary peaks found in the area scan which are within 2 dB of the maximum peak and are not within this zoom scan, the zoom scan should be repeated

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	$\frac{1}{2} \delta \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: Δx_{Area} , Δy_{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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 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		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ 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 area scan based <i>1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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.				

9.4 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.

9.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

9.6 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.

10. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

Note:

1. Per KDB 447498 D01v05r02, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. The EUT do not support DTM function.
3. For Body SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 2 Tx slots for GSM850 and GSM1900 due to its highest frame-average power.

Band GSM850	Burst Average Power (dBm)			Tune-up	Frame-Average Power (dBm)			Tune-up
TX Channel	128	189	251	Limit	128	189	251	Limit
Frequency (MHz)	824.2	836.4	848.8	(dBm)	824.2	836.4	848.8	(dBm)
GPRS (GMSK, 1 Tx slot) – CS1	32.39	32.08	32.23	33.00	23.39	23.08	23.23	24.00
GPRS (GMSK, 2 Tx slots) – CS1	30.96	30.71	30.86	32.00	24.96	24.71	24.86	26.00
EDGE (8PSK, 1 Tx slot) – MCS5	26.76	26.49	26.52	28.00	17.76	17.49	17.52	19.00
EDGE (8PSK, 2 Tx slots) – MCS5	24.41	24.05	24.13	25.00	18.41	18.05	18.13	19.00
EDGE (8PSK, 3 Tx slots) – MCS5	22.46	22.14	22.40	23.50	18.20	17.88	18.14	19.24
EDGE (8PSK, 4 Tx slots) – MCS5	21.81	21.56	21.76	22.50	18.81	18.56	18.76	19.50
Band GSM1900	Burst Average Power (dBm)			Tune-up	Frame-Average Power (dBm)			Tune-up
TX Channel	512	661	810	Limit	512	661	810	Limit
Frequency (MHz)	1850.2	1880	1909.8	(dBm)	1850.2	1880	1909.8	(dBm)
GPRS (GMSK, 1 Tx slot) – CS1	29.32	29.40	29.45	30.50	20.32	20.40	20.45	21.50
GPRS (GMSK, 2 Tx slots) – CS1	27.71	27.89	27.94	29.00	21.71	21.89	21.94	23.00
EDGE (8PSK, 1 Tx slot) – MCS5	25.27	25.38	25.44	26.50	16.27	16.38	16.44	17.50
EDGE (8PSK, 2 Tx slots) – MCS5	23.10	23.22	23.31	24.00	17.10	17.22	17.31	18.00
EDGE (8PSK, 3 Tx slots) – MCS5	21.14	21.31	21.44	22.50	16.88	17.05	17.18	18.24
EDGE (8PSK, 4 Tx slots) – MCS5	20.76	20.84	20.90	22.00	17.76	17.84	17.90	19.00

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

The calculated method are shown as below:

Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB

Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB

Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB

Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

<WCDMA Conducted Power>

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:

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 (β_c and β_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: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{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: Δ_{ACK} , Δ_{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, Δ_{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 DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_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 (β_c and β_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-TFCI
 - viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note 1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	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	β_{ed1} : 47/15 β_{ed2} : 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (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: Δ_{ACK} , Δ_{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 β_c/β_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 β_c/β_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: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

HSPA+ 3GPP release 7 (uplink category 7) 16QAM, 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 = 5.2E:HSPA+:UL with 16QAM
 - ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.4, quoted from the TS 34.121-1 s5.2E
 - iii. Set Channel Params
 - iv. Set Cell Power = -86 dBm
 - v. Set Channel Type = HSPA
 - vi. Set UE Target Power = 21 dBm
 - vii. Power Ctrl Mode= All Up Bits
 - viii. Set Manual Uplink DPCH Bc/Bd = Manual
 - ix. Set Manual Uplink DPCH Bc and Bd=15,15(for 34.121-1 v8.10.0 table C11.1.4 sub-test 1)
 - x. Set HSPA Conn DL Channel Levels
 - xi. Set HS-SCCH Configs
 - xii. Set RB Test Mode Setup
 - xiii. Set Common HSUPA Parameters
 - xiv. Set Serving Grant
 - xv. Confirm that E-TFCI is equal to the target E-TFCI of 105 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_c (Note 3)	β_d	β_{HS} (Note 1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed1} : 30/15 β_{ed2} : 30/15	β_{ed3} : 24/15 β_{ed4} : 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{ts} = 30/15 * \beta_c$.
 Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
 Note 3: DPDCH is not configured, therefore the β_c is set to 1 and $\beta_d = 0$ by default.
 Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
 Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.

Setup Configuration

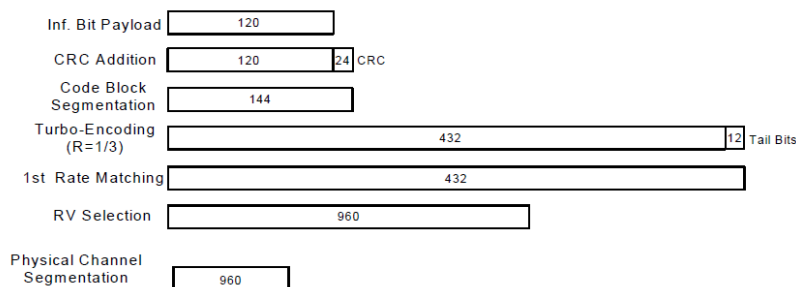
DC-HSDPA 3GPP release 8 Setup Configuration:

- 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 (β_c and β_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>
Note:

1. Applying the subtest setup in Table C.11.1.3 of 3GPP TS 34.121-1 V9.1.0 to Rel. 6 HSPA, the subtest setup in Table C.11.1.4 to Rel. 7 HSPA+, and the subtest setup in C.8.1.12 to Rel. 8 DC-HSDPA.
2. By design, AMR, HSDPA/HSUPA, HSPA+ (16QAM in uplink) and DC-HSDPA RF power will not be larger than RMC 12.2kbps., detailed information is included in Tune-up Procure exhibit.
3. It is expected by the manufacturer that MPR for some HSDPA/HSUPA, HSPA+ (64QAM in uplink) and DC-HSDPA subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.

Band			WCDMA Band V				WCDMA Band II			
TX Channel			4132	4182	4233	Tune-up Limit (dBm)	9262	9400	9538	Tune-up Limit (dBm)
Rx Channel			4357	4407	4458		9662	9800	9938	
Frequency (MHz)			826.4	836.4	846.6		1852.4	1880	1907.6	
3GPP MPR (dB)	3GPP Rel 99	RMC 12.2Kbps	21.95	21.85	22.01	23.00	22.15	22.22	21.98	23.00
0	3GPP Rel 6	HSDPA Subtest-1	21.01	20.84	21.07	22.00	21.18	21.24	21.11	22.00
0	3GPP Rel 6	HSDPA Subtest-2	21.02	20.73	21.05	22.00	21.25	21.31	21.19	22.00
0.5	3GPP Rel 6	HSDPA Subtest-3	20.54	20.18	20.59	21.50	20.73	20.87	20.68	21.50
0.5	3GPP Rel 6	HSDPA Subtest-4	20.53	20.21	20.57	21.50	20.77	20.94	20.74	21.50
0	3GPP Rel 8	DC-HSDPA Subtest-1	20.93	20.76	20.99	21.10	21.16	21.03	20.93	20.76
0	3GPP Rel 8	DC-HSDPA Subtest-2	20.94	20.65	20.97	21.17	21.23	21.11	20.94	20.65
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	20.46	20.10	20.51	20.65	20.79	20.60	20.46	20.10
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	20.45	20.13	20.49	20.69	20.86	20.66	20.45	20.13
0	3GPP Rel 6	HSUPA Subtest-1	20.17	20.14	20.29	21.50	20.92	21.11	20.31	21.50
2	3GPP Rel 6	HSUPA Subtest-2	19.91	19.89	19.95	21.00	19.78	19.81	19.75	20.50
1	3GPP Rel 6	HSUPA Subtest-3	19.56	19.54	19.61	20.50	20.17	20.21	19.97	21.00
2	3GPP Rel 6	HSUPA Subtest-4	20.48	20.28	20.57	21.50	20.69	20.89	20.55	21.50
0	3GPP Rel 6	HSUPA Subtest-5	20.32	20.29	20.36	21.00	20.44	20.67	20.32	21.50
2.5	3GPP Rel 7	HSPA+ (16QAM) Subtest-1	20.73	20.71	20.82	21.50	20.89	20.96	20.74	22.00



<LTE Conducted Power>

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. 16QAM output power for each RB allocation configuration is not > ½ dB higher than the same configuration in QPSK
6. Smaller bandwidth output power for each RB allocation configuration is not > ½ dB higher than the same configuration in the largest supported bandwidth

<LTE Band 7 Conducted Power>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	Target MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	21.57	21.45	21.78	23	0
20	QPSK	1	49	21.50	21.41	21.69		
20	QPSK	1	99	21.40	21.44	21.71		
20	QPSK	50	0	20.37	20.35	20.51	22	1
20	QPSK	50	24	20.27	20.31	20.49		
20	QPSK	50	49	20.32	20.34	20.50		
20	QPSK	100	0	20.42	20.38	20.50	22	1
20	16QAM	1	0	20.72	20.74	20.90		
20	16QAM	1	49	20.67	20.69	20.86		
20	16QAM	1	99	20.61	20.68	20.76	21	2
20	16QAM	50	0	19.45	19.43	19.42		
20	16QAM	50	24	19.41	19.36	19.47		
20	16QAM	50	49	19.43	19.40	19.51	21	2
20	16QAM	50	49	19.43	19.40	19.51		
20	16QAM	100	0	19.46	19.46	19.63		
Channel				20825	21100	21375		
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	21.67	21.53	21.75	23	0
15	QPSK	1	37	21.55	21.52	21.71		
15	QPSK	1	74	21.54	21.49	21.74		
15	QPSK	36	0	20.29	20.36	20.53	22	1
15	QPSK	36	18	20.32	20.38	20.54		
15	QPSK	36	37	20.30	20.44	20.60		
15	QPSK	75	0	20.26	20.36	20.49	22	1
15	16QAM	1	0	20.36	20.45	20.58		
15	16QAM	1	37	20.21	20.22	20.46		
15	16QAM	1	74	20.33	20.35	20.51	21	2
15	16QAM	36	0	19.61	19.46	19.47		
15	16QAM	36	18	19.52	19.44	19.56		
15	16QAM	36	37	19.53	19.43	19.61	21	2
15	16QAM	36	37	19.53	19.43	19.61		
15	16QAM	75	0	19.38	19.35	19.60		
Channel				20800	21100	21400		
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	21.60	21.52	21.46	23	0
10	QPSK	1	24	21.48	21.30	21.45		
10	QPSK	1	49	21.51	21.45	21.41		
10	QPSK	25	0	20.32	20.33	20.48	22	1
10	QPSK	25	12	20.46	20.47	20.56		
10	QPSK	25	24	20.37	20.48	20.51		
10	QPSK	50	0	20.33	20.34	20.39	22	1
10	16QAM	1	0	20.61	20.50	20.75		
10	16QAM	1	24	20.57	20.49	20.73		
10	16QAM	1	49	20.44	20.42	20.67	21	2
10	16QAM	25	0	19.42	19.35	19.58		
10	16QAM	25	12	19.58	19.35	19.68		
10	16QAM	25	24	19.50	19.37	19.53	21	2
10	16QAM	25	24	19.50	19.37	19.53		
10	16QAM	50	0	19.38	19.27	19.44		



Channel				20775	21100	21425	Tune up Limit (dBm)	Target MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	21.66	21.54	21.63	23	0
5	QPSK	1	12	21.65	21.48	21.53		
5	QPSK	1	24	21.63	21.45	21.44		
5	QPSK	12	0	20.53	20.49	20.57	22	1
5	QPSK	12	6	20.58	20.59	20.56		
5	QPSK	12	11	20.50	20.54	20.65		
5	QPSK	25	0	20.39	20.44	20.61	22	1
5	16QAM	1	0	20.31	20.25	20.60		
5	16QAM	1	12	20.30	20.23	20.59		
5	16QAM	1	24	20.28	20.20	20.48	21	2
5	16QAM	12	0	19.65	19.49	19.82		
5	16QAM	12	6	19.87	19.51	19.72		
5	16QAM	12	11	19.59	19.52	19.67	21	2
5	16QAM	25	0	19.43	19.34	19.47		

11. SAR Test Results

Note:

- Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
- Per KDB 447498 D01v05r02, for each exposure position, if the highest output channel reported SAR ≤ 0.8 W/kg, other channels SAR testing is not necessary.
- Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA, HSPA+ (16QAM in uplink) /DC-HSDPA output power is < 0.25dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2 W/kg, HSDPA/HSUPA and HSPA+ (16QAM in uplink)/DC-HSDPA SAR evaluation can be excluded.
- Per KDB 941225 D05v02r03, when reported SAR of 1RB and 50%RB allocation for QPSK ≤ 0.8 W/kg, and 100%RB with QPSK output power is less than 1RB and 50%RB, 100%RB allocation for QPSK is not required.
- 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 ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
- 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 smaller bandwidth SAR testing is not required.

11.1 Body SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
30	GSM850	GPRS (GMSK 2 Tx slots)	Horizontal Up	0.5	128	824.2	30.96	32	1.271	0.08	0.377	0.479
31	GSM850	GPRS (GMSK 2 Tx slots)	Horizontal Down	0.5	128	824.2	30.96	32	1.271	0.05	0.604	0.767
32	GSM850	GPRS (GMSK 2 Tx slots)	Vertical Front	0.5	128	824.2	30.96	32	1.271	0.07	0.292	0.371
33	GSM850	GPRS (GMSK 2 Tx slots)	Vertical Back	0.5	128	824.2	30.96	32	1.271	-0.05	0.186	0.236
34	GSM850	GPRS (GMSK 2 Tx slots)	Tip Mode	0.5	128	824.2	30.96	32	1.271	0.03	0.00463	0.006
08	GSM1900	GPRS (GMSK 2 Tx slots)	Horizontal Up	0.5	810	1909.8	27.94	29	1.276	0.05	0.638	0.814
09	GSM1900	GPRS (GMSK 2 Tx slots)	Horizontal Down	0.5	810	1909.8	27.94	29	1.276	-0.12	0.724	0.924
10	GSM1900	GPRS (GMSK 2 Tx slots)	Vertical Front	0.5	810	1909.8	27.94	29	1.276	-0.07	0.440	0.562
11	GSM1900	GPRS (GMSK 2 Tx slots)	Vertical Back	0.5	810	1909.8	27.94	29	1.276	0.07	0.219	0.280
12	GSM1900	GPRS (GMSK 2 Tx slots)	Tip Mode	0.5	810	1909.8	27.94	29	1.276	0.04	0.051	0.065
13	GSM1900	GPRS (GMSK 2 Tx slots)	Horizontal Up	0.5	512	1850.2	27.71	29	1.346	-0.03	0.456	0.614
14	GSM1900	GPRS (GMSK 2 Tx slots)	Horizontal Up	0.5	661	1880	27.89	29	1.291	-0.06	0.536	0.692
15	GSM1900	GPRS (GMSK 2 Tx slots)	Horizontal Down	0.5	512	1850.2	27.71	29	1.346	0.05	0.551	0.742
16	GSM1900	GPRS (GMSK 2 Tx slots)	Horizontal Down	0.5	661	1880	27.89	29	1.291	-0.08	0.629	0.812

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
35	WCDMA Band V	RMC12.2K	Horizontal Up	0.5	4233	846.6	22.01	23	1.256	0.16	0.491	0.617
36	WCDMA Band V	RMC12.2K	Horizontal Down	0.5	4233	846.6	22.01	23	1.256	0.01	0.681	0.855
37	WCDMA Band V	RMC12.2K	Vertical Front	0.5	4233	846.6	22.01	23	1.256	0.15	0.314	0.394
38	WCDMA Band V	RMC12.2K	Vertical Back	0.5	4233	846.6	22.01	23	1.256	0.04	0.201	0.252
39	WCDMA Band V	RMC12.2K	Tip Mode	0.5	4233	846.6	22.01	23	1.256	0.07	0.0073	0.009
40	WCDMA Band V	RMC12.2K	Horizontal Down	0.5	4132	826.4	21.95	23	1.274	0.08	0.406	0.517
41	WCDMA Band V	RMC12.2K	Horizontal Down	0.5	4182	836.4	21.85	23	1.303	0.01	0.480	0.626
01	WCDMA Band II	RMC12.2K	Horizontal Up	0.5	9400	1880	22.22	23	1.197	-0.1	0.711	0.851
02	WCDMA Band II	RMC12.2K	Horizontal Down	0.5	9400	1880	22.22	23	1.197	-0.04	0.864	1.034
03	WCDMA Band II	RMC12.2K	Vertical Front	0.5	9400	1880	22.22	23	1.197	0.09	0.566	0.677
04	WCDMA Band II	RMC12.2K	Vertical Back	0.5	9400	1880	22.22	23	1.197	0.11	0.289	0.346
05	WCDMA Band II	RMC12.2K	Tip Mode	0.5	9400	1880	22.22	23	1.197	0.06	0.026	0.031
06	WCDMA Band II	RMC12.2K	Horizontal Up	0.5	9262	1852.4	22.15	23	1.216	0.18	0.762	0.927
07	WCDMA Band II	RMC12.2K	Horizontal Up	0.5	9538	1907.6	21.98	23	1.265	0.05	0.686	0.868
17	WCDMA Band II	RMC12.2K	Horizontal Down	0.5	9262	1852.4	22.15	23	1.216	-0.07	0.929	1.130
18	WCDMA Band II	RMC12.2K	Horizontal Down	0.5	9538	1907.6	21.98	23	1.265	-0.04	0.815	1.031

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
19	LTE band 7	20M	QPSK	1	0	Horizontal Up	0.5	21350	2560	21.78	23	1.324	0.15	0.421	0.558
20	LTE band 7	20M	QPSK	1	0	Horizontal Down	0.5	21350	2560	21.78	23	1.324	-0.08	0.551	0.730
21	LTE band 7	20M	QPSK	1	0	Vertical Front	0.5	21350	2560	21.78	23	1.324	0.07	0.320	0.424
22	LTE band 7	20M	QPSK	1	0	Vertical Back	0.5	21350	2560	21.78	23	1.324	0.08	0.151	0.200
23	LTE band 7	20M	QPSK	1	0	Tip Mode	0.5	21350	2560	21.78	23	1.324	0.05	0.00477	0.006
24	LTE band 7	20M	QPSK	50	0	Horizontal Up	0.5	21350	2560	20.51	22	1.409	0.08	0.493	0.695
25	LTE band 7	20M	QPSK	50	0	Horizontal Down	0.5	21350	2560	20.51	22	1.409	0.02	0.538	0.758
26	LTE band 7	20M	QPSK	50	0	Vertical Front	0.5	21350	2560	20.51	22	1.409	-0.09	0.330	0.465
27	LTE band 7	20M	QPSK	50	0	Vertical Back	0.5	21350	2560	20.51	22	1.409	0.09	0.163	0.230
28	LTE band 7	20M	QPSK	50	0	Tip Mode	0.5	21350	2560	20.51	22	1.409	0.08	0.011	0.016

**11.2 Repeated SAR Measurement**

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
17	WCDMA Band II	RMC12.2K	Horizontal Down	0.5	9262	1852.4	22.15	23	1.216	-0.07	0.929	1	1.130
29	WCDMA Band II	RMC12.2K	Horizontal Down	0.5	9262	1852.4	22.15	23	1.216	0.14	0.902	1.030	1.097

Note:

1. Per KDB 865664 D01v01r02, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg
2. Per KDB 865664 D01v01r02, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR < 1.45 W/kg, only one repeated measurement is required.
3. The ratio is the largest SAR to the smallest SAR among original and repeated measurement.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

11.3 Highest SAR Plot

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2014.03.18

31 GSM850_GPRS (GMSK 2 Tx slots)_Horizontal Down_0.5Cm_Ch128

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 824.2 MHz; Duty Cycle: 1:4.15
 Medium: MSL_835_140318 Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.964$ S/m; $\epsilon_r = 54.201$;
 $\rho = 1000$ kg/m³
 Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch128/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.745 W/kg

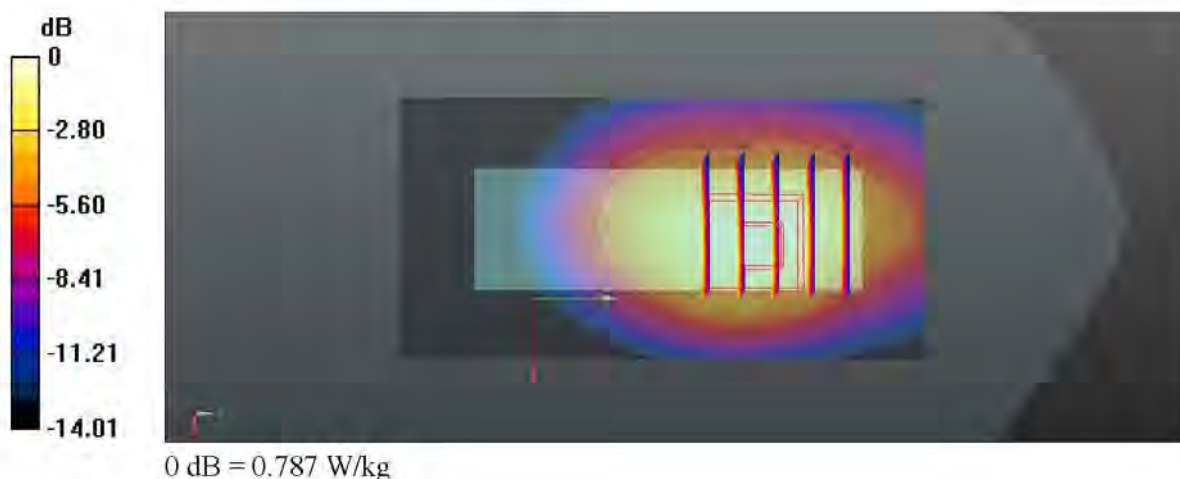
Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.326 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.970 W/kg

SAR(1 g) = 0.604 W/kg; SAR(10 g) = 0.359 W/kg

Maximum value of SAR (measured) = 0.787 W/kg



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2014.03.17

09 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Down_0.5Cm_Ch810

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15
Medium: MSL_1900_140317 Medium parameters used: $f = 1909.8 \text{ MHz}$; $\sigma = 1.511 \text{ S/m}$; $\epsilon_r = 53.819$;
 $\rho = 1000 \text{ kg/m}^3$
Ambient Temperature: 23.5°C ; Liquid Temperature : 22.6°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch810/Area Scan (41x81x1): Interpolated grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.884 W/kg

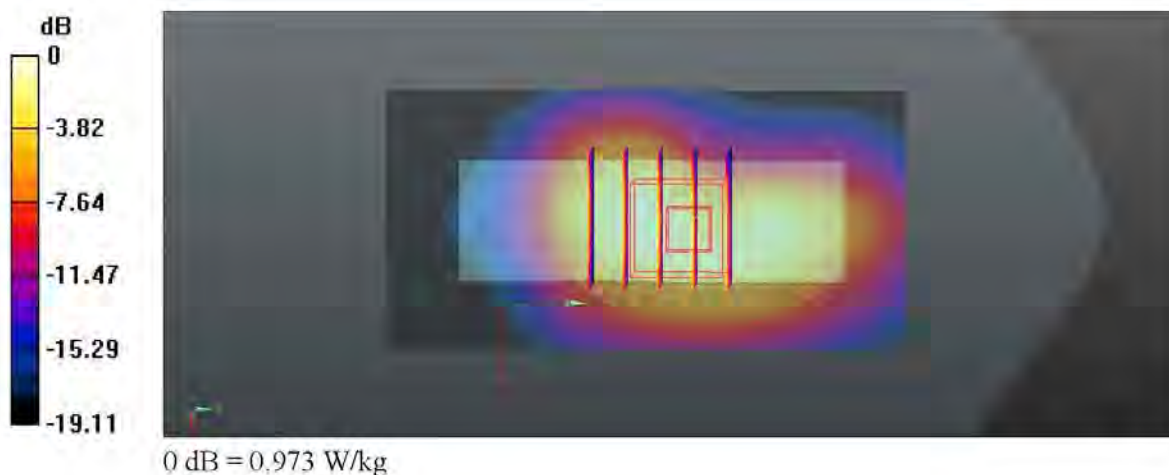
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 2.339 V/m ; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 1.26 W/kg

SAR(1 g) = 0.724 W/kg ; SAR(10 g) = 0.394 W/kg

Maximum value of SAR (measured) = 0.973 W/kg



TestLaboratory: Sporton International Inc. SAR/HAC TestingLab

Date: 2014.03.18

36 WCDMA Band V_RMC 12.2K_Horizontal Down_0.5Cm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 846.6 \text{ MHz}$; $\sigma = 0.985 \text{ S/m}$; $\epsilon_r = 54.002$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: $23.6 \text{ }^\circ\text{C}$; Liquid Temperature : $22.7 \text{ }^\circ\text{C}$

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4233/Area Scan (41x81x1): Interpolated grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.781 W/kg

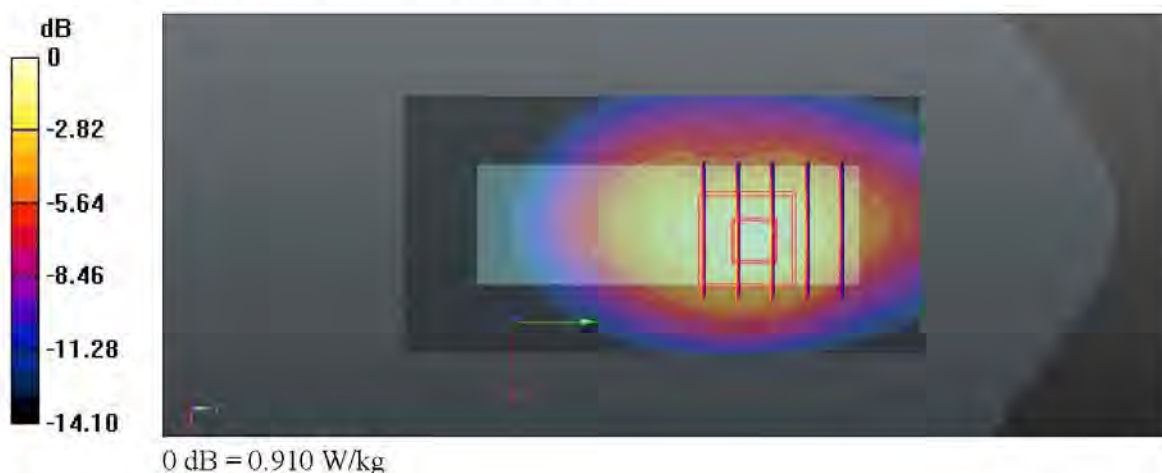
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 3.237 V/m ; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.10 W/kg

SAR(1 g) = 0.681 W/kg ; SAR(10 g) = 0.397 W/kg

Maximum value of SAR (measured) = 0.910 W/kg



TestLaboratory: Sporton International Inc. SAR/HAC TestingLab

Date: 2014.03.17

17 WCDMA Band II_RMC 12.2K_Horizontal Down_0.5Cm_Ch9262

Communication System: WCDMA; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium: MSL_1900_140317 Medium parameters used: $f = 1852.4$ MHz; $\sigma = 1.444$ S/m; $\epsilon_r = 53.844$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9262/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.30 W/kg

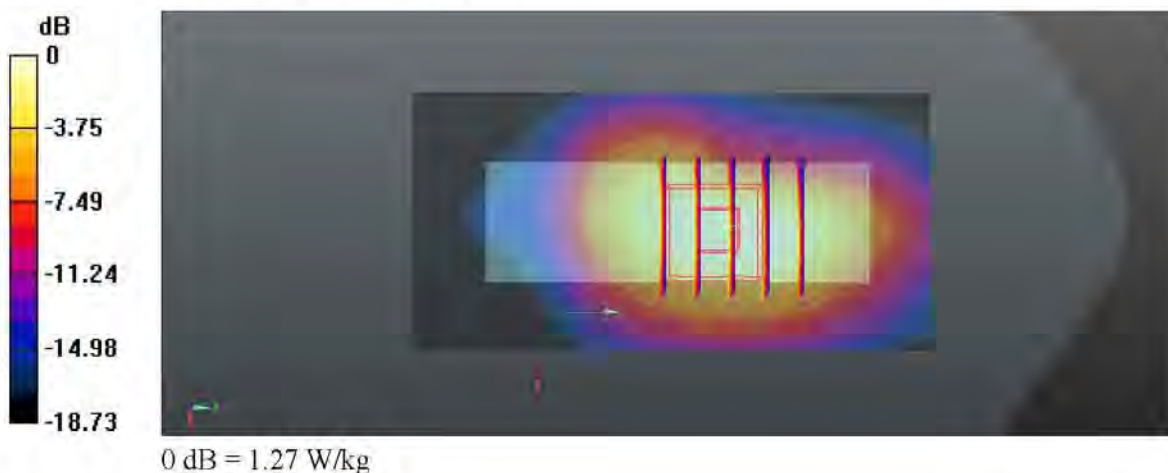
Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.536 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.59 W/kg

SAR(1 g) = 0.929 W/kg; SAR(10 g) = 0.510 W/kg

Maximum value of SAR (measured) = 1.27 W/kg



TestLaboratory: Sporton International Inc. SAR/HAC TestingLab

Date: 2014.03.18

25 LTE Band 7_20M_QPSK(50, 0)_Horizontal Down_0.5Cm_Ch21350

Communication System: LTE;Frequency: 2560 MHz;Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$;

 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (41x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.703 W/kg

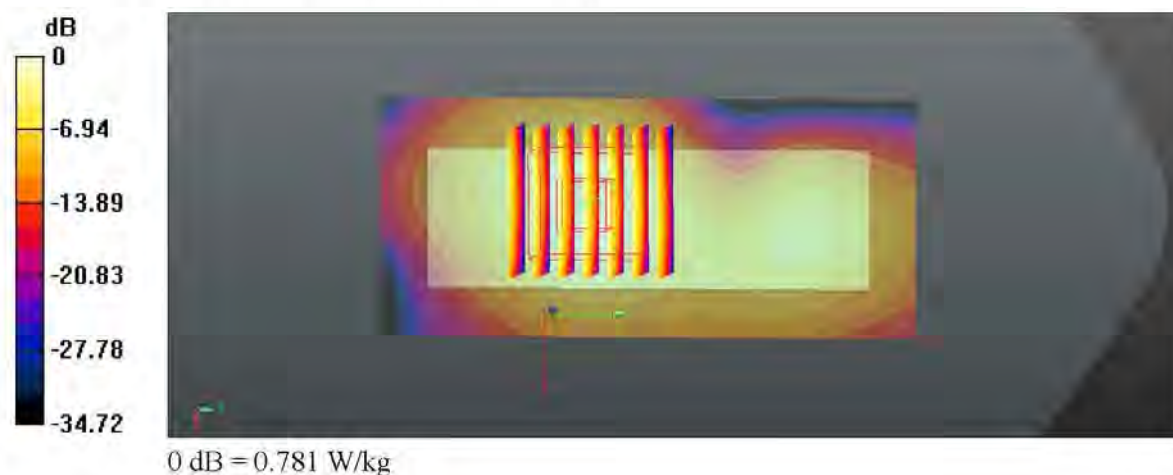
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.695 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.03 W/kg

SAR(1 g) = 0.538 W/kg; SAR(10 g) = 0.262 W/kg

Maximum value of SAR (measured) = 0.781 W/kg


Test Engineer : Kat Yin

12. 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 12.1

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

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

(b) κ is the coverage factor

Table 12.1 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)
Measurement System							
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 %
Test Sample Related							
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 %
Phantom and Setup							
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 %
Combined Standard Uncertainty						± 11.0 %	± 10.8 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						± 22.0 %	± 21.5 %

Table 12.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

13. 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 447498 D01 v05r02, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Feb 2014
- [6] FCC KDB 447498 D02 v02, "SAR Measurement Procedures for USB Dongle Transmitters", Nov 2009
- [7] FCC KDB 941225 D03 v01, "Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE", December 2008
- [8] FCC KDB 941225 D05 v02r03, "SAR Evaluation Considerations for LTE Devices", Dec 2013
- [9] FCC KDB 941225 D01 v02, "SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA", October 2007
- [10] FCC KDB 941225 D02 v02r02, "SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced", May 2013.
- [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.



Appendix A. Plots of System Performance Check

The plots are shown as follows.

System Check_Body_835MHz_140318**DUT: D835V2-SN: 4d151**

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

Medium: MSL_835_140318 Medium parameters used: $f = 835$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 54.111$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.97 W/kg

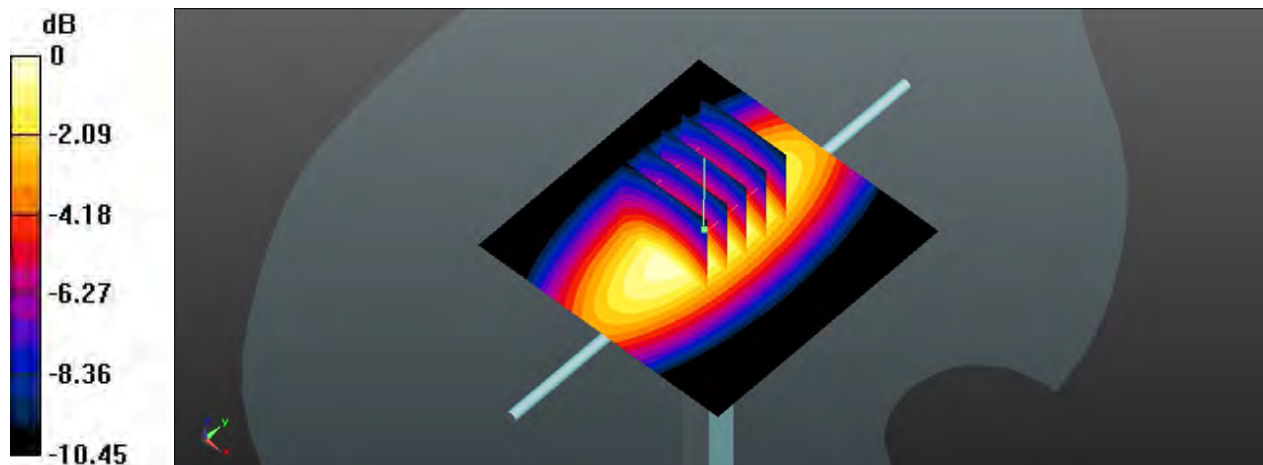
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 55.701 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.47 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 2.93 W/kg



0 dB = 2.93 W/kg

System Check_Body_1900MHz_140317**DUT: D1900V2-SN:5d170**

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

Medium: MSL_1900_140317 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.501$ S/m; $\epsilon_r = 53.849$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm

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

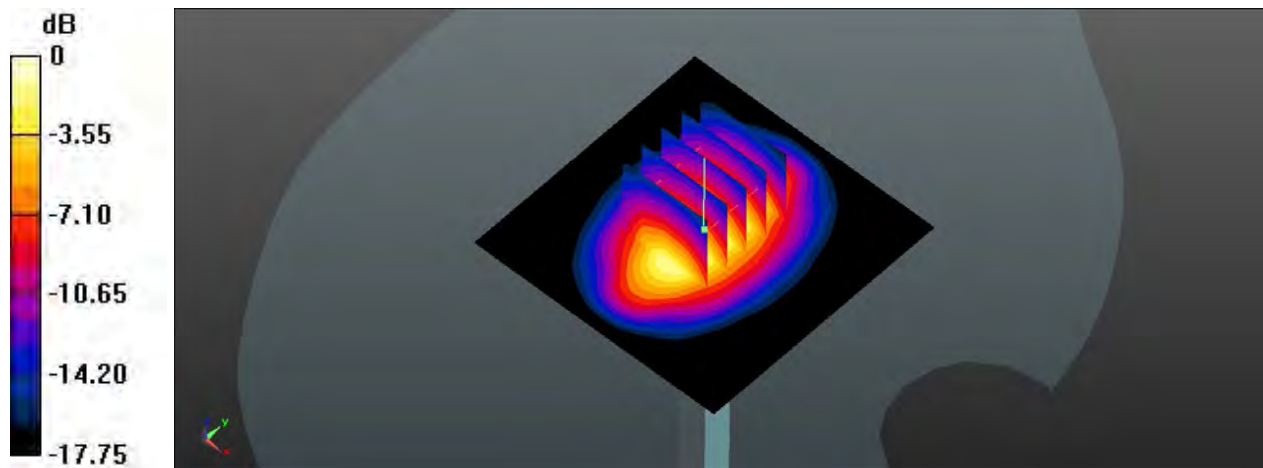
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 98.102 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.7 W/kg

SAR(1 g) = 9.87 W/kg; SAR(10 g) = 5.17 W/kg

Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg

System Check_Body_2600MHz_140318**DUT: D2600V2-SN:1061**

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

Medium: MSL_2600_140318 Medium parameters used: $f = 2600$ MHz; $\sigma = 2.201$ S/m; $\epsilon_r = 52.823$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Pin=250mW/Area Scan (71x81x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 23.0 W/kg

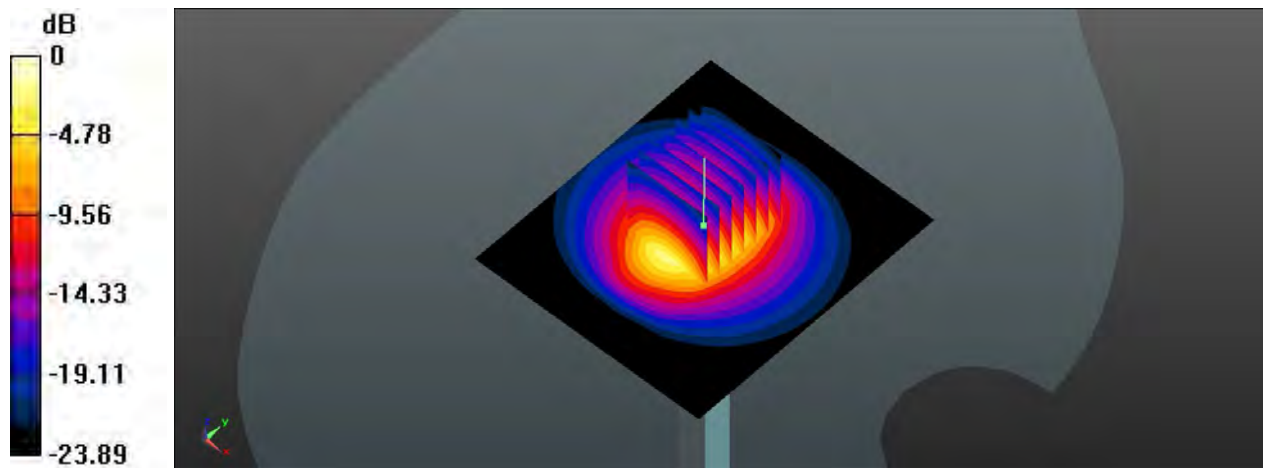
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.037 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 14.50 W/kg; SAR(10 g) = 6.45 W/kg

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



0 dB = 22.3 W/kg



Appendix B. Plots of SAR Measurement

The plots are shown as follows.

30 GSM850_GPRS (GMSK 2 Tx slots)_Horizontal Up_0.5Cm_Ch128

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 824.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_835_140318 Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.964$ S/m; $\epsilon_r = 54.201$;
 $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch128/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.490 W/kg

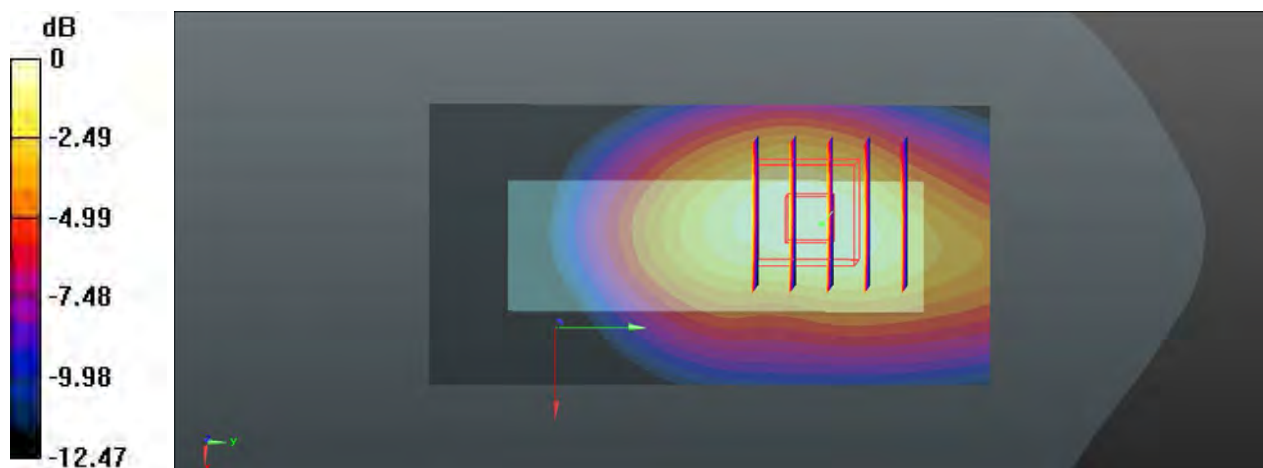
Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.154 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.579 W/kg

SAR(1 g) = 0.377 W/kg; SAR(10 g) = 0.237 W/kg

Maximum value of SAR (measured) = 0.481 W/kg



0 dB = 0.481 W/kg

31 GSM850_GPRS (GMSK 2 Tx slots)_Horizontal Down_0.5Cm_Ch128

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 824.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_835_140318 Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.964$ S/m; $\epsilon_r = 54.201$;

$\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch128/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.745 W/kg

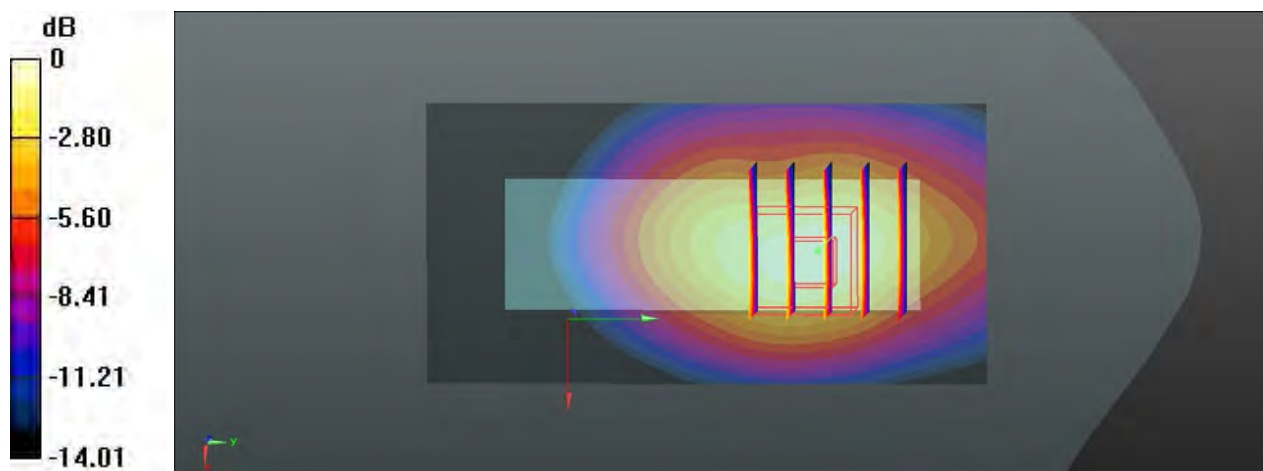
Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.326 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.970 W/kg

SAR(1 g) = 0.604 W/kg; SAR(10 g) = 0.359 W/kg

Maximum value of SAR (measured) = 0.787 W/kg



0 dB = 0.787 W/kg

32 GSM850_GPRS (GMSK 2 Tx slots)_Vertical Front_0.5Cm_Ch128

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 824.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_835_140318 Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.964$ S/m; $\epsilon_r = 54.201$;

$\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch128/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.361 W/kg

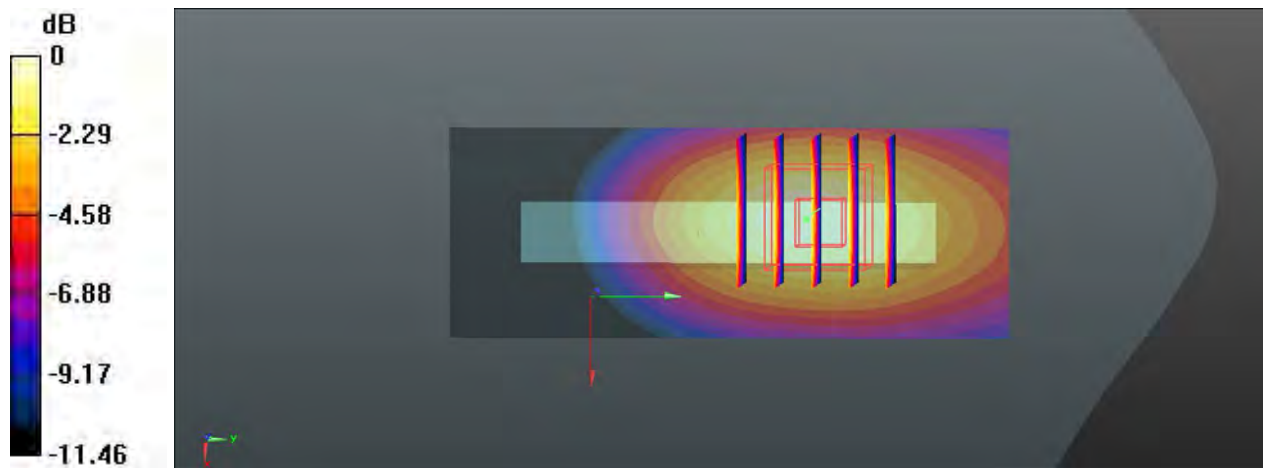
Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.412 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.446 W/kg

SAR(1 g) = 0.292 W/kg; SAR(10 g) = 0.183 W/kg

Maximum value of SAR (measured) = 0.371 W/kg



0 dB = 0.371 W/kg

33 GSM850_GPRS (GMSK 2 Tx slots)_Vertical Back_0.5Cm_Ch128

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 824.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_835_140318 Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.964$ S/m; $\epsilon_r = 54.201$;

$\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch128/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.243 W/kg

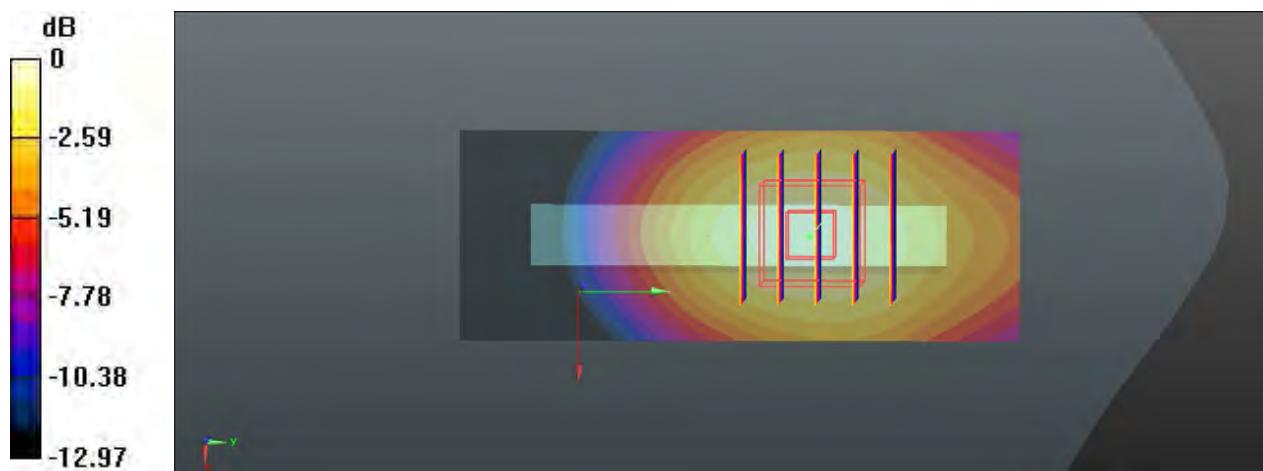
Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.472 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.362 W/kg

SAR(1 g) = 0.186 W/kg; SAR(10 g) = 0.110 W/kg

Maximum value of SAR (measured) = 0.271 W/kg



0 dB = 0.271 W/kg

34 GSM850_GPRS (GMSK 2 Tx slots)_Tip mode_0.5Cm_Ch128

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 824.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_835_140318 Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.964$ S/m; $\epsilon_r = 54.201$;

$\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch128/Area Scan (31x41x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.00706 W/kg

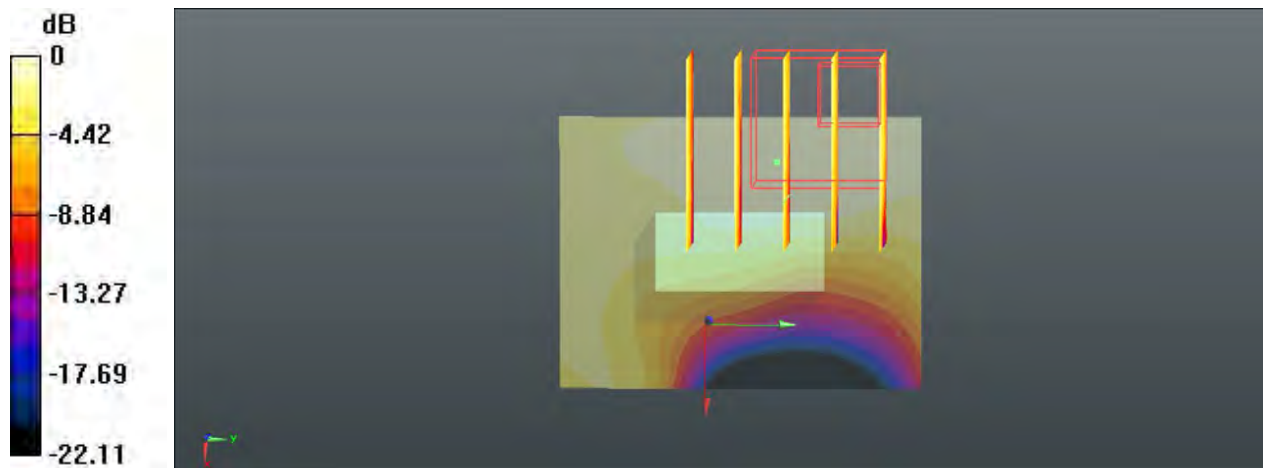
Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.407 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.00801 W/kg

SAR(1 g) = 0.00463 W/kg; SAR(10 g) = 0.00339 W/kg

Maximum value of SAR (measured) = 0.00608 W/kg



0 dB = 0.00608 W/kg

08 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Up_0.5Cm_Ch810

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.511$ S/m; $\epsilon_r = 53.819$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch810/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.860 W/kg

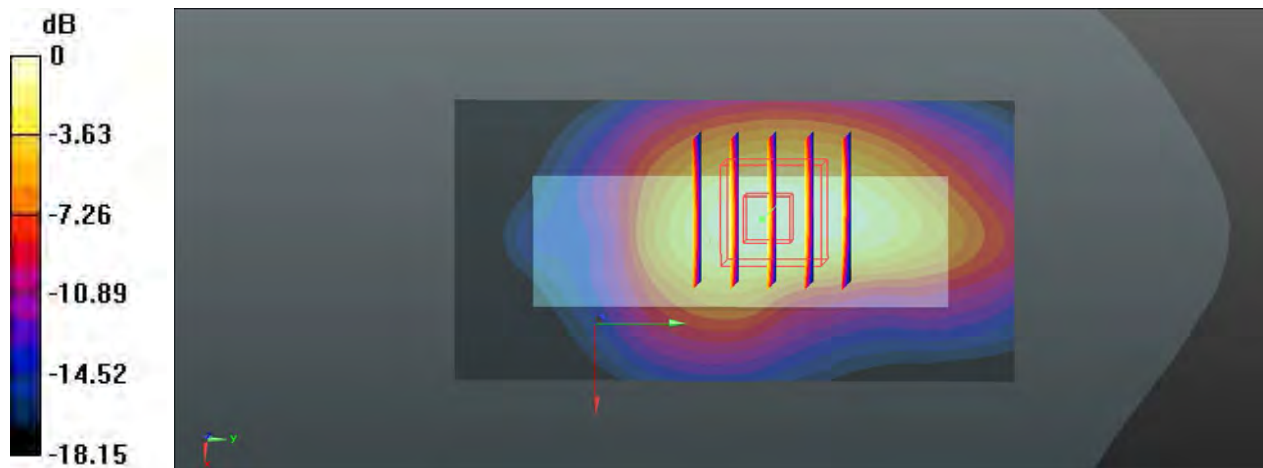
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.580 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.638 W/kg; SAR(10 g) = 0.358 W/kg

Maximum value of SAR (measured) = 0.853 W/kg



0 dB = 0.853 W/kg

09 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Down_0.5Cm_Ch810

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.511$ S/m; $\epsilon_r = 53.819$;

$\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch810/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.884 W/kg

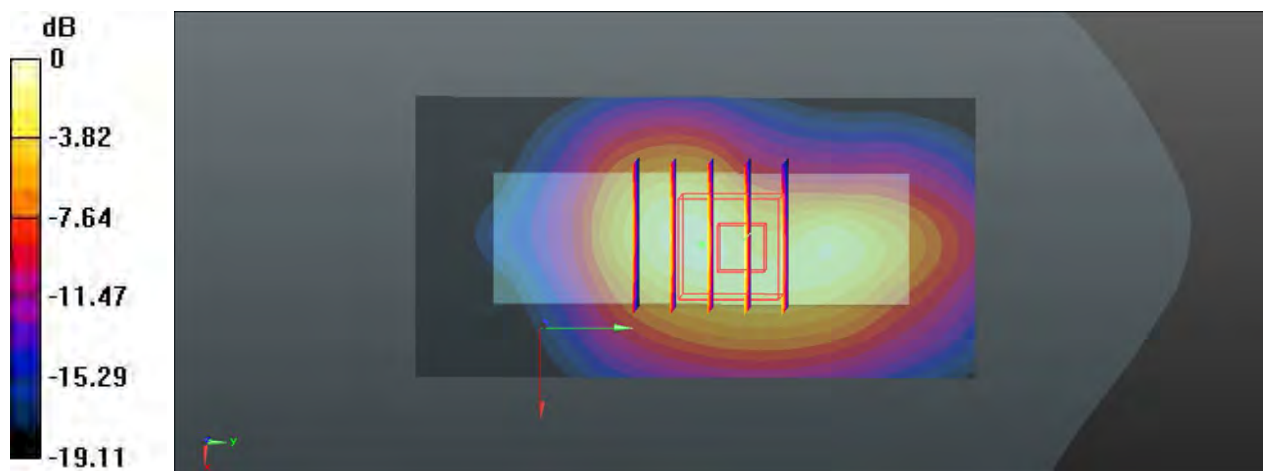
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.339 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 1.26 W/kg

SAR(1 g) = 0.724 W/kg; SAR(10 g) = 0.394 W/kg

Maximum value of SAR (measured) = 0.973 W/kg



0 dB = 0.973 W/kg

10 GSM1900_GPRS (GMSK 2 Tx slots)_Vertical Front_0.5Cm_Ch810

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.511$ S/m; $\epsilon_r = 53.819$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch810/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.614 W/kg

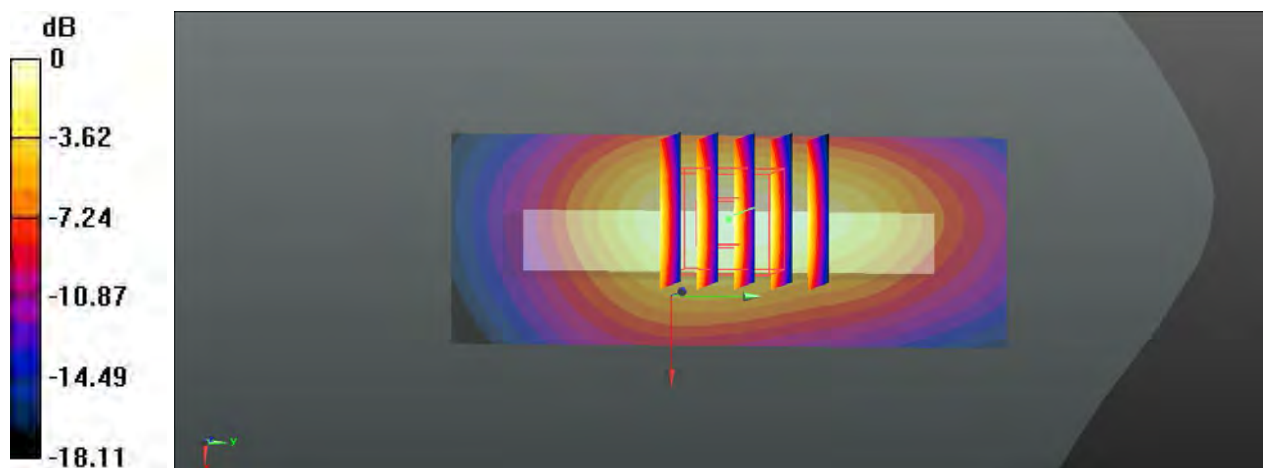
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.161 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.768 W/kg

SAR(1 g) = 0.440 W/kg; SAR(10 g) = 0.238 W/kg

Maximum value of SAR (measured) = 0.601 W/kg



0 dB = 0.601 W/kg

11 GSM1900_GPRS (GMSK 2 Tx slots)_Vertical Back_0.5Cm_Ch810

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.511$ S/m; $\epsilon_r = 53.819$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch810/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.328 W/kg

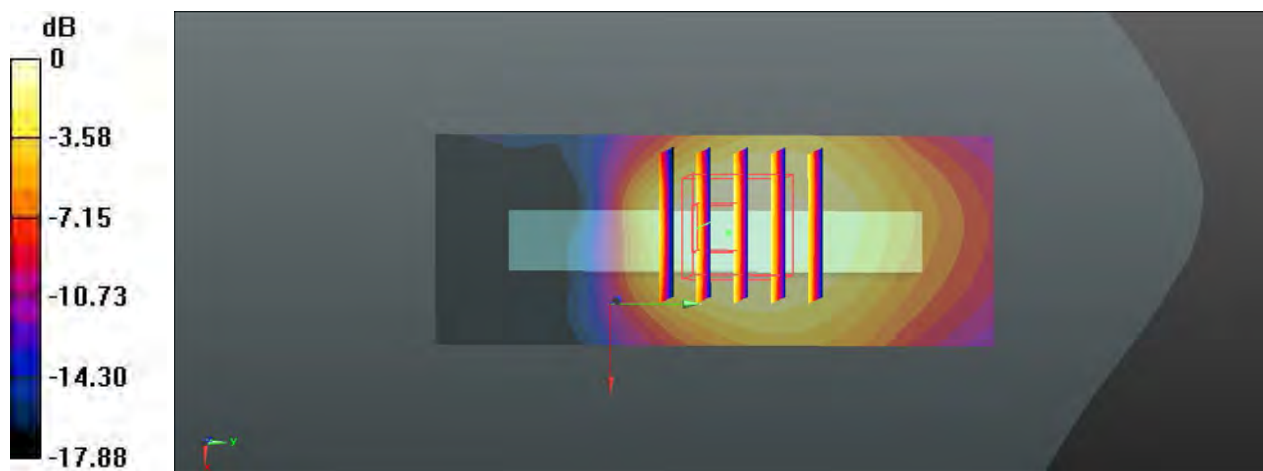
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.248 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.383 W/kg

SAR(1 g) = 0.219 W/kg; SAR(10 g) = 0.126 W/kg

Maximum value of SAR (measured) = 0.294 W/kg



0 dB = 0.294 W/kg

12 GSM1900_GPRS (GMSK 2 Tx slots)_Tip side_0.5Cm_Ch810

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.511$ S/m; $\epsilon_r = 53.819$;

$\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch810/Area Scan (31x41x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.0778 W/kg

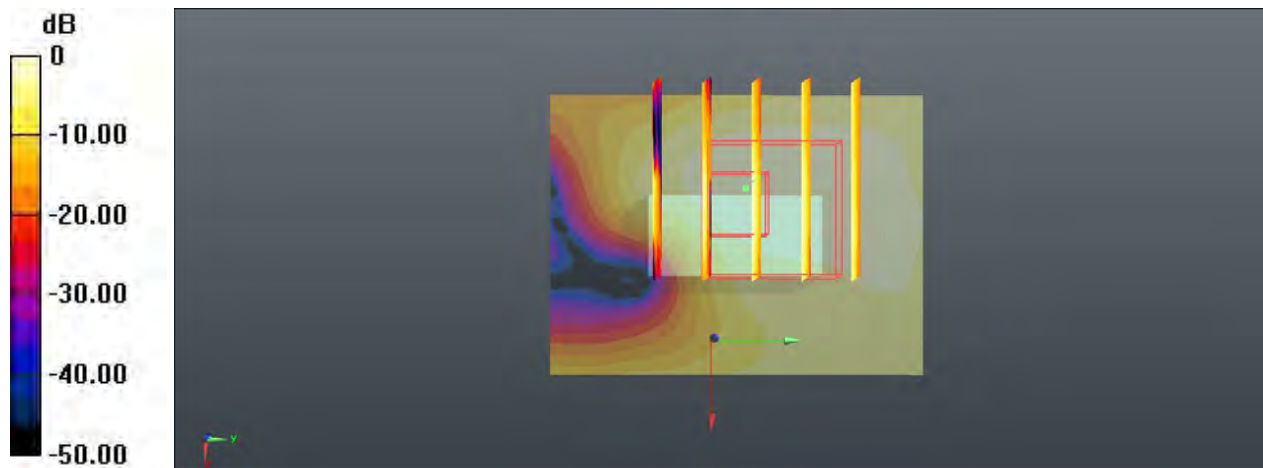
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 0.281 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.123 W/kg

SAR(1 g) = 0.051 W/kg; SAR(10 g) = 0.021 W/kg

Maximum value of SAR (measured) = 0.0591 W/kg



0 dB = 0.0591 W/kg

13 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Up_0.5Cm_Ch512

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1850.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.44$ S/m; $\epsilon_r = 53.854$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch512/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.633 W/kg

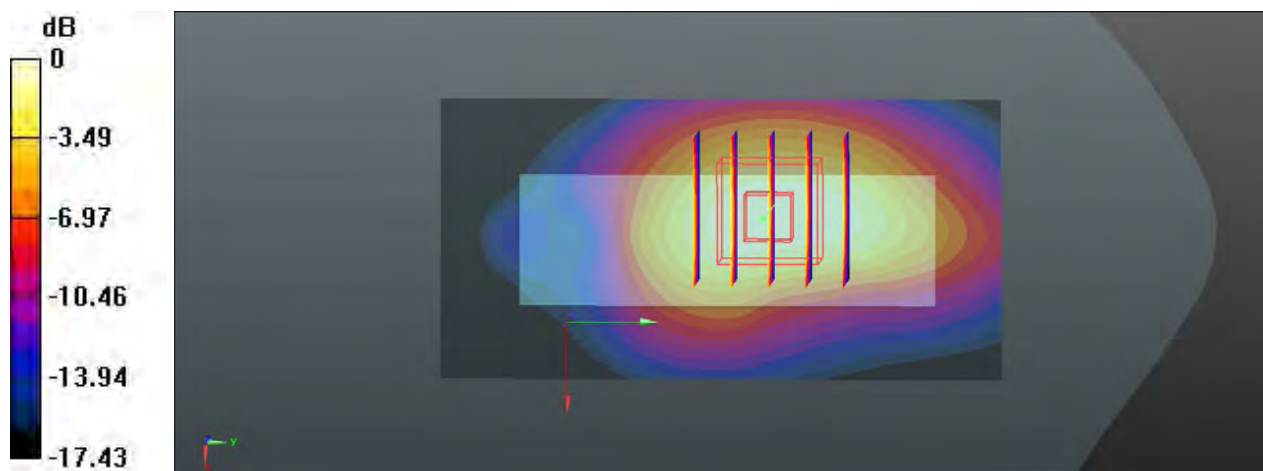
Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.622 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.749 W/kg

SAR(1 g) = 0.456 W/kg; SAR(10 g) = 0.258 W/kg

Maximum value of SAR (measured) = 0.611 W/kg



0 dB = 0.611 W/kg

14 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Up_0.5Cm_Ch661

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³
Ambient Temperature: 23.5 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch661/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.753 W/kg

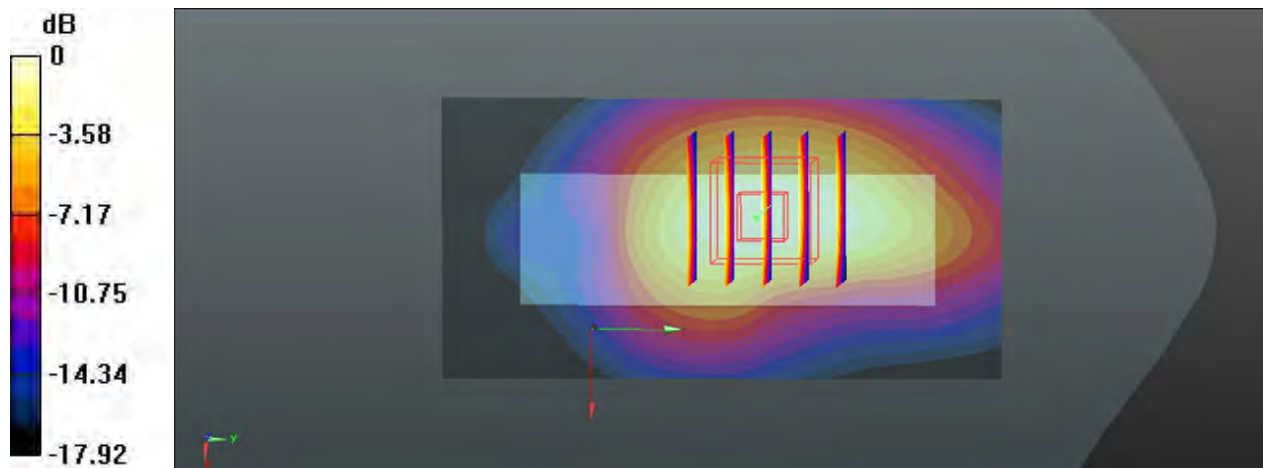
Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.681 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.884 W/kg

SAR(1 g) = 0.536 W/kg; SAR(10 g) = 0.302 W/kg

Maximum value of SAR (measured) = 0.716 W/kg



0 dB = 0.716 W/kg

15 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Down_0.5Cm_Ch512

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1850.2 MHz; Duty Cycle: 1:4.15

Medium: MSL_1900_140317 Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.44$ S/m; $\epsilon_r = 53.854$;

$\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch512/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

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

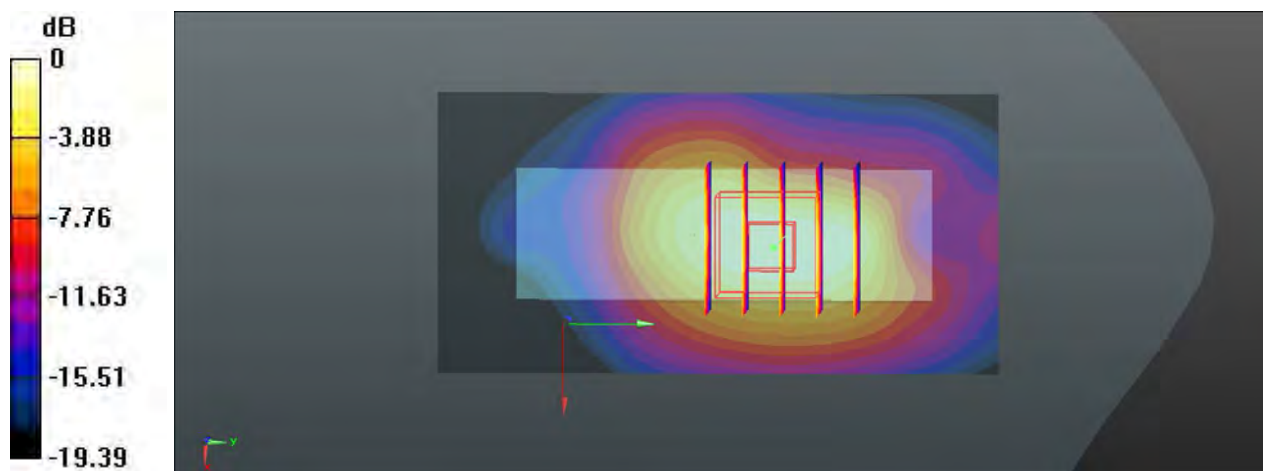
Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.903 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.940 W/kg

SAR(1 g) = 0.551 W/kg; SAR(10 g) = 0.301 W/kg

Maximum value of SAR (measured) = 0.755 W/kg



0 dB = 0.755 W/kg

16 GSM1900_GPRS (GMSK 2 Tx slots)_Horizontal Down_0.5Cm_Ch661

Communication System: GPRS/EDGE (2 Tx slot); Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³
Ambient Temperature: 23.5 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch661/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.873 W/kg

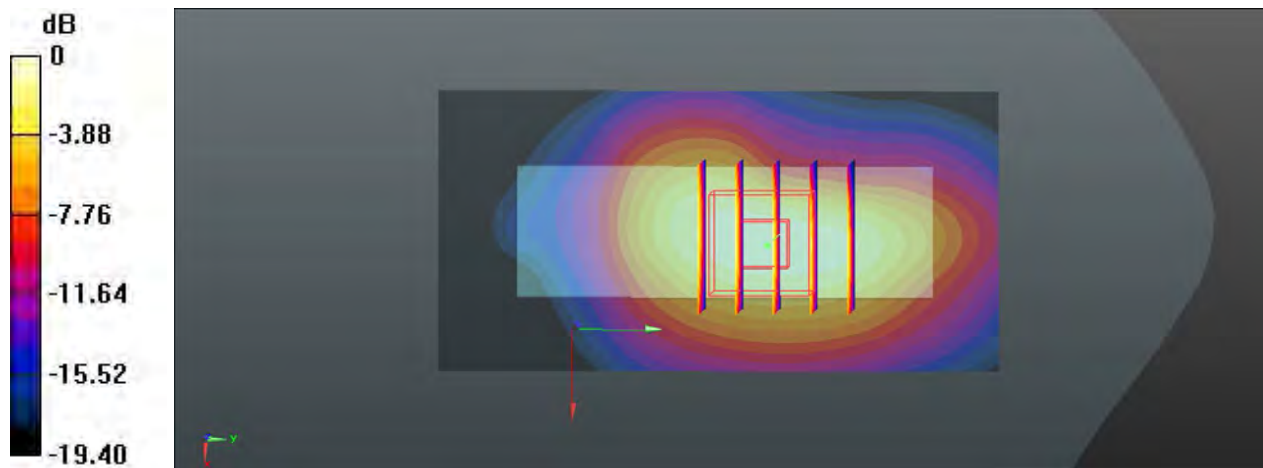
Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.024 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.08 W/kg

SAR(1 g) = 0.629 W/kg; SAR(10 g) = 0.343 W/kg

Maximum value of SAR (measured) = 0.860 W/kg



0 dB = 0.860 W/kg

35 WCDMA Band V_RMC 12.2K_Horizontal Up_0.5Cm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.985$ S/m; $\epsilon_r = 54.002$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4233/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.601 W/kg

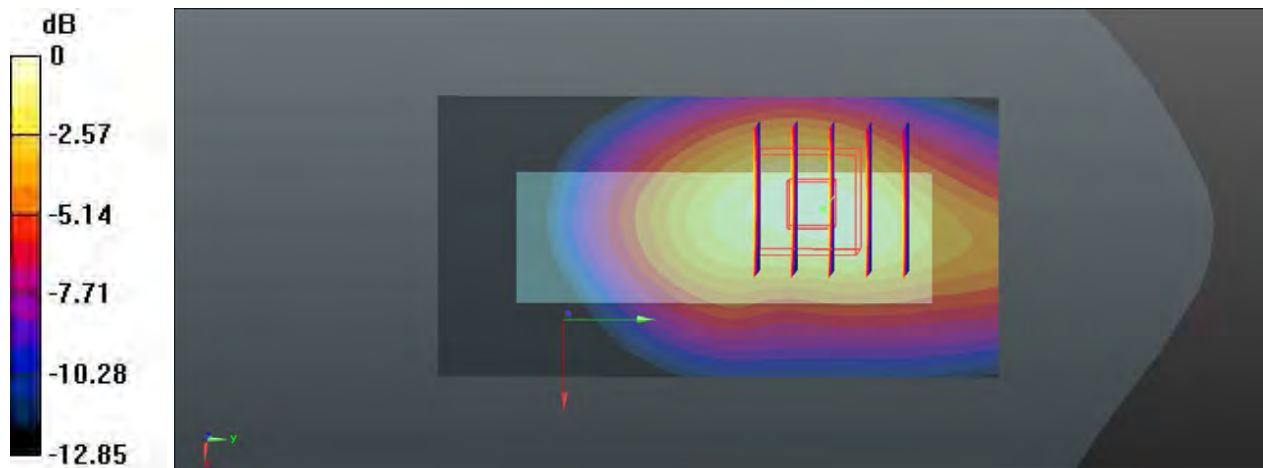
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.867 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.765 W/kg

SAR(1 g) = 0.491 W/kg; SAR(10 g) = 0.302 W/kg

Maximum value of SAR (measured) = 0.632 W/kg



0 dB = 0.632 W/kg

36 WCDMA Band V_RMC 12.2K_Horizontal Down_0.5Cm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.985$ S/m; $\epsilon_r = 54.002$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4233/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.781 W/kg

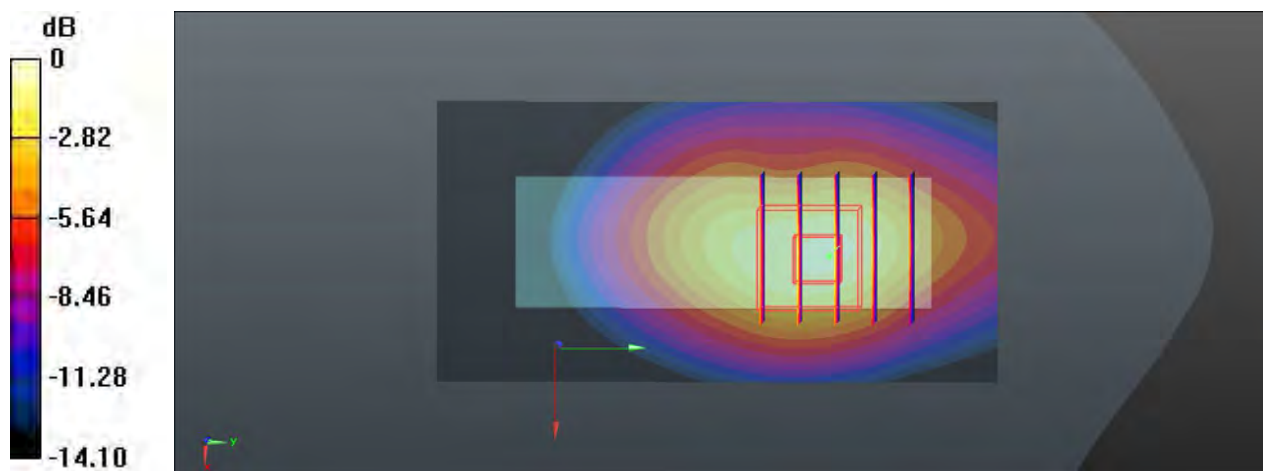
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.237 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.10 W/kg

SAR(1 g) = 0.681 W/kg; SAR(10 g) = 0.397 W/kg

Maximum value of SAR (measured) = 0.910 W/kg



0 dB = 0.910 W/kg

37 WCDMA Band V_RMC 12.2K_Vertical Front_0.5Cm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.985$ S/m; $\epsilon_r = 54.002$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4233/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.389 W/kg

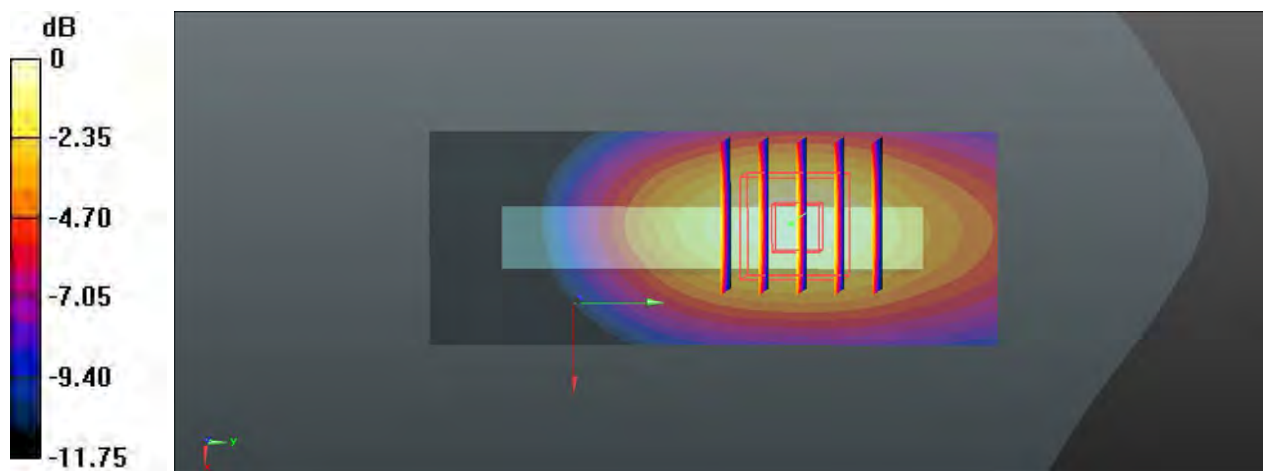
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.064 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.484 W/kg

SAR(1 g) = 0.314 W/kg; SAR(10 g) = 0.196 W/kg

Maximum value of SAR (measured) = 0.405 W/kg



0 dB = 0.405 W/kg

38 WCDMA Band V_RMC 12.2K_Vertical Back_0.5Cm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.985$ S/m; $\epsilon_r = 54.002$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4233/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

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

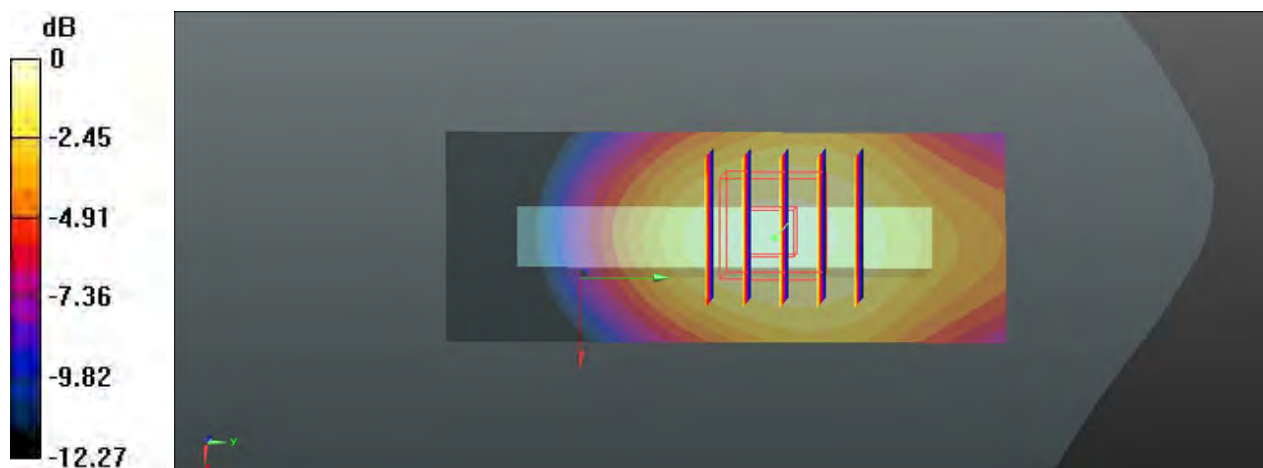
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.228 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.367 W/kg

SAR(1 g) = 0.201 W/kg; SAR(10 g) = 0.123 W/kg

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



0 dB = 0.282 W/kg

39 WCDMA Band V_RMC 12.2K_Tip mode_0.5Cm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.985$ S/m; $\epsilon_r = 54.002$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4233/Area Scan (31x41x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.0101 W/kg

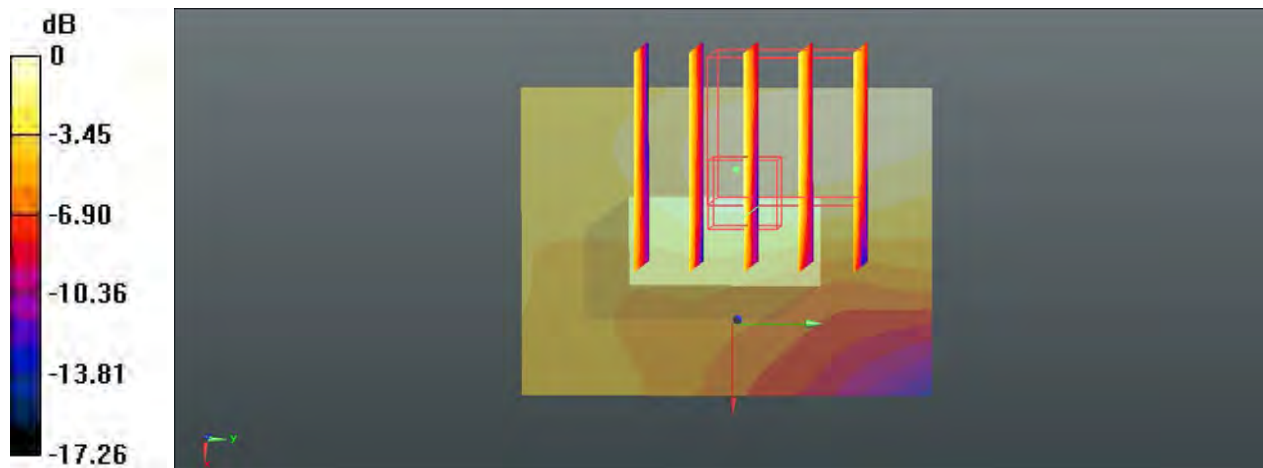
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.816 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.0140 W/kg

SAR(1 g) = 0.0073 W/kg; SAR(10 g) = 0.00483 W/kg

Maximum value of SAR (measured) = 0.0105 W/kg



0 dB = 0.0105 W/kg

40 WCDMA Band V_RMC 12.2K_Horizontal Down_0.5Cm_Ch4132

Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 826.4$ MHz; $\sigma = 0.966$ S/m; $\epsilon_r = 54.179$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4132/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.499 W/kg

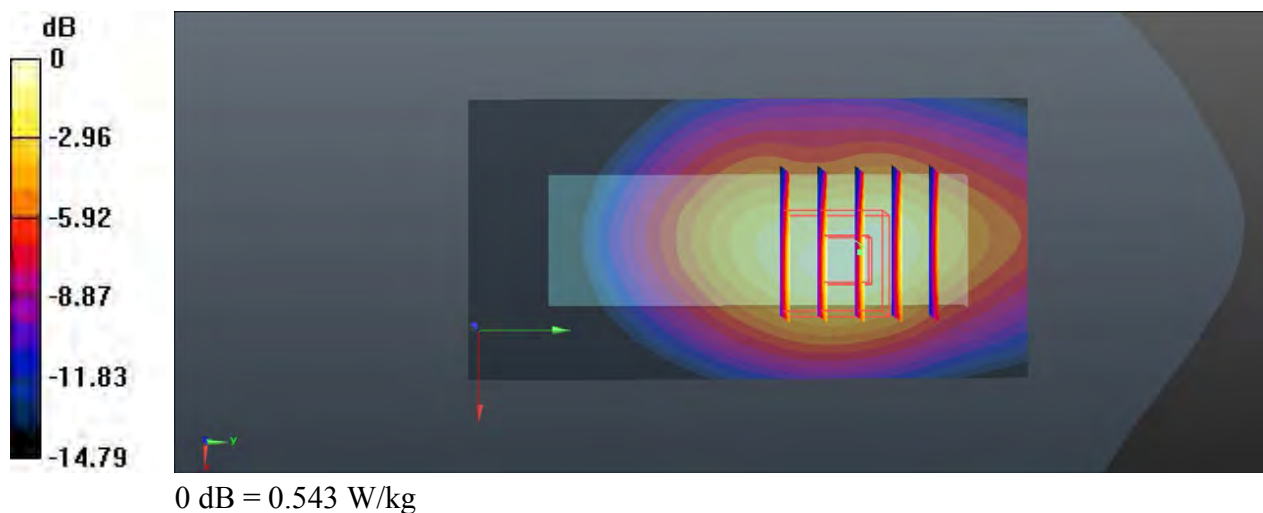
Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.261 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.673 W/kg

SAR(1 g) = 0.406 W/kg; SAR(10 g) = 0.236 W/kg

Maximum value of SAR (measured) = 0.543 W/kg



41 WCDMA Band V_RMC 12.2K_Horizontal Down_0.5Cm_Ch4182

Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1

Medium: MSL_835_140318 Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.975$ S/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.6 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(9.93, 9.93, 9.93); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch4182/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.580 W/kg

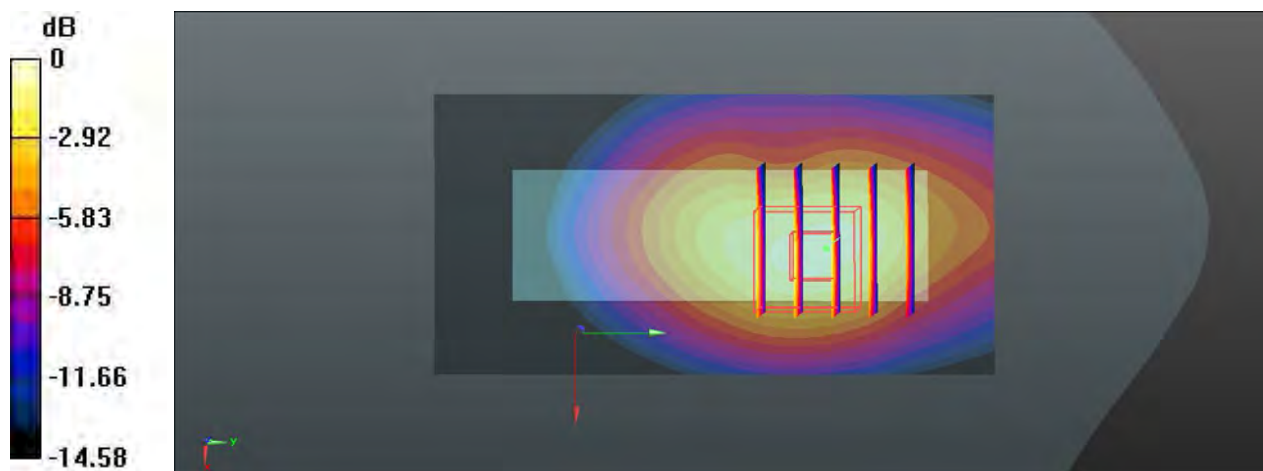
Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.526 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.794 W/kg

SAR(1 g) = 0.480 W/kg; SAR(10 g) = 0.280 W/kg

Maximum value of SAR (measured) = 0.643 W/kg



0 dB = 0.643 W/kg

01 WCDMA Band II_RMC 12.2K_Horizontal Up_0.5Cm_Ch9400

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

Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9400/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.993 W/kg

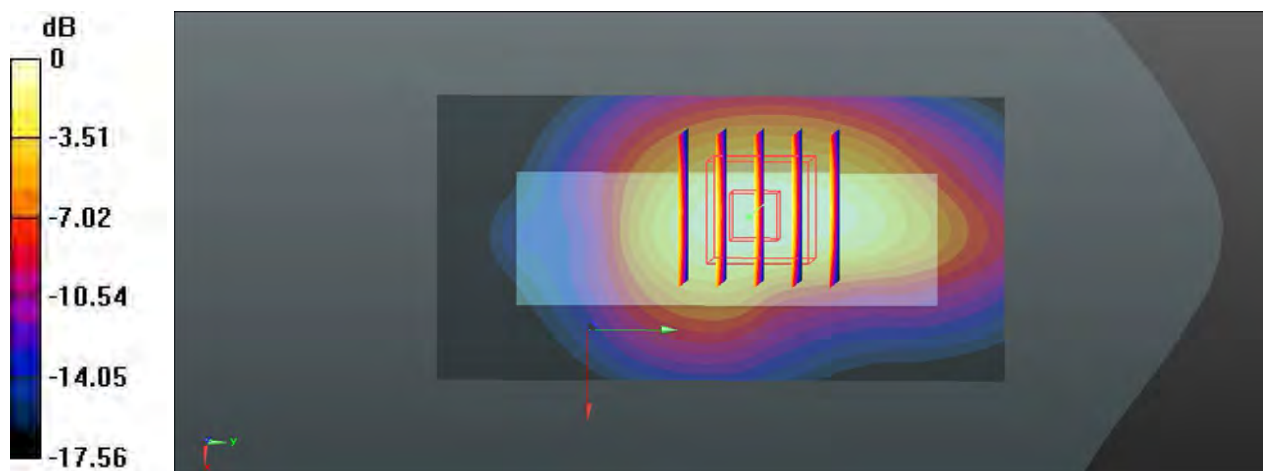
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.086 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 1.17 W/kg

SAR(1 g) = 0.711 W/kg; SAR(10 g) = 0.402 W/kg

Maximum value of SAR (measured) = 0.948 W/kg



0 dB = 0.948 W/kg

02 WCDMA Band II_RMC 12.2K_Horizontal Down_0.5Cm_Ch9400

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

Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9400/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.20 W/kg

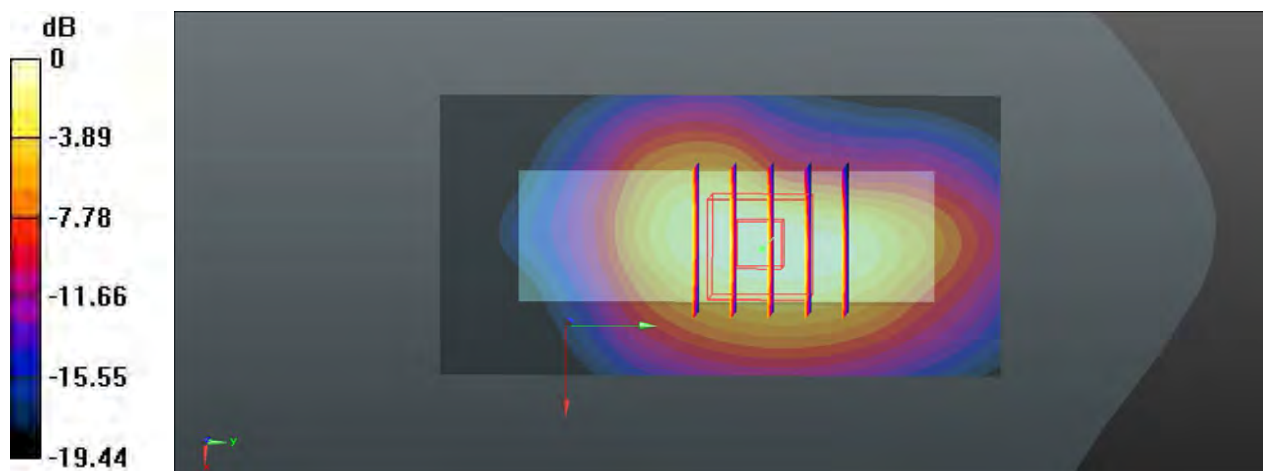
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.454 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.864 W/kg; SAR(10 g) = 0.472 W/kg

Maximum value of SAR (measured) = 1.18 W/kg



0 dB = 1.18 W/kg

03 WCDMA Band II_RMC 12.2K_Vertical Front_0.5Cm_Ch9400

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

Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9400/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.786 W/kg

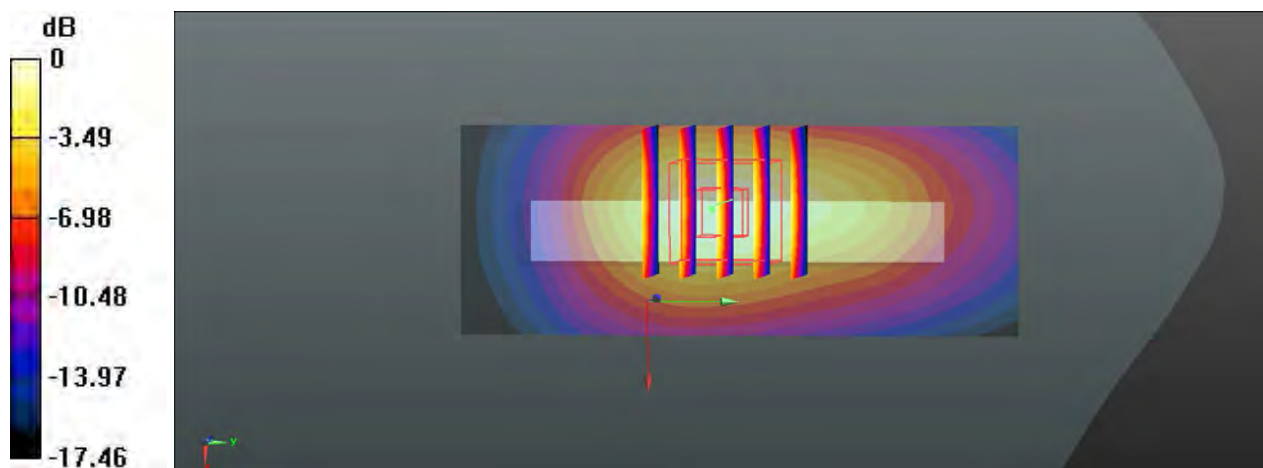
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.090 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.978 W/kg

SAR(1 g) = 0.566 W/kg; SAR(10 g) = 0.308 W/kg

Maximum value of SAR (measured) = 0.773 W/kg



0 dB = 0.773 W/kg

04 WCDMA Band II_RMC 12.2K_Vertical Back_0.5Cm_Ch9400

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

Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9400/Area Scan (31x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.402 W/kg

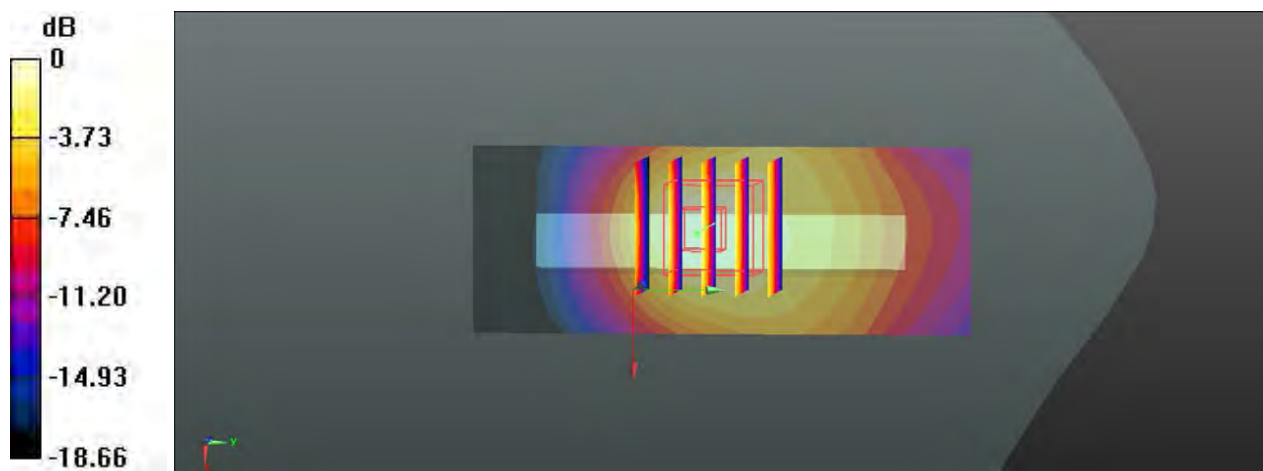
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.073 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.504 W/kg

SAR(1 g) = 0.289 W/kg; SAR(10 g) = 0.161 W/kg

Maximum value of SAR (measured) = 0.405 W/kg



0 dB = 0.405 W/kg

05 WCDMA Band II_RMC 12.2K_Tip side_0.5Cm_Ch9400

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

Medium: MSL_1900_140317 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.479$ S/m; $\epsilon_r = 53.835$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9400/Area Scan (31x41x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.0385 W/kg

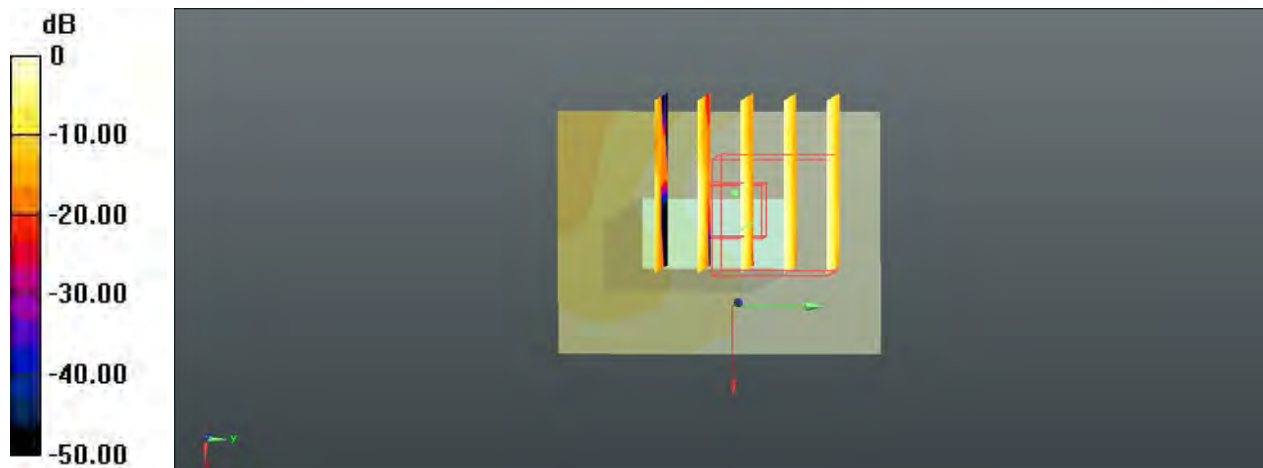
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.422 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.0500 W/kg

SAR(1 g) = 0.026 W/kg; SAR(10 g) = 0.014 W/kg

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



0 dB = 0.0327 W/kg

06 WCDMA Band II_RMC 12.2K_Horizontal Up_0.5Cm_Ch9262

Communication System: WCDMA; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium: MSL_1900_140317 Medium parameters used: $f = 1852.4$ MHz; $\sigma = 1.444$ S/m; $\epsilon_r = 53.844$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9262/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.06 W/kg

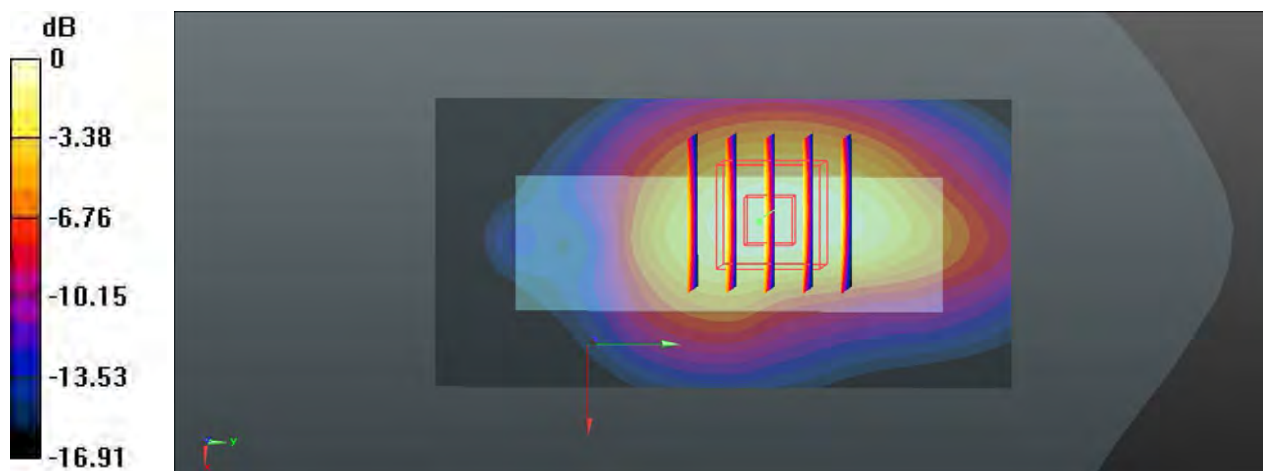
Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.264 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 1.27 W/kg

SAR(1 g) = 0.762 W/kg; SAR(10 g) = 0.433 W/kg

Maximum value of SAR (measured) = 1.02 W/kg



0 dB = 1.02 W/kg

07 WCDMA Band II_RMC 12.2K_Horizontal Up_0.5Cm_Ch9538

Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium: MSL_1900_140317 Medium parameters used: $f = 1907.6$ MHz; $\sigma = 1.509$ S/m; $\epsilon_r = 53.826$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9538/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.964 W/kg

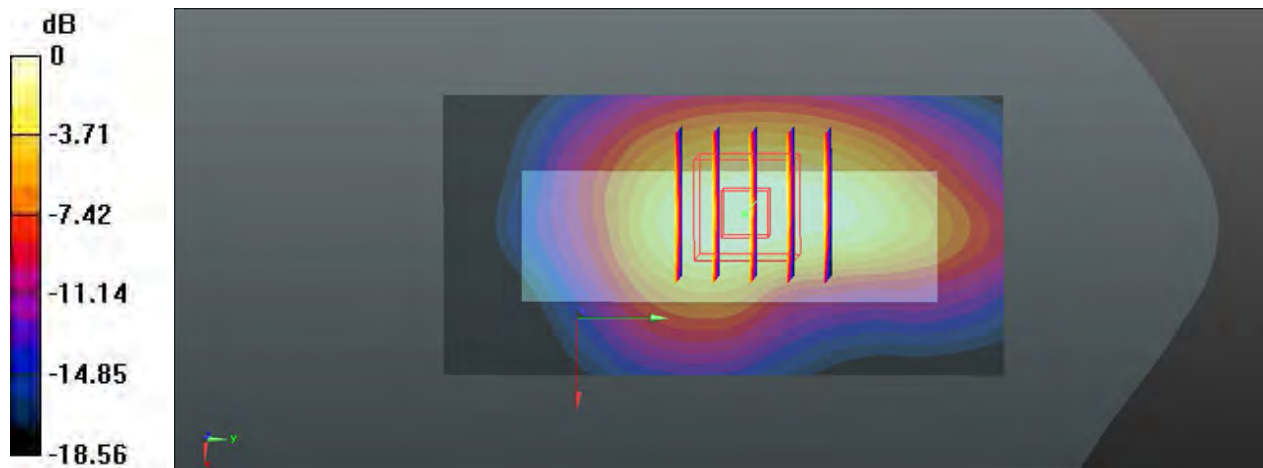
Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.541 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.686 W/kg; SAR(10 g) = 0.386 W/kg

Maximum value of SAR (measured) = 0.915 W/kg



0 dB = 0.915 W/kg

17 WCDMA Band II_RMC 12.2K_Horizontal Down_0.5Cm_Ch9262

Communication System: WCDMA; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium: MSL_1900_140317 Medium parameters used: $f = 1852.4$ MHz; $\sigma = 1.444$ S/m; $\epsilon_r = 53.844$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9262/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.30 W/kg

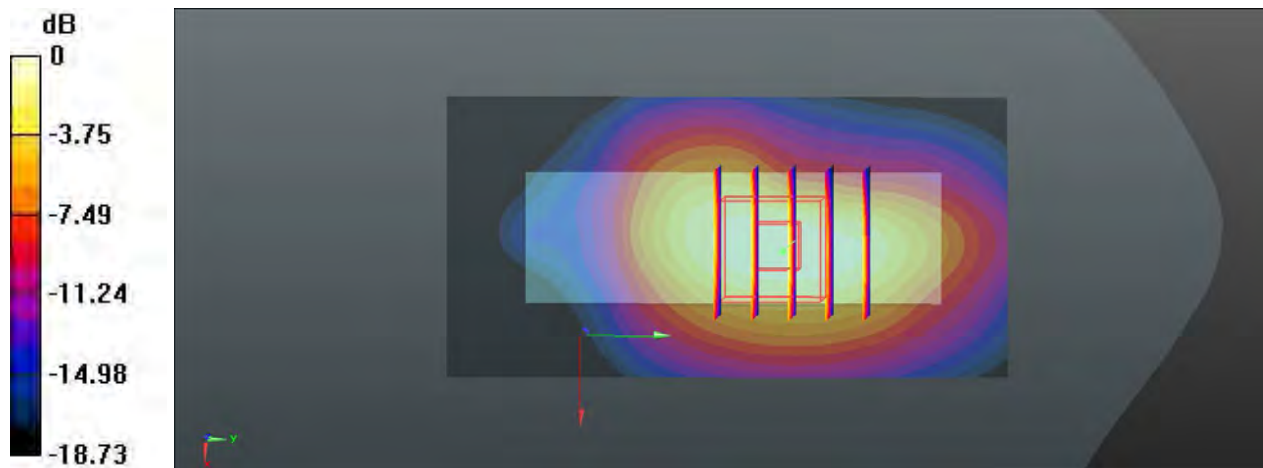
Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.536 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.59 W/kg

SAR(1 g) = 0.929 W/kg; SAR(10 g) = 0.510 W/kg

Maximum value of SAR (measured) = 1.27 W/kg



0 dB = 1.27 W/kg

29 WCDMA Band II_RMC 12.2K_Horizontal Down_0.5Cm_Ch9262

Communication System: WCDMA; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium: MSL_1900_140317 Medium parameters used: $f = 1852.4$ MHz; $\sigma = 1.444$ S/m; $\epsilon_r = 53.844$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9262/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.24 W/kg

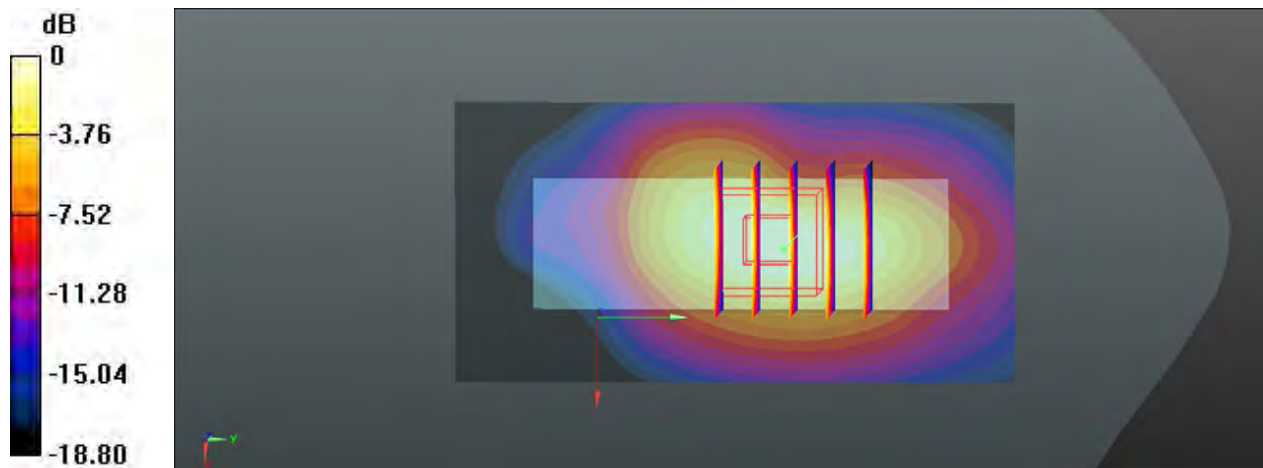
Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.549 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 1.54 W/kg

SAR(1 g) = 0.902 W/kg; SAR(10 g) = 0.493 W/kg

Maximum value of SAR (measured) = 1.23 W/kg



0 dB = 1.23 W/kg

18 WCDMA Band II_RMC 12.2K_Horizontal Down_0.5Cm_Ch9538

Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium: MSL_1900_140317 Medium parameters used: $f = 1907.6$ MHz; $\sigma = 1.509$ S/m; $\epsilon_r = 53.826$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.7, 7.7, 7.7); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch9538/Area Scan (41x81x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.11 W/kg

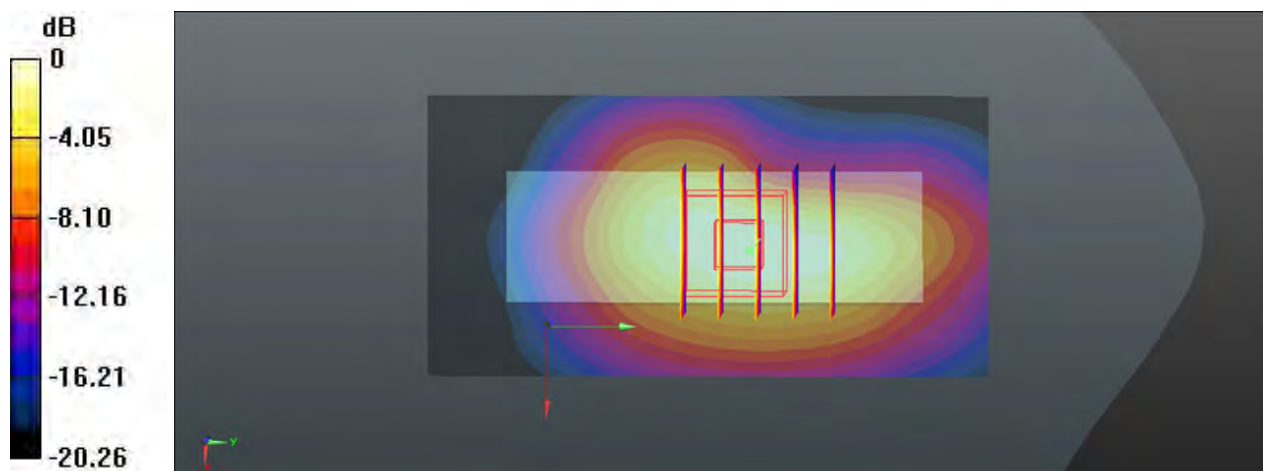
Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.058 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.40 W/kg

SAR(1 g) = 0.815 W/kg; SAR(10 g) = 0.444 W/kg

Maximum value of SAR (measured) = 1.11 W/kg



0 dB = 1.11 W/kg

19 LTE Band 7_20M_QPSK(1, 0)_Horizontal Up_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (41x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.571 W/kg

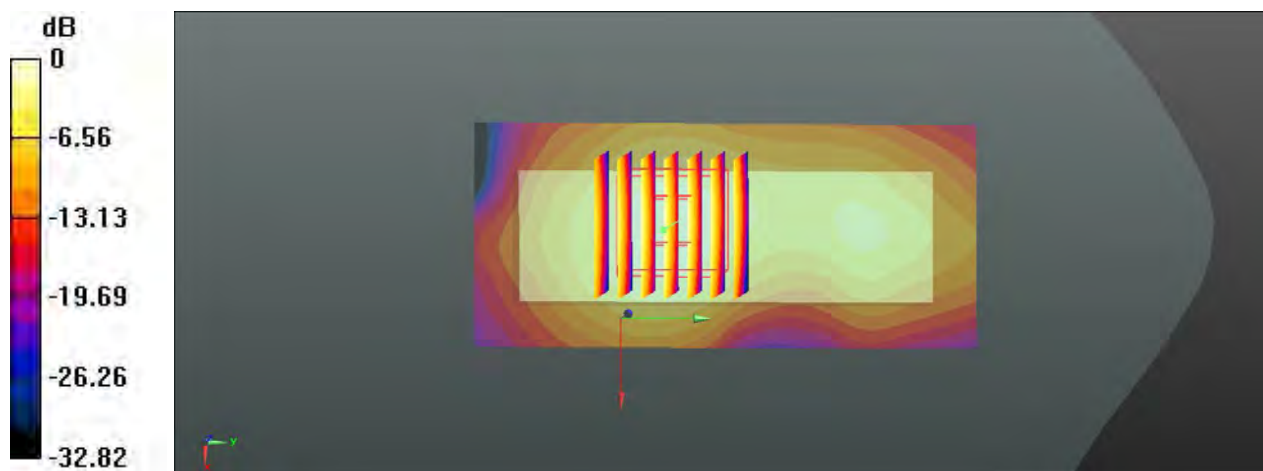
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.927 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.815 W/kg

SAR(1 g) = 0.421 W/kg; SAR(10 g) = 0.205 W/kg

Maximum value of SAR (measured) = 0.607 W/kg



0 dB = 0.607 W/kg

20 LTE Band 7_20M_QPSK(1, 0)_Horizontal Down_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (41x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.739 W/kg

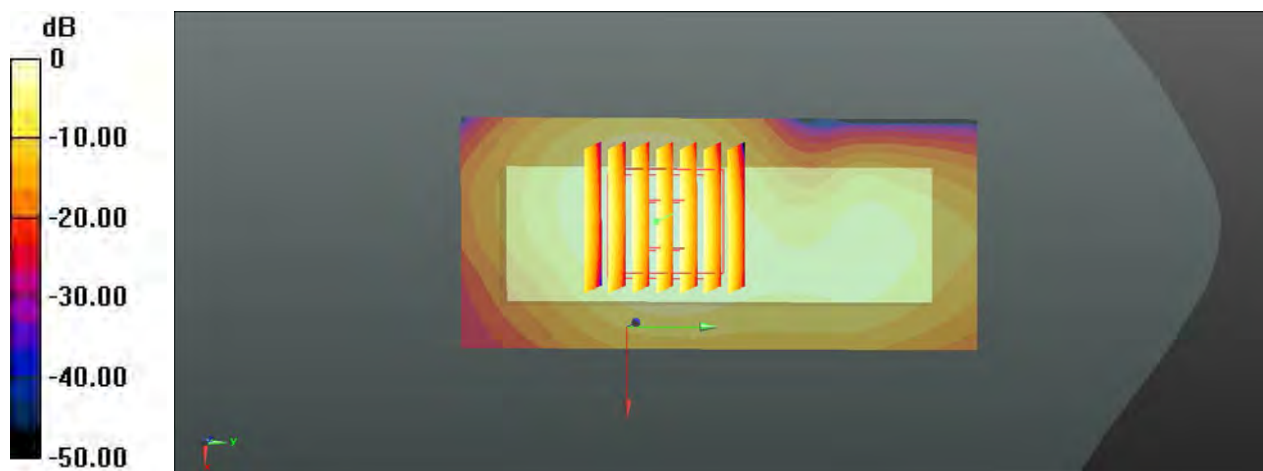
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.158 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.551 W/kg; SAR(10 g) = 0.270 W/kg

Maximum value of SAR (measured) = 0.798 W/kg



0 dB = 0.798 W/kg

21 LTE Band 7_20M_QPSK(1, 0)_Vertical Front_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (31x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.471 W/kg

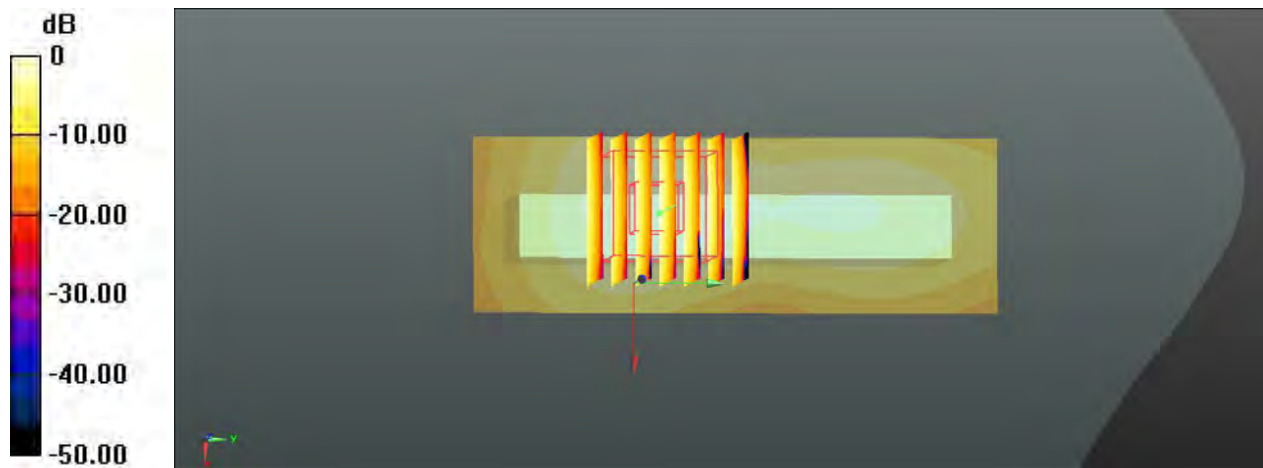
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.169 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.666 W/kg

SAR(1 g) = 0.320 W/kg; SAR(10 g) = 0.151 W/kg

Maximum value of SAR (measured) = 0.484 W/kg



0 dB = 0.484 W/kg

22 LTE Band 7_20M_QPSK(1, 0)_Vertical Back_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (31x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.266 W/kg

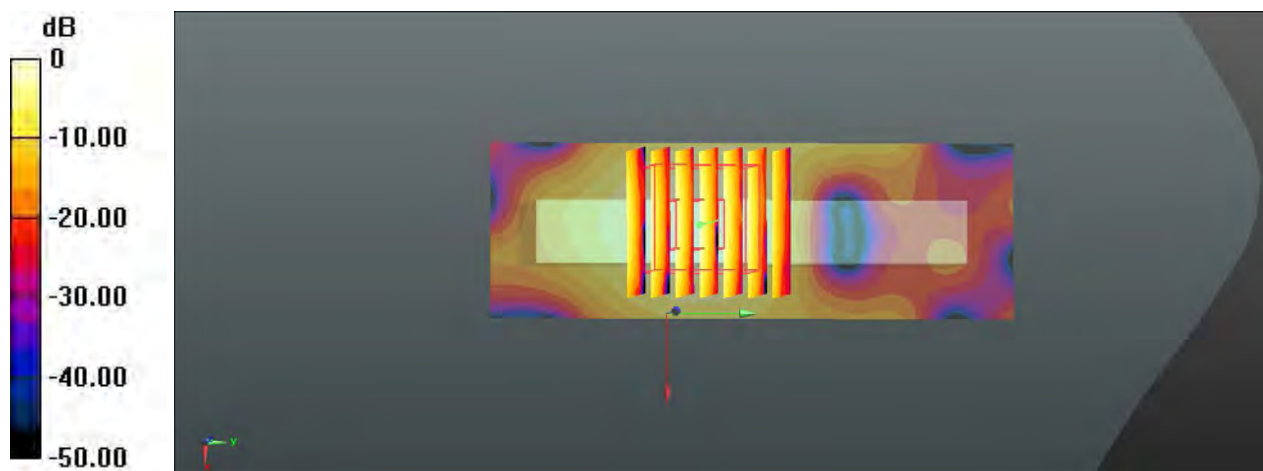
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.758 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.330 W/kg

SAR(1 g) = 0.151 W/kg; SAR(10 g) = 0.066 W/kg

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



0 dB = 0.238 W/kg

23 LTE Band7_20M_QPSK(1, 0)_Tip side_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (31x51x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.0120 W/kg

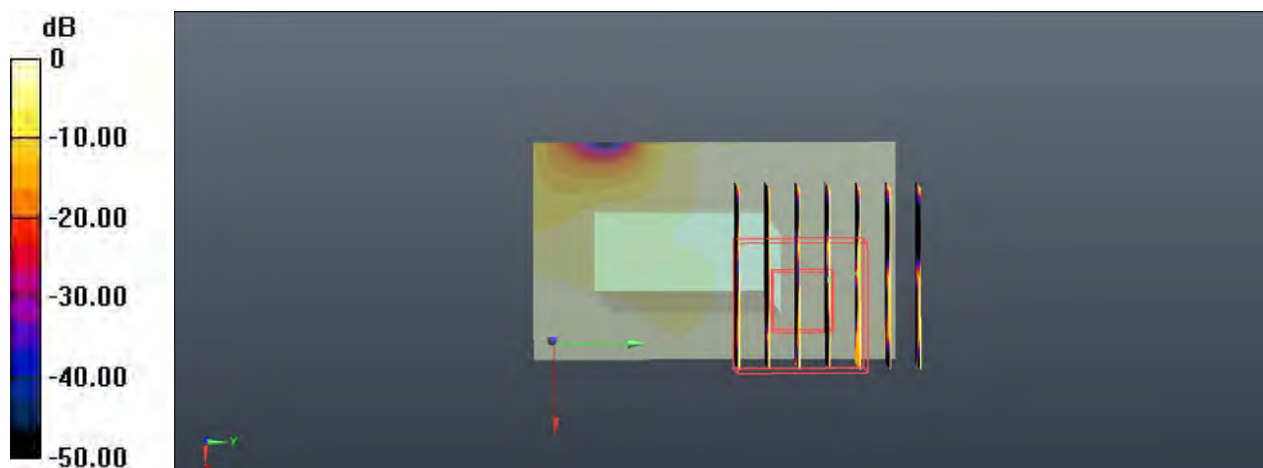
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.416 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.0300 W/kg

SAR(1 g) = 0.00477 W/kg; SAR(10 g) = 0.00143 W/kg

Maximum value of SAR (measured) = 0.0122 W/kg



0 dB = 0.0122 W/kg

24 LTE Band 7_20M_QPSK(50, 0)_Horizontal Up_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (41x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.741 W/kg

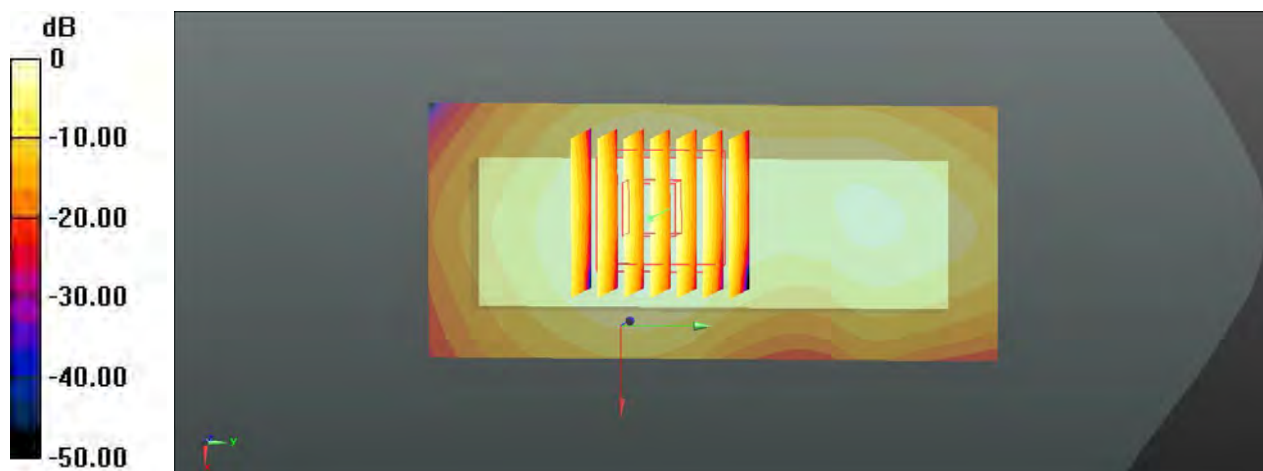
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.728 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.955 W/kg

SAR(1 g) = 0.493 W/kg; SAR(10 g) = 0.240 W/kg

Maximum value of SAR (measured) = 0.709 W/kg



25 LTE Band 7_20M_QPSK(50, 0)_Horizontal Down_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$; $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (41x91x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.703 W/kg

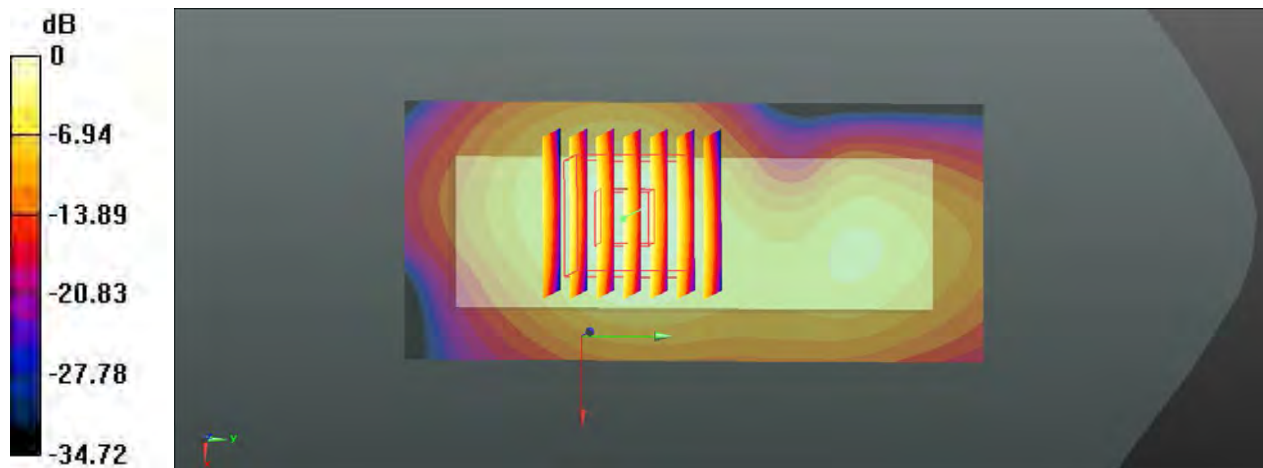
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.695 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.03 W/kg

SAR(1 g) = 0.538 W/kg; SAR(10 g) = 0.262 W/kg

Maximum value of SAR (measured) = 0.781 W/kg



0 dB = 0.781 W/kg

26 LTE Band 7_20M_QPSK(50, 0)_Vertical Front_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (31x91x1): Interpolated grid: dx=12mm, dy=12mm

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

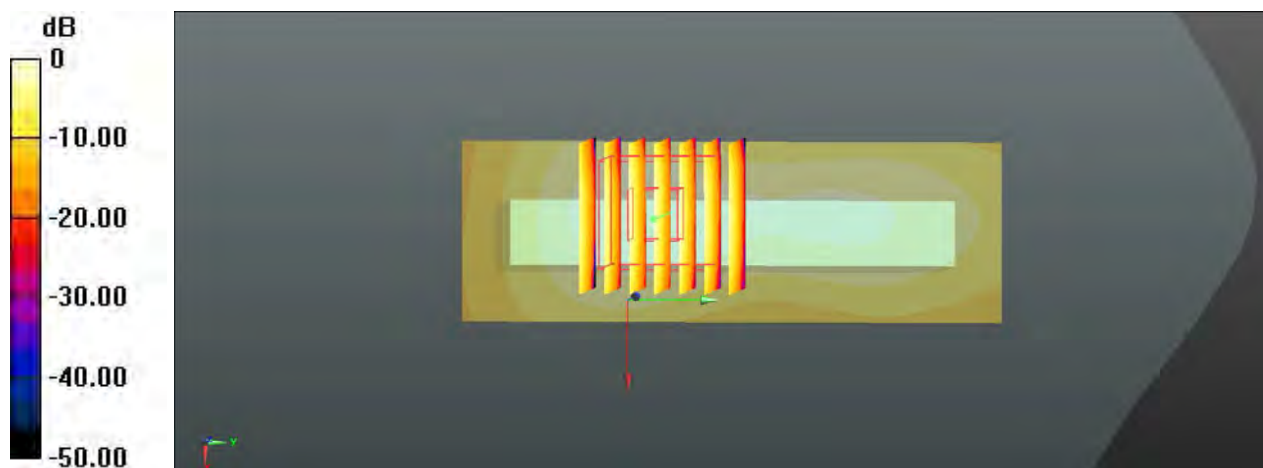
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.390 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.683 W/kg

SAR(1 g) = 0.330 W/kg; SAR(10 g) = 0.156 W/kg

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



0 dB = 0.501 W/kg

27 LTE Band 7_20M_QPSK(50, 0)_Vertical Back_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (31x91x1): Interpolated grid: dx=12mm, dy=12mm

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

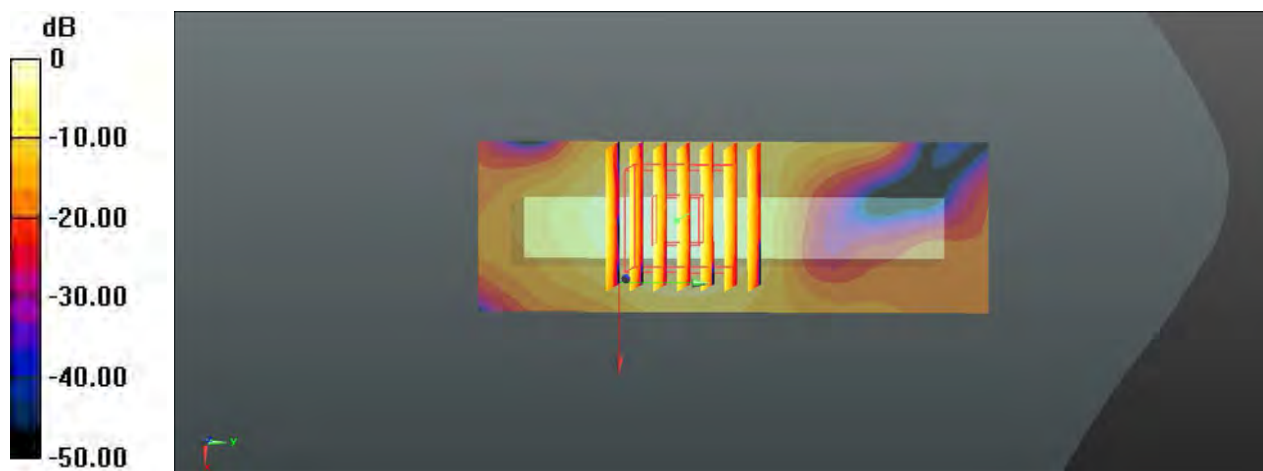
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.766 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.356 W/kg

SAR(1 g) = 0.163 W/kg; SAR(10 g) = 0.072 W/kg

Maximum value of SAR (measured) = 0.256 W/kg



0 dB = 0.256 W/kg

28 LTE Band7_20M_QPSK(50, 0)_Tip side_0.5Cm_Ch21350

Communication System: LTE; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: MSL_2600_140318 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.149$ S/m; $\epsilon_r = 52.782$;
 $\rho = 1000$ kg/m³

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.02, 7.02, 7.02); Calibrated: 2013.04.11;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2013.04.08
- Phantom: SAM 2; Type: QD 000 P40 C; Serial: TP-1754
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Ch21350/Area Scan (31x51x1): Interpolated grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.0162 W/kg

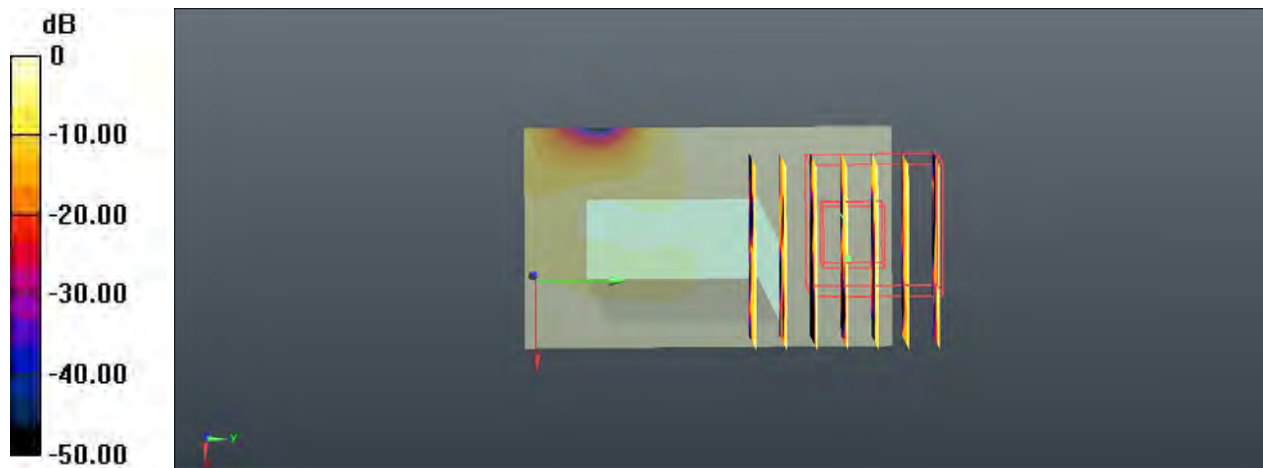
Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.664 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.0380 W/kg

SAR(1 g) = 0.011 W/kg; SAR(10 g) = 0.005 W/kg

Maximum value of SAR (measured) = 0.0174 W/kg



0 dB = 0.0174 W/kg



Appendix C. DASYS Calibration Certificate

The DASYS calibration certificates are shown as follows.



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-KS (Auden)**

Certificate No: **D835V2-4d151_Mar13**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d151**

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

Calibration date: **March 25, 2013**

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
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Jeton Kastrati** **Laboratory Technician**

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

Signature

Issued: March 26, 2013

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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

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	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.9 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.49 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.18 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.1 $\pm$ 6 %	1.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.43 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.23 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 2.2 j Ω
Return Loss	- 31.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 4.3 j Ω
Return Loss	- 25.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 27, 2012

DASY5 Validation Report for Head TSL

Date: 25.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.94$ S/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

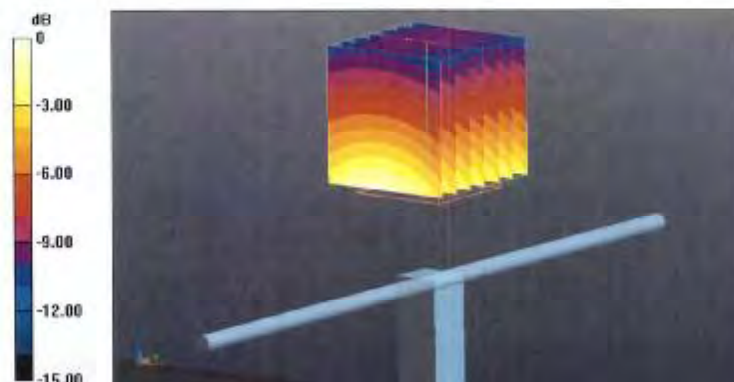
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.742 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.74 W/kg

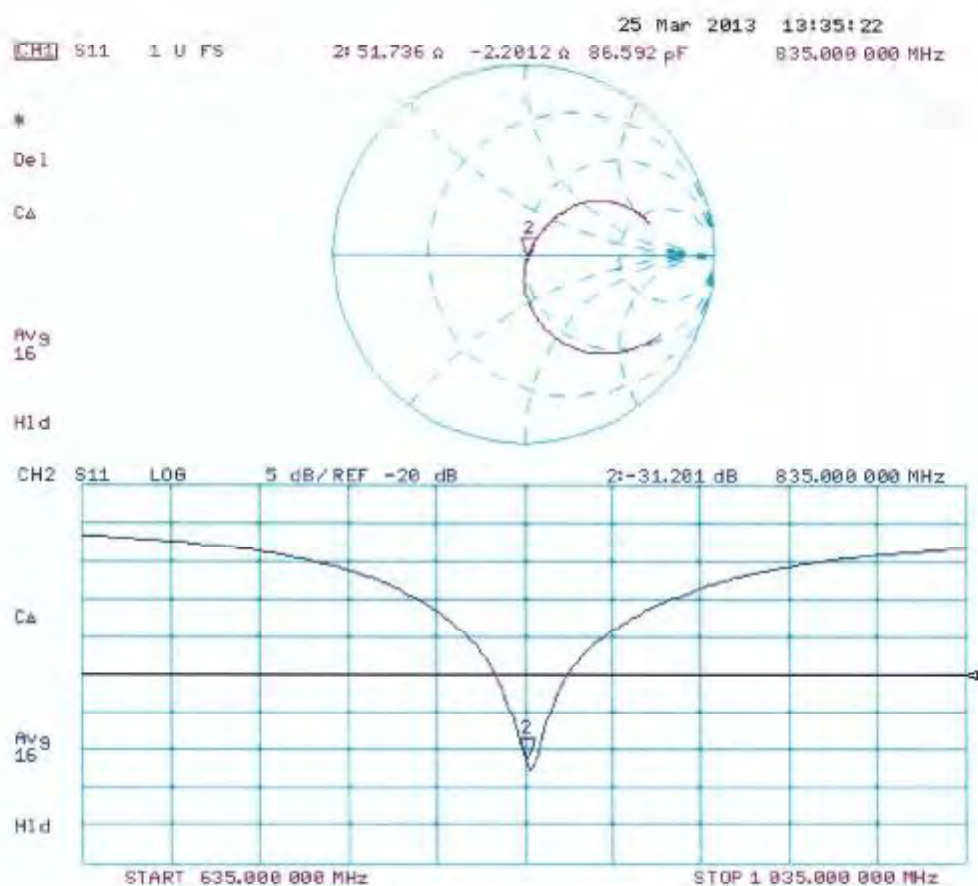
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.88 W/kg



0 dB = 2.88 W/kg = 4.59 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 1.02$ S/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9I.; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

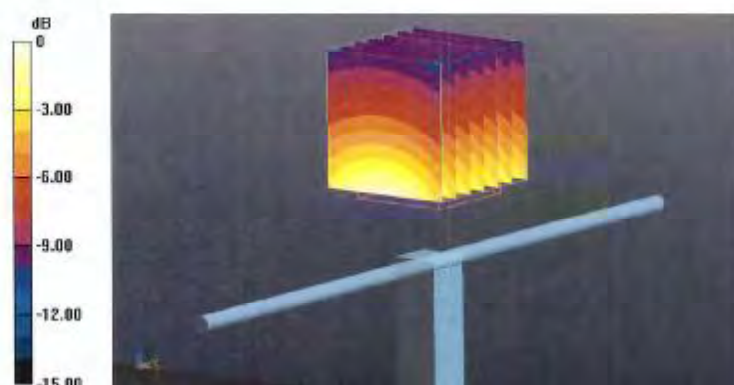
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.816 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.63 W/kg

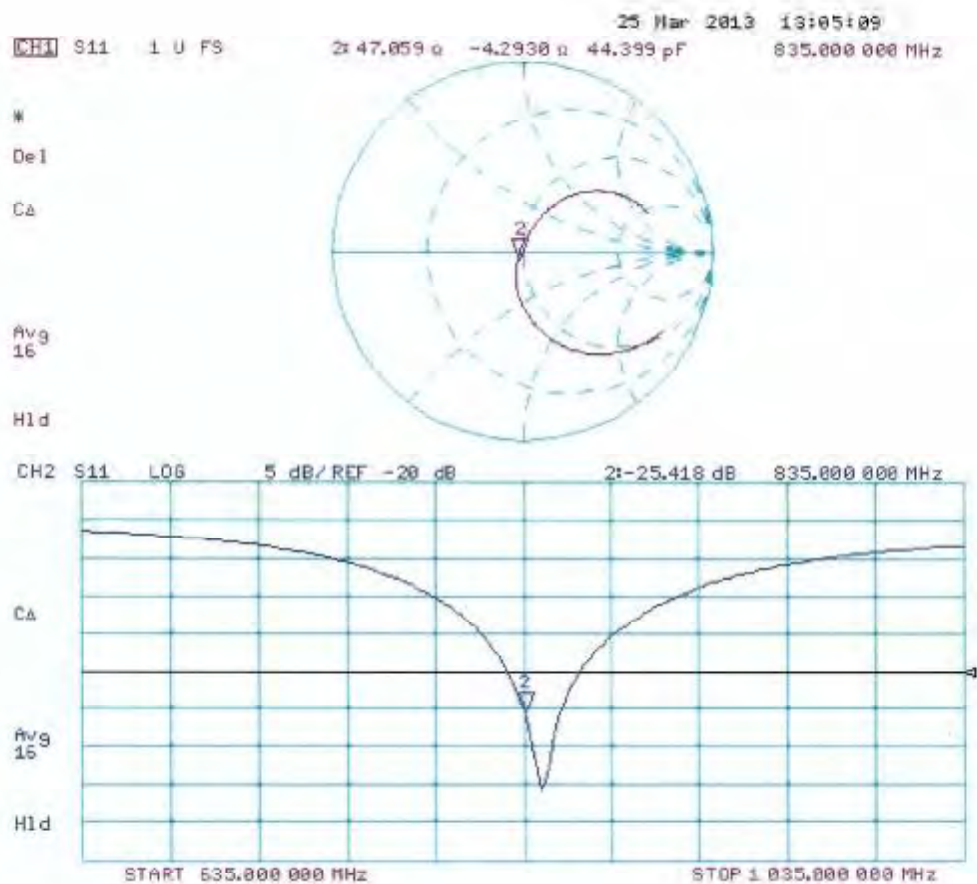
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.61 W/kg

Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 4.58 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton KS (Auden)**

Certificate No: **D1900V2-5d170_Mar13**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d170**

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

Calibration date: **March 27, 2013**

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
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / D6327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP B753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 27, 2013

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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

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	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.3 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.1 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.8 $\pm$ 6 %	1.53 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	41.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.8 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53,8 \Omega + 4,7 j\Omega$
Return Loss	- 24,7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49,6 \Omega + 5,0 j\Omega$
Return Loss	- 26,0 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	June 08, 2012

DASY5 Validation Report for Head TSL

Date: 27.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ S/m; $\epsilon_r = 39.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAB4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

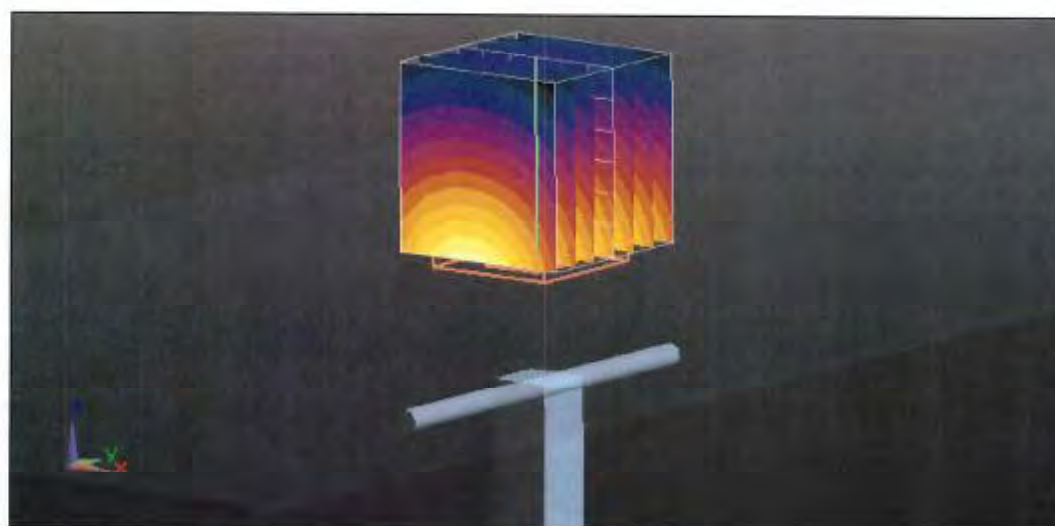
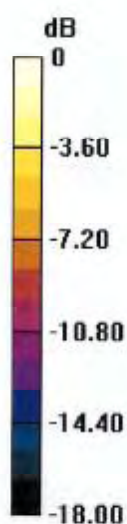
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.871 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 18.2 W/kg

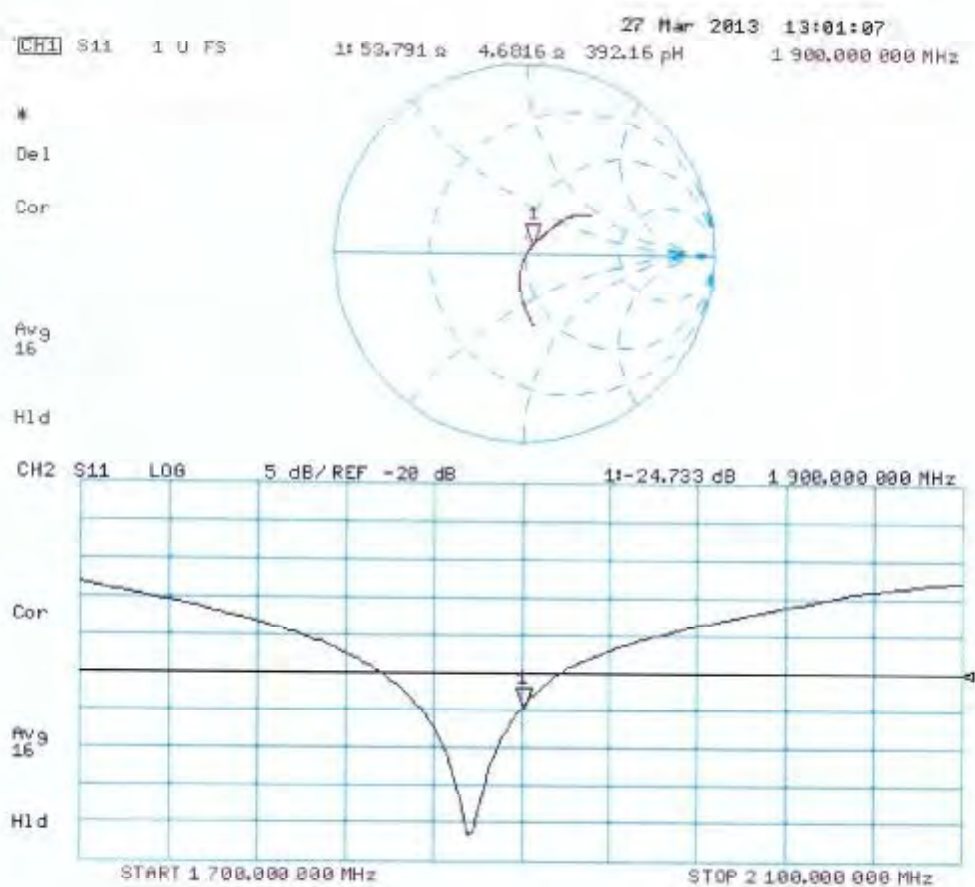
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.25 W/kg

Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 27.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.53$ S/m; $\epsilon_r = 51.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface; 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

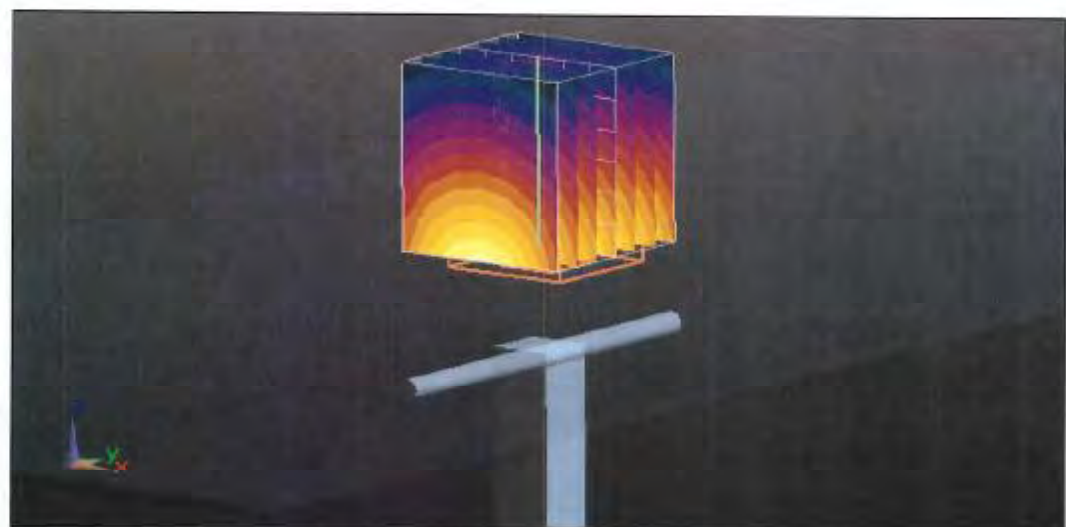
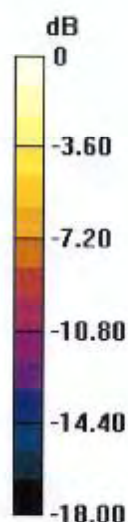
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.871 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.0 W/kg

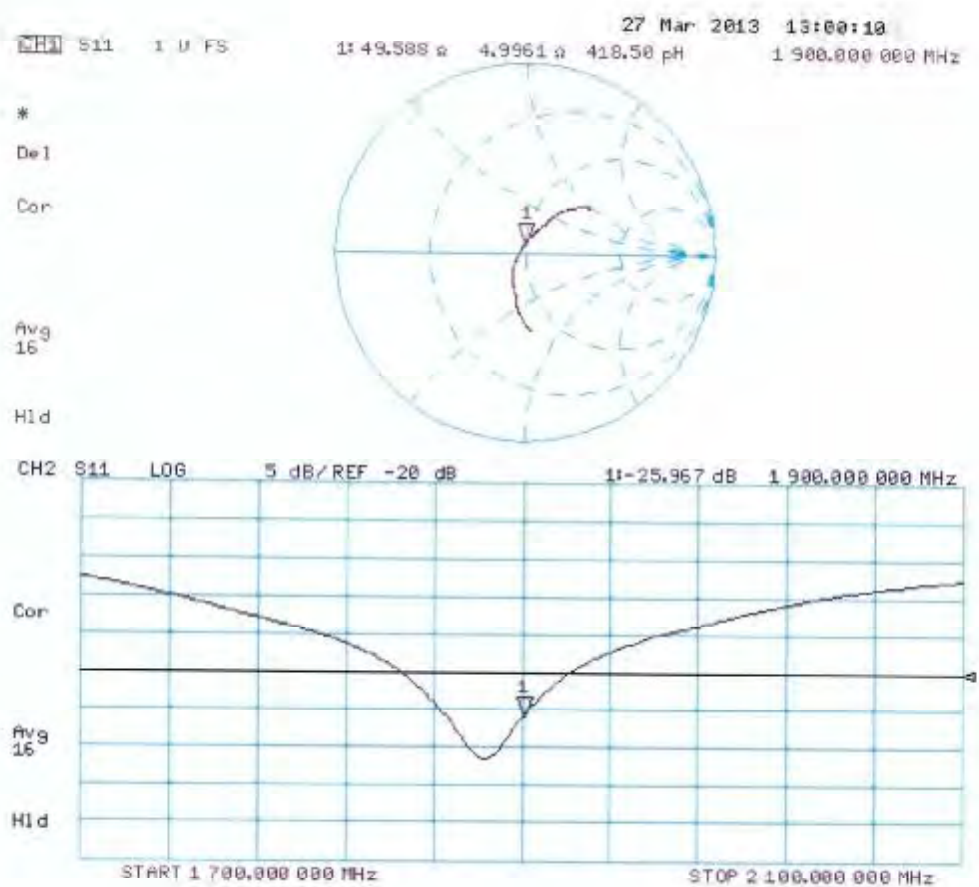
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.49 W/kg

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



0 dB = 13.2 W/kg = 11.21 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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 Multilateral Agreement for the recognition of calibration certificates

Client **Sporton-KS (Auden)**

Certificate No: **D2600V2-1061_Mar13**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1061**

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

Calibration date: **March 26, 2013**

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
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Signature

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

Issued: March 26, 2013

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

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	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.3 $\pm$ 6 %	2.02 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	-----	-----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	15.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	58.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.65 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	26.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.3 $\pm$ 6 %	2.18 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	55.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.6 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.4 Ω - 6.0 j Ω
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 4.4 j Ω
Return Loss	- 25.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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 14, 2012

DASY5 Validation Report for Head TSL

Date: 26.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1061

Communication System: CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 37.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

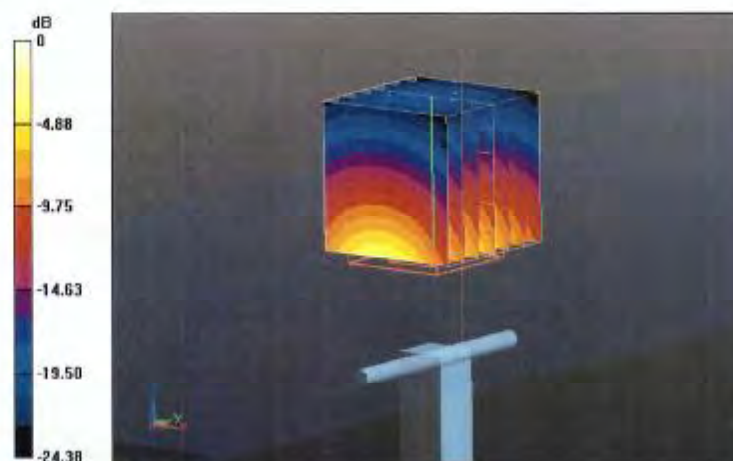
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.3 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 32.5 W/kg

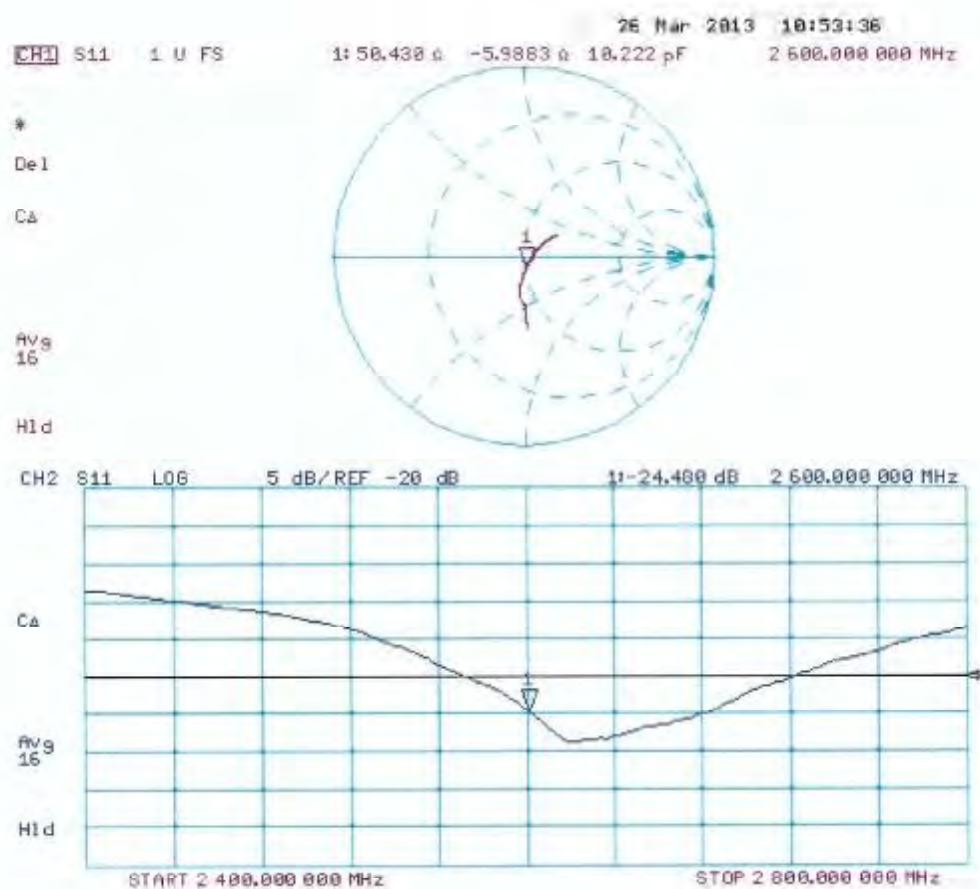
SAR(1 g) = 15 W/kg; SAR(10 g) = 6.65 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 26.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1061

Communication System: CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.18$ S/m; $\epsilon_r = 50.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

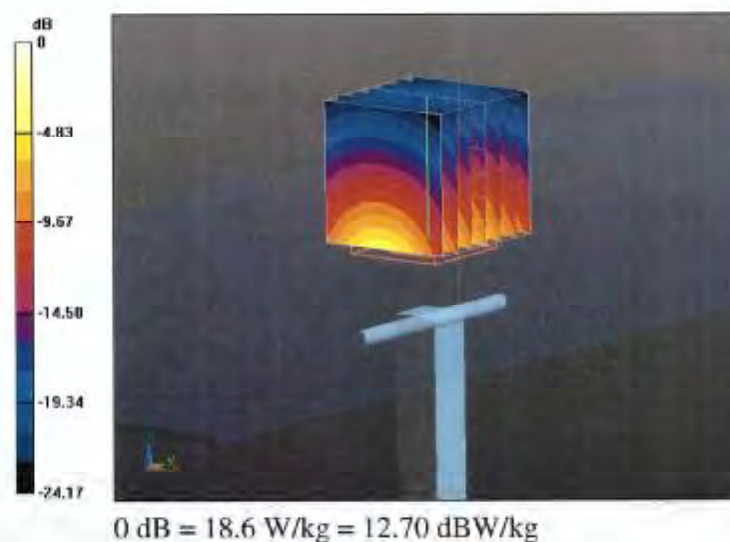
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.258 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.22 W/kg

Maximum value of SAR (measured) = 18.6 W/kg



Impedance Measurement Plot for Body TSL

26 Mar 2013 10:54:19
 CH1 S11 1 U FS 1: 47.141 Ω -4.3945 Ω 13.929 pF 2 500.000 000 MHz

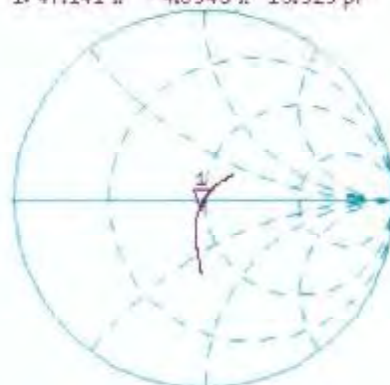
*

De1

Ca

Avg
16

H1 d



CH2 S11 LOG 5 dB/REF -20 dB 1: -25.370 dB 2 500.000 000 MHz

Ca

Avg
16

H1 d



IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.



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Accreditation No.: **SCS 108**

Client **Sporton-KS (Auden)**

Certificate No: **DAE4-1358_Apr13**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 1358**

Calibration procedure(s) **QA CAL-06.v25**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **April 08, 2013**

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	02-Oct-12 (No:12728)	Oct-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

Calibrated by: **Eric Hainfeld**

Function
Technician

Signature

Approved by: **Fin Bomholt**

Deputy Technical Manager

Issued: April 8, 2013

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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 μ 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	403.933 $\pm$ 0.02% (k=2)	403.556 $\pm$ 0.02% (k=2)	403.933 $\pm$ 0.02% (k=2)
Low Range	3.97521 $\pm$ 1.55% (k=2)	3.95654 $\pm$ 1.55% (k=2)	4.00297 $\pm$ 1.55% (k=2)

Connector Angle

Connector Angle to be used in DASY system	178.0 ° $\pm$ 1 °
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Appendix

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	199993.36	-1.09	-0.00
Channel X + Input	20000.31	1.02	0.01
Channel X - Input	-20001.09	0.76	-0.00
Channel Y + Input	199995.85	1.46	0.00
Channel Y + Input	19999.30	-0.23	-0.00
Channel Y - Input	-20002.23	-0.47	0.00
Channel Z + Input	199993.88	-0.98	-0.00
Channel Z + Input	19998.92	-0.42	-0.00
Channel Z - Input	-20004.29	-2.52	0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	1999.60	-0.28	-0.01
Channel X + Input	199.73	-0.50	-0.25
Channel X - Input	-199.30	0.38	-0.19
Channel Y + Input	1999.61	-0.37	-0.02
Channel Y + Input	200.18	-0.15	-0.07
Channel Y - Input	-200.05	-0.51	0.26
Channel Z + Input	1999.24	-0.58	-0.03
Channel Z + Input	199.11	-1.13	-0.56
Channel Z - Input	-201.30	-1.62	0.81

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 (μV)	Low Range Average Reading (μV)
Channel X	200	20.31	18.48
	- 200	-17.67	-19.82
Channel Y	200	5.83	6.14
	- 200	-7.60	-7.32
Channel Z	200	-7.25	-7.25
	- 200	4.72	4.81

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.54	-3.23
Channel Y	200	8.34	-	4.28
Channel Z	200	9.52	6.93	-

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	16098	15883
Channel Y	15750	16507
Channel Z	15897	17395

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.64	-0.51	1.77	0.48
Channel Y	-0.65	-1.74	0.62	0.47
Channel Z	1.76	-0.13	3.51	0.70

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

Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
 Swiss Calibration Service

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Accreditation No.: **SCS 108**

Client **Sporton-KS (Auden)**

Certificate No: **EX3-3911_Apr13**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3911**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4**
Calibration procedure for dosimetric E-field probes

Calibration date: **April 11, 2013**

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
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
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Issued: April 11, 2013			



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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ 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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * 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_{x,y,z}**: 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_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}; 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_{x,y,z} * 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 ± 50 MHz to ± 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.

Probe EX3DV4

SN:3911

Manufactured: September 4, 2012
Calibrated: April 11, 2013

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3911

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^{2.5}$) ^A	0.47	0.45	0.56	$\pm 10.1 \%$
DCP (mV) ^B	99.7	104.4	101.2	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	157.8	$\pm 3.0 \%$
		Y	0.0	0.0	1.0		156.2	
		Z	0.0	0.0	1.0		168.9	

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%.

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6)

^B Numerical linearization parameter, uncertainty not required.

^E 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:3911

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	10.59	10.59	10.59	0.64	0.65	± 12.0 %
835	41.5	0.90	10.05	10.05	10.05	0.25	1.01	± 12.0 %
900	41.5	0.97	10.07	10.07	10.07	0.13	1.43	± 12.0 %
1750	40.1	1.37	8.59	8.59	8.59	0.70	0.62	± 12.0 %
1900	40.0	1.40	8.25	8.25	8.25	0.80	0.58	± 12.0 %
2000	40.0	1.40	8.16	8.16	8.16	0.55	0.70	± 12.0 %
2300	39.5	1.67	7.72	7.72	7.72	0.50	0.73	± 12.0 %
2450	39.2	1.80	7.22	7.22	7.22	0.66	0.66	± 12.0 %
2600	39.0	1.96	7.02	7.02	7.02	0.30	1.09	± 12.0 %

^C Frequency validity 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.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) 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 (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3911

Calibration Parameter Determined in Body Tissue Simulating Media

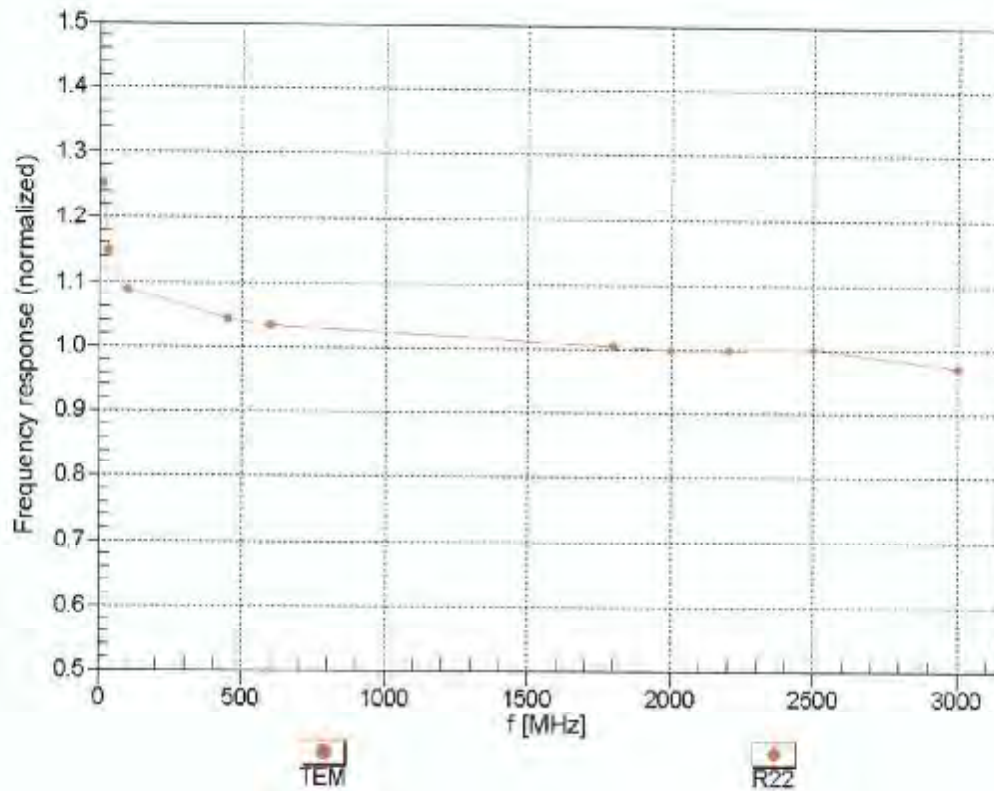
f (MHz) ^C	Relative Permittivity ^E	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	10.21	10.21	10.21	0.34	0.92	± 12.0 %
835	55.2	0.97	9.93	9.93	9.93	0.29	0.97	± 12.0 %
900	55.0	1.05	9.78	9.78	9.78	0.80	0.58	± 12.0 %
1750	53.4	1.49	8.17	8.17	8.17	0.60	0.67	± 12.0 %
1900	53.3	1.52	7.70	7.70	7.70	0.60	0.69	± 12.0 %
2000	53.3	1.52	7.84	7.84	7.84	0.30	0.99	± 12.0 %
2300	52.9	1.81	7.53	7.53	7.53	0.64	0.64	± 12.0 %
2450	52.7	1.95	7.34	7.34	7.34	0.67	0.61	± 12.0 %
2600	52.5	2.16	7.02	7.02	7.02	0.80	0.50	± 12.0 %

^C Frequency validity 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.

^E At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) 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 (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

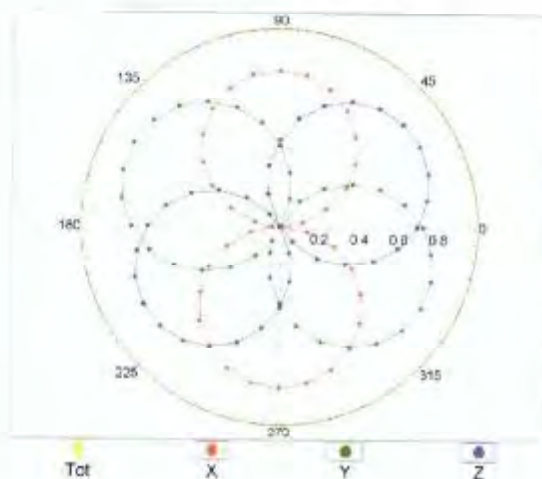
(TEM-Cell: ifi110 EXX, Waveguide: R22)



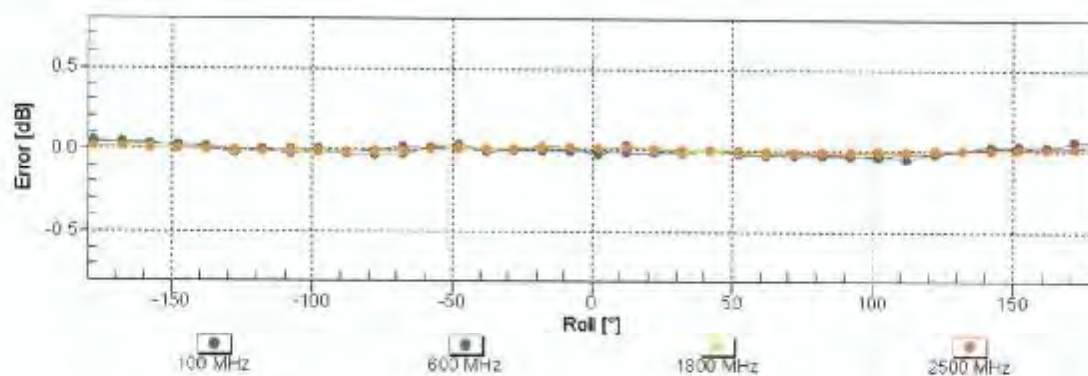
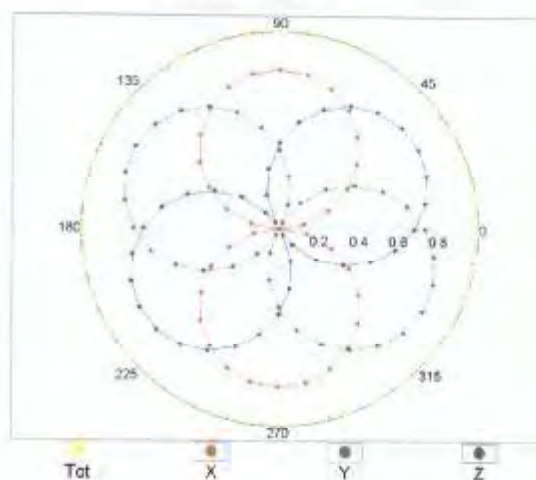
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz,TEM

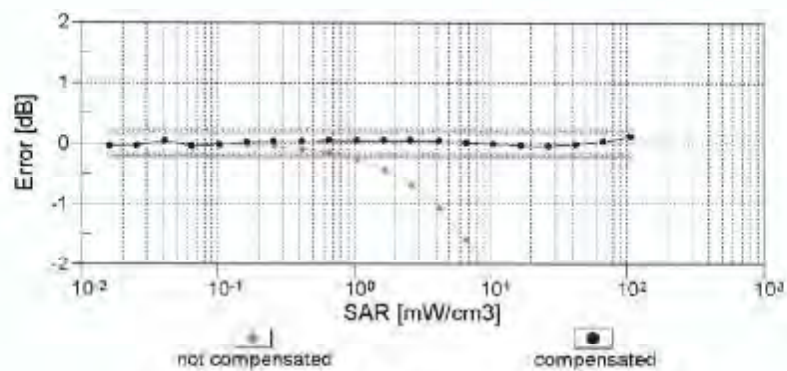
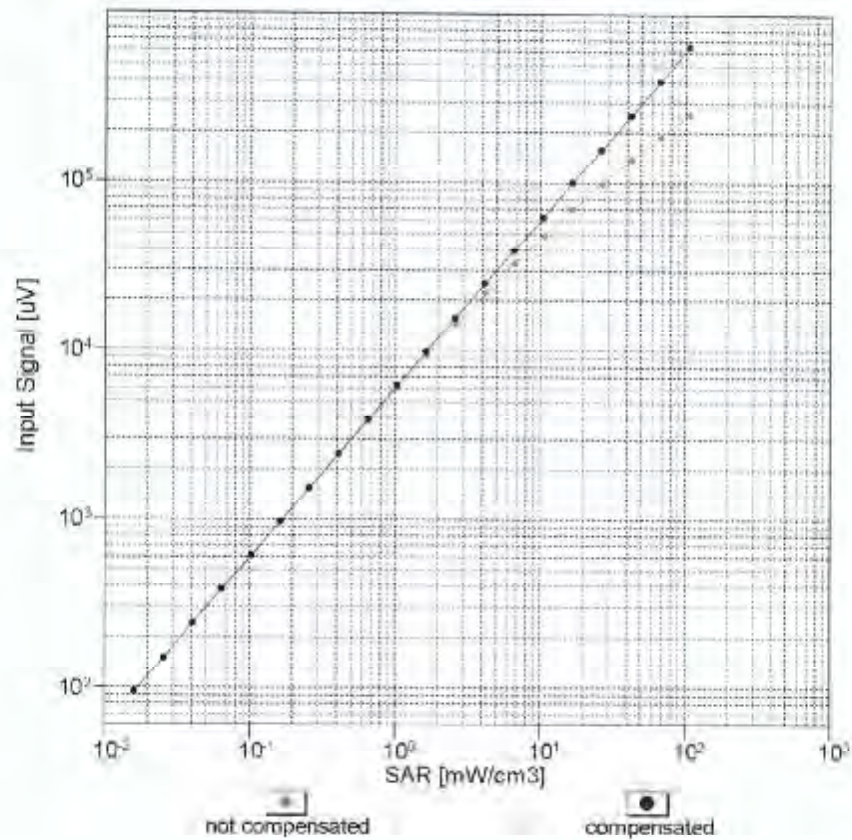


f=1800 MHz,R22



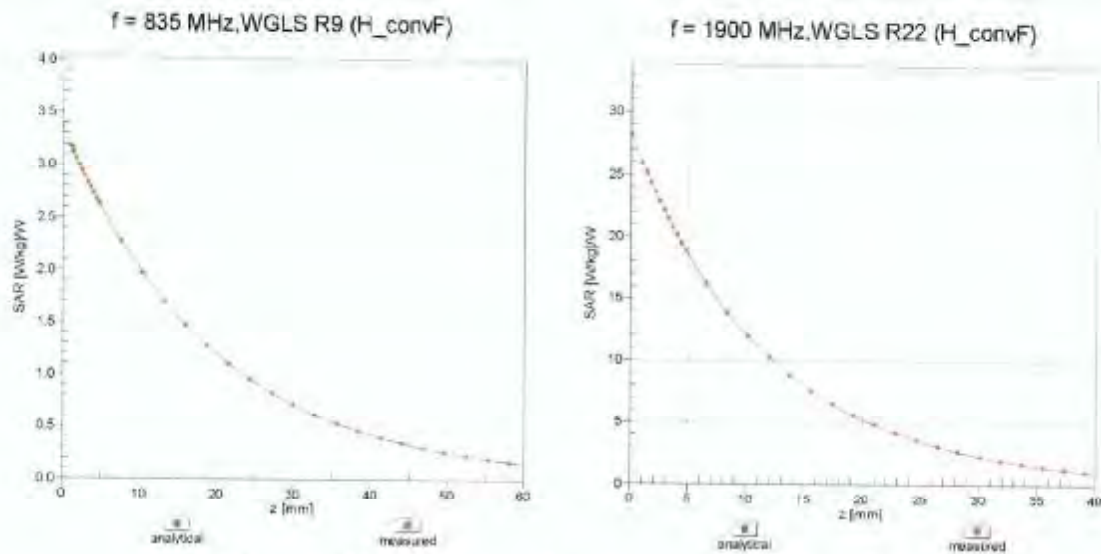
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)



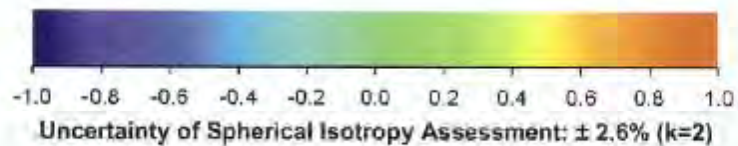
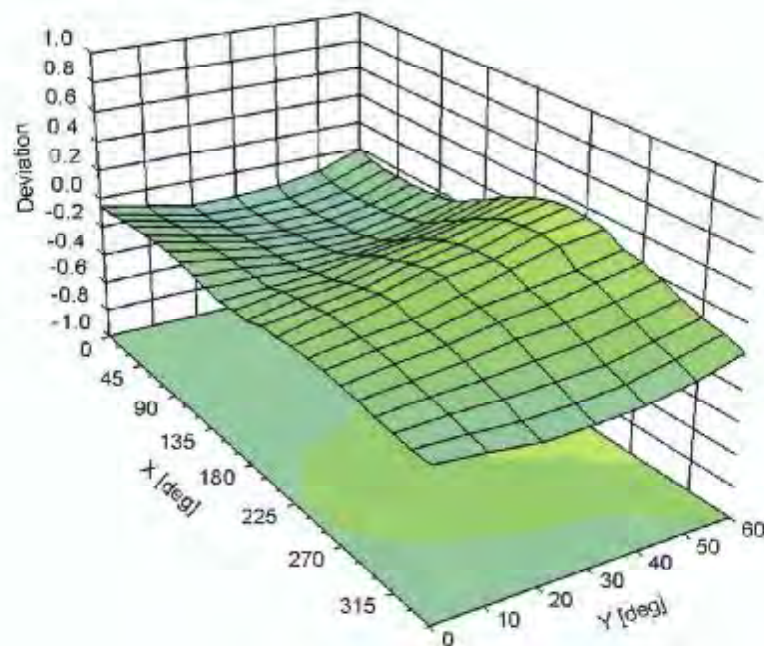
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3911

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	12
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