FCC SAR Test Report

APPLICANT	:	HTC Corporation
EQUIPMENT	:	Smartphone
MODEL NAME	:	0P9O110
FCC ID	:	NM80P9O110
STANDARD	:	FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2003

The product was testing completed on Feb. 21, 2014. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA421125	Rev. 01	Initial issue of report	Mar. 17, 2014

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **HTC Corporation Smartphone, 0P9O110** are as follows.

<Highest SAR Summary>

Exposure Position	Frequency Band	Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Head	GSM850	0.25	PCE	0.51
	GSM1900	0.27		
	WCDMA Band V	0.32		
	WCDMA Band II	0.48		
	LTE Band 17	0.51		
	LTE Band 5	0.26		
	LTE Band 4	0.44		
	LTE Band 2	0.38		
	WLAN 2.4GHz Band	0.11	DTS	
Hotspot (Separation 1cm)	GSM850	0.63	PCE	1.09
	GSM1900	0.68		
	WCDMA Band V	0.53		
	WCDMA Band II	1.01		
	LTE Band 17	0.63		
	LTE Band 5	0.56		
	LTE Band 4	1.02		
	LTE Band 2	1.09		
	WLAN 2.4GHz Band	0.52	DTS	
Body-worn (Separation 1cm)	GSM850	0.63	PCE	1.02
	GSM1900	0.54		
	WCDMA Band V	0.53		
	WCDMA Band II	0.90		
	LTE Band 17	0.63		
	LTE Band 5	0.56		
	LTE Band 4	1.02		
	LTE Band 2	0.73		
	WLAN 2.4GHz Band	0.52	DTS	

<Highest Simultaneous transmission SAR>

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Hotspot (Separation 1cm)	LTE Band 4	PCE	1.12
	Bluetooth	DSS	

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Hotspot (Separation 1cm)	LTE Band 4	PCE	1.54
	WLAN 2.4GHz Band	DTS	

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 INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

2.2 Applicant

Company Name	HTC Corporation
Address	No. 23, Xinghua Rd., Taoyuan City, Taoyuan County 330, Taiwan.

2.3 Manufacturer

Company Name	HTC Corporation
Address	No. 23, Xinghua Rd., Taoyuan City, Taoyuan County 330, Taiwan.

2.4 Application Details

Date of Start during the Test	Feb. 18, 2014
Date of End during the Test	Feb. 21, 2014

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	Smartphone
Model Name	0P9O110
FCC ID	NM80P9O110
IMEI Code	352189060000275
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 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	・GSM/GPRS/EGPRS ・RMC 12.2Kbps Rel 99 ・HSDPA Rel 7, Cat14 ・HSUPA Rel 6, Cat6 ・LTE: QPSK, 16QAM ・802.11b/g/n HT20 ・Bluetooth v3.0+HS，Bluetooth v4.0-LE
Antenna Type	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna
Transfer Mode Category	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype

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. This device supported VoIP in GSM, WCDMA, LTE (e.g. 3rd party VoIP).
3. This product has two kinds of earphone and battery accessories that only manufacturer is difference, therefore RF exposure evaluation was selected battery1 and earphone 1 performed SAR testing, more detail information please referred to External Photo, report No: EP421125.

3.2 Maximum RF output power among production units

Mode	Average Power (dBm)	
	GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)	34.0	31.0
GPRS/EDGE (GMSK, 1 Tx slot)	34.0	31.0
GPRS/EDGE (GMSK, 2 Tx slots)	32.0	29.0
EDGE (8PSK, 1 Tx slot)	28.0	27.0
EDGE (8PSK, 2 Tx slots)	27.0	26.0

Mode	Average Power (dBm)	
	WCDMA Band V	WCDMA Band II
AMR 12.2K	24.0	24.0
RMC 12.2K	24.0	24.0
HSDPA Subtest-1	24.0	24.0
HSUPA Subtest-5	24.0	24.0

Mode	Average Power (dBm)
2.4GHz 802.11b	18.5
2.4GHz 802.11g	14.0
2.4GHz 802.11n-HT20	14.0
Bluetooth v3.0+HS	7.0
Bluetooth v4.0-LE	7.0

LTE Band 17				
Modulation	BW (MHz)	RB size	MPR	Average Power (dBm)
QPSK	10	≤ 12	0	24
QPSK	10	> 12	1	23
16QAM	10	≤ 12	1	23
16QAM	10	> 12	2	22
QPSK	5	≤ 8	0	24
QPSK	5	> 8	1	23
16QAM	5	≤ 8	1	23
16QAM	5	> 8	2	22

LTE Band 5				
Modulation	BW (MHz)	RB size	MPR	Average Power (dBm)
QPSK	10	≤ 12	0	24
QPSK	10	> 12	1	23
16QAM	10	≤ 12	1	23
16QAM	10	> 12	2	22
QPSK	5	≤ 8	0	24
QPSK	5	> 8	1	23
16QAM	5	≤ 8	1	23
16QAM	5	> 8	2	22
QPSK	3	≤ 4	0	24
QPSK	3	> 4	1	23
16QAM	3	≤ 4	1	23
16QAM	3	> 4	2	22
QPSK	1.4	≤ 5	0	24
QPSK	1.4	> 5	1	23
16QAM	1.4	≤ 5	1	23
16QAM	1.4	> 5	2	22

LTE Band 4				
Modulation	BW (MHz)	RB size	MPR	Average Power (dBm)
QPSK	20	≤ 18	0	24
QPSK	20	> 18	1	23
16QAM	20	≤ 18	1	23
16QAM	20	> 18	2	22
QPSK	15	≤ 16	0	24
QPSK	15	> 16	1	23
16QAM	15	≤ 16	1	23
16QAM	15	> 16	2	22
QPSK	10	≤ 12	0	24
QPSK	10	> 12	1	23
16QAM	10	≤ 12	1	23
16QAM	10	> 12	2	22
QPSK	5	≤ 8	0	24
QPSK	5	> 8	1	23
16QAM	5	≤ 8	1	23
16QAM	5	> 8	2	22
QPSK	3	≤ 4	0	24
QPSK	3	> 4	1	23
16QAM	3	≤ 4	1	23
16QAM	3	> 4	2	22
QPSK	1.4	≤ 5	0	24
QPSK	1.4	> 5	1	23
16QAM	1.4	≤ 5	1	23
16QAM	1.4	> 5	2	22

LTE Band 2				
Modulation	BW (MHz)	RB size	MPR	Average Power (dBm)
QPSK	20	≤ 18	0	24
QPSK	20	> 18	1	23
16QAM	20	≤ 18	1	23
16QAM	20	> 18	2	22
QPSK	15	≤ 16	0	24
QPSK	15	> 16	1	23
16QAM	15	≤ 16	1	23
16QAM	15	> 16	2	22
QPSK	10	≤ 12	0	24
QPSK	10	> 12	1	23
16QAM	10	≤ 12	1	23
16QAM	10	> 12	2	22
QPSK	5	≤ 8	0	24
QPSK	5	> 8	1	23
16QAM	5	≤ 8	1	23
16QAM	5	> 8	2	22
QPSK	3	≤ 4	0	24
QPSK	3	> 4	1	23
16QAM	3	≤ 4	1	23
16QAM	3	> 4	2	22
QPSK	1.4	≤ 5	0	24
QPSK	1.4	> 5	1	23
16QAM	1.4	≤ 5	1	23
16QAM	1.4	> 5	2	22

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

FCC ID	NM80P9O110
EUT	SMARTPHONE
Operating Frequency Range of each LTE transmission band	LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz
Channel Bandwidth	LTE Band 17: 5MHz, 10MHz LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 2: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz

Transmission (H, M, L) channel numbers and frequencies in each LTE band

Band 17

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Frequency (MHz)	Channel #	Frequency (MHz)
L	23755	706.5	23780	709
M	23790	710	23790	710
H	23825	713.5	23800	711

LTE Band 5

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 4

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

LTE Band 2

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

uplink modulations used	QPSK, and 16QAM
LTE Voice / Data requirements	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

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
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 648474 D04 Handset SAR v01r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- 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
- FCC KDB 941225 D05A Rel.10 LTE SAR Test Guidance v01

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 ℃
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.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting
Duty factor observed as below:
802.11b, 1Mbps: 97.64%
For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

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:

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

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

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

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

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

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

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

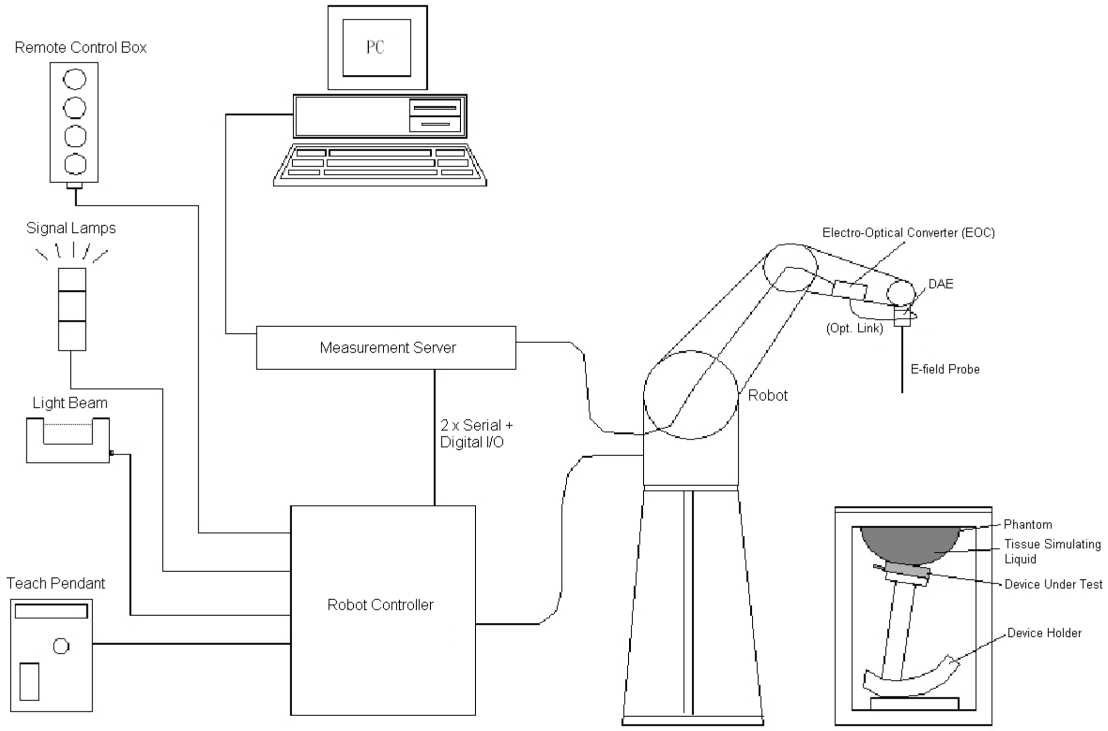


Fig 5.1 SPEAG DASY System Configurations

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
- Remove control with teach pendant and additional circuitry for robot safety such as warming 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 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/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/ES3DV4**

5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25dB. 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 (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; 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)

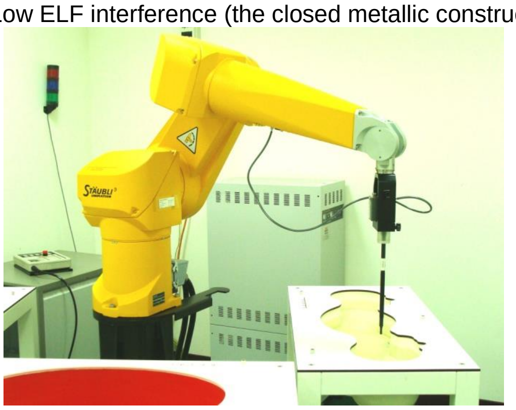


Fig 5.4 Photo of DASY4

Fig 5.5 Photo of DASY5

5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, 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 5.6 Photo of Server for DASY4

Fig 5.7 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 5.8 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.

<ELI4 Phantom>

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

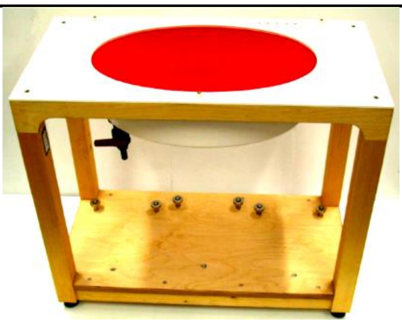


Fig 5.9 Photo of ELI4 Phantom

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

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 ε = 3 and loss tangent δ = 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 5.10 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.

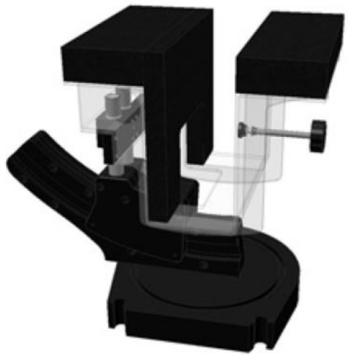


Fig 5.11 Laptop Extension Kit

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：

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

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：

E-field Probes：$\mathbf{E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}}$

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

with V$_i$ = compensated signal of channel i, (i = x, y, z)
Norm$_i$ = sensor sensitivity of channel i, (i = x, y, z), μV/(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)：

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

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

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

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	750MHz System Validation Kit	D750V3	1099	Nov. 11, 2013	Nov. 10, 2014
SPEAG	835MHz System Validation Kit	D835V2	4d162	Nov. 11, 2013	Nov. 10, 2014
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Nov. 27, 2013	Nov. 26, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Nov. 12, 2013	Nov. 11, 2014
SPEAG	2450MHz System Validation Kit	D2450V2	924	Nov. 13, 2013	Nov. 12, 2014
SPEAG	Data Acquisition Electronics	DAE3	577	May. 08, 2013	May. 07, 2014
SPEAG	Data Acquisition Electronics	DAE3	495	May. 08, 2013	May. 07, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 10, 2013	Sep. 09, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	Jun. 12, 2013	Jun. 11, 2014
Wisewind	Thermometer	HTC-1	TM642	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	HTC-1	TM281	Oct. 22, 2013	Oct. 21, 2014
Anritsu	Radio Communication Analyzer	MT8820C	6201341950	Dec. 25, 2013	Dec. 24, 2014
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 10, 2014	Jan. 09, 2014
SPEAG	Device Holder	N/A	N/A	NCR	NCR
R&S	Signal Generator	SMF 100A	101107	May. 27, 2013	May. 26, 2014
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 23, 2013	Jul. 22, 2014
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 07, 2014	Feb. 06, 2015
Anritsu	Power Meter	ML2495A	1132003	Aug. 28, 2013	Aug. 27, 2014
Anritsu	Power Sensor	MA2411B	1126017	Aug. 27, 2013	Aug. 26, 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	FSP 7	101131	Jul. 09, 2013	Jul. 08, 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 head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.2.

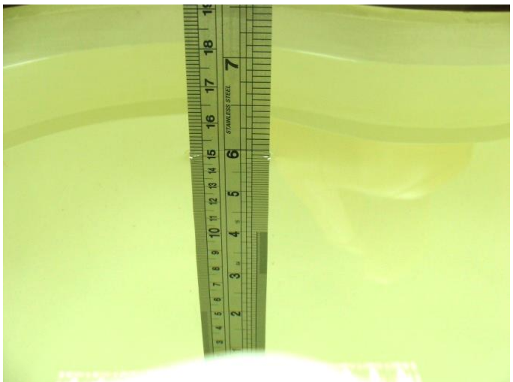


Fig 6.1 Photo of Liquid Height for Head SAR

Fig 6.2 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 Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Table 6.1 Recipes of Tissue Simulating Liquid

Simulating Liquid for 5G, Manufactured by SPEAG

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

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SPEAG DAK-3.5 Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
750	Head	22.2	0.882	40.800	0.89	41.90	-0.90	-2.63	±5	2014/2/21
750	Body	22.4	0.963	54.200	0.96	55.50	0.31	-2.34	±5	2014/2/21
835	Head	22.4	0.904	41.100	0.90	41.50	0.44	-0.96	±5	2014/2/19
835	Body	22.5	0.963	54.500	0.97	55.20	-0.72	-1.27	±5	2014/2/19
1750	Head	22.4	1.390	40.100	1.40	40.00	-0.71	0.25	±5	2014/2/20
1750	Body	22.5	1.550	51.700	1.52	53.30	1.97	-3.00	±5	2014/2/20
1900	Head	22.2	1.430	39.100	1.40	40.00	2.14	-2.25	±5	2014/2/19
1900	Head	22.4	1.450	38.200	1.40	40.00	3.57	-4.50	±5	2014/2/20
1900	Body	22.7	1.530	52.800	1.52	53.30	0.66	-0.94	±5	2014/2/18
1900	Body	22.7	1.530	52.500	1.52	53.30	0.66	-1.50	±5	2014/2/20
2450	Head	22.2	1.840	39.300	1.80	39.20	2.22	0.26	±5	2014/2/21
2450	Body	22.3	1.930	53.300	1.95	52.70	-1.03	1.14	±5	2014/2/21

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:

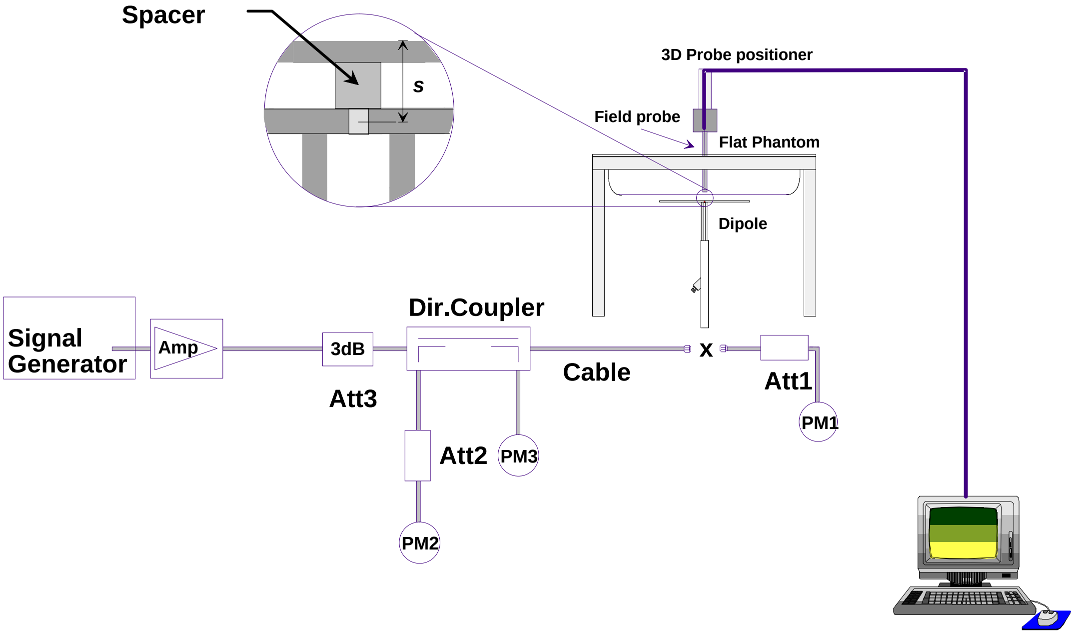


Fig 7.1 System Setup for System Evaluation

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

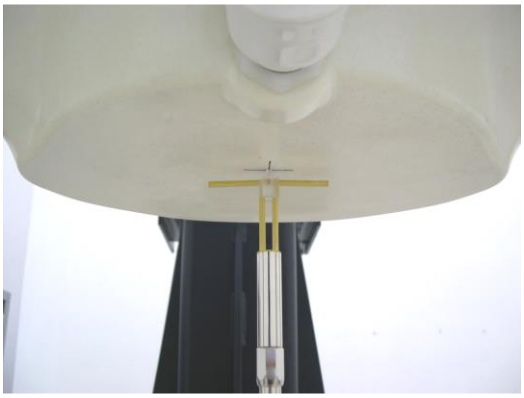


Fig 7.2 Photo of Dipole Setup

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 (%)
2014/2/21	750	Head	250	D750V3-1099	3925	495	2.09	8.42	8.36	-0.71
2014/2/21	750	Body	250	D750V3-1099	3925	495	2.29	8.56	9.16	7.01
2014/2/19	835	Head	250	D835V2-4d162	3931	577	2.45	9.53	9.8	2.83
2014/2/19	835	Body	250	D835V2-4d162	3931	577	2.42	9.28	9.68	4.31
2014/2/20	1750	Head	250	D1750V2-1068	3931	577	9.37	37.30	37.48	0.48
2014/2/20	1750	Body	250	D1750V2-1068	3931	577	9.36	37.50	37.44	-0.16
2014/2/19	1900	Head	250	D1900V2-5d182	3931	577	10.80	40.10	43.2	7.73
2014/2/20	1900	Head	250	D1900V2-5d182	3931	577	10.50	40.10	42	4.74
2014/2/18	1900	Body	250	D1900V2-5d182	3931	577	9.66	39.50	38.64	-2.18
2014/2/20	1900	Body	250	D1900V2-5d182	3931	577	10.30	39.50	41.2	4.30
2014/2/21	2450	Head	250	D2450V2-924	3925	495	12.90	52.40	51.6	-1.53
2014/2/21	2450	Body	250	D2450V2-924	3925	495	12.30	50.20	49.2	-1.99

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

8.1 Define two imaginary lines on the handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

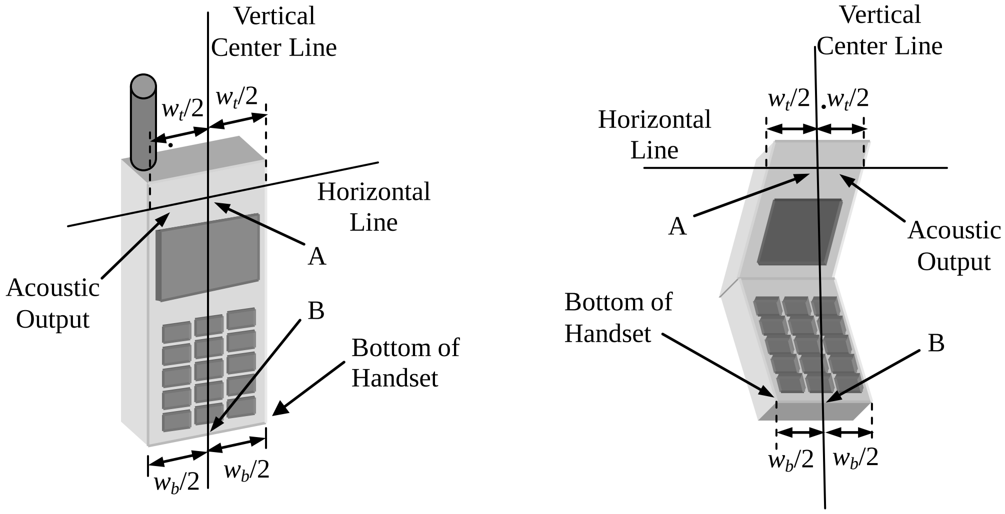


Fig 8.1 Illustration for Handset Vertical and Horizontal Reference Lines

8.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig. 8.2).

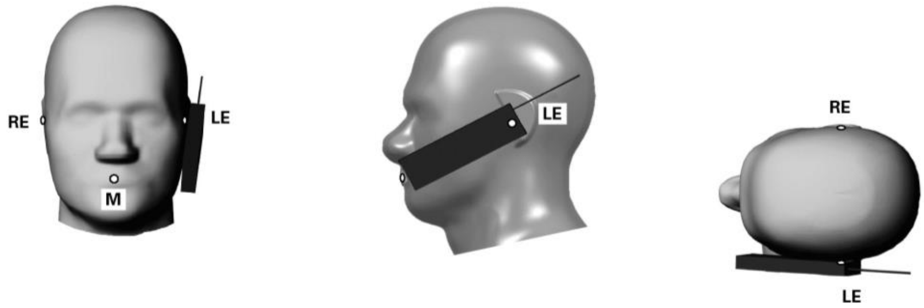


Fig 8.2 Illustration for Cheek Position

8.3 Tilted Position

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 8.3).

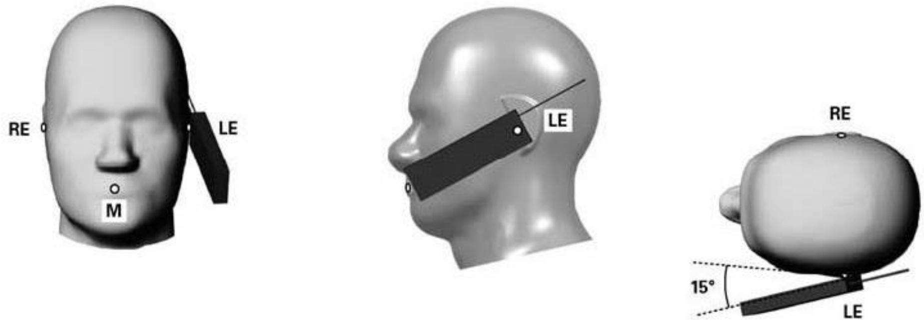


Fig 8.3 Illustration for Tilted Position

8.4 Body Worn Position

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

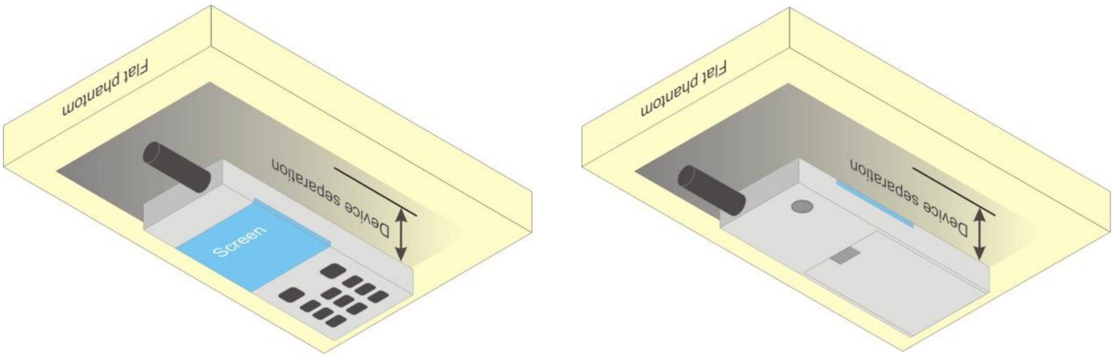


Fig 8.4 Illustration for Body Worn Position

8.5 Hotspot Position

(a) To position the device parallel to the phantom surface with all sides and either keypad up or down.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device and the flat phantom to 1.0cm.

<EUT Setup Photos>

Please refer to Appendix D for the test setup photos.

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.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

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

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

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

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.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">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 <u>reported</u> SAR from the area scan based 1-g SAR estimation 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.</td></tr>
</table>

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. Bluetooth Exclusions Applied

Mode Band	Average power(dBm)	
	Bluetooth v3.0+HS	Bluetooth v4.0+LE
2.4GHz Bluetooth	7	7

Note:

1. Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
7	5	2.48	1.57

2. Per KDB 447498 D01v05r02 exclusion thresholds is 1.57 < 3, RF exposure evaluation is not required.

11. 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. According to October 2013TCB Workshop, For GSM / EGPRS, the number of time slots to test for SAR should correspond to the highest source-based time-averaged maximum output power configuration, Considering the possibility of e.g. 3rd party VoIP operation for head and body-worn SAR testing, the EUT was set in GPRS (2Tx slots) for GSM850/GSM1900 band due to its highest frame-average power.
3. For hotspot mode SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 2 Tx slots for GSM850/GSM1900 due to its highest frame-average power.

Band GSM850	Burst Average Power (dBm)			Frame-Average Power (dBm)		
TX Channel	128	189	251	128	189	251
Frequency (MHz)	824.2	836.4	848.8	824.2	836.4	848.8
GSM (GMSK, 1 Tx slot)	33.52	33.50	33.45	24.52	24.50	24.45
GPRS (GMSK, 1 Tx slot)	33.64	33.61	33.51	24.64	24.61	24.51
GPRS (GMSK, 2 Tx slots)	30.94	30.92	30.74	24.94	24.92	24.74
EDGE (8PSK, 1 Tx slot)	27.35	27.32	27.30	18.35	18.32	18.30
EDGE (8PSK, 2 Tx slots)	26.35	26.34	26.28	20.35	20.34	20.28

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

Band GSM1900	Burst Average Power (dBm)			Frame-Average Power (dBm)		
TX Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
GSM (GMSK, 1 Tx slot)	29.91	29.95	30.06	20.91	20.95	21.06
GPRS (GMSK, 1 Tx slot)	30.08	30.15	30.23	21.08	21.15	21.23
GPRS (GMSK, 2 Tx slots)	28.14	28.22	28.30	22.14	22.22	22.30
EDGE (8PSK, 1 Tx slot)	25.78	25.84	25.93	16.78	16.84	16.93
EDGE (8PSK, 2 Tx slots)	24.81	24.86	24.95	18.81	18.86	18.95

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} (Note1, 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 Δ_{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 Δ_{NACK} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$, and Δ_{CQI} = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_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 β_c = 11/15 and β_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} (Note1)	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_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_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 β_c = 10/15 and β_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 β_c = 14/15 and β_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

<WCDMA Conducted Power>

Note:

1. Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA / HSUPA output power is < 0.25dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA / HSUPA SAR evaluation can be excluded.

Band			WCDMA V			WCDMA II		
TX Channel			4132	4182	4233	9262	9400	9538
Rx Channel			4357	4407	4458	9662	9800	9938
Frequency (MHz)			826.4	836.4	846.6	1852.4	1880	1907.6
3GPP MPR (dB)	3GPP Rel 99	AMR 12.2Kbps	23.23	23.70	23.58	23.91	23.15	23.60
	3GPP Rel 99	RMC 12.2Kbps	23.26	23.71	23.62	23.92	23.18	23.63
0	3GPP Rel 6	HSDPA Subtest-1	22.36	22.73	22.70	22.90	22.24	22.70
0	3GPP Rel 6	HSDPA Subtest-2	22.33	22.72	22.71	22.89	22.27	22.64
0.5	3GPP Rel 6	HSDPA Subtest-3	21.89	22.26	22.16	22.49	21.81	22.28
0.5	3GPP Rel 6	HSDPA Subtest-4	21.88	22.31	22.14	22.46	21.76	22.18
0	3GPP Rel 6	HSUPA Subtest-1	22.07	22.18	22.09	22.66	22.13	22.58
2	3GPP Rel 6	HSUPA Subtest-2	21.44	21.70	21.58	21.62	21.22	21.50
1	3GPP Rel 6	HSUPA Subtest-3	21.46	21.66	21.54	21.57	21.12	21.34
2	3GPP Rel 6	HSUPA Subtest-4	21.67	21.83	21.76	21.71	21.44	21.62
0	3GPP Rel 6	HSUPA Subtest-5	22.40	22.78	22.70	22.99	22.24	22.74

<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. Per KDB 941225 D05v02r03, when reported SAR of 1RB and 50%RB allocation for QPSK ≤0.8W/kg, and 100%RB with QPSK output power is less than 1RB and 50%RB, 100%RB allocation for QPSK is not required.
6. Per KDB 941225 D05v02r03, when reported SAR of 1RB and 50%RB allocation for QPSK >0.8W/kg for any exposure position, SAR testing of 100%RB allocation for QPSK is performed at the highest power channel.
7. 16QAM output power for each RB allocation configuration is > not ½ 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.
8. Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

<LTE Band 17 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)	MPR (dB)
Channel				23780	23790	23800		
Frequency (MHz)				709	710	711		
10	QPSK	1	0	23.18	23.17	23.19	24	0
10	QPSK	1	24	23.24	23.19	23.31		
10	QPSK	1	49	23.43	23.39	23.34		
10	QPSK	25	0	22.30	22.23	22.30	23	1
10	QPSK	25	12	22.26	22.28	22.41		
10	QPSK	25	24	22.41	22.43	22.43		
10	QPSK	50	0	22.32	22.30	22.29		
10	16QAM	1	0	22.16	22.10	22.13	23	1
10	16QAM	1	24	22.17	22.20	22.32		
10	16QAM	1	49	22.38	22.35	22.35		
10	16QAM	25	0	21.29	21.26	21.26	22	2
10	16QAM	25	12	21.31	21.33	21.39		
10	16QAM	25	24	21.44	21.43	21.45		
10	16QAM	50	0	21.31	21.28	21.27		
Channel				23755	23790	23825	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				706.5	710	713.5		
5	QPSK	1	0	23.21	23.15	23.28	24	0
5	QPSK	1	12	23.21	23.18	23.32		
5	QPSK	1	24	23.28	23.34	23.34		
5	QPSK	12	0	22.31	22.25	22.42	23	1
5	QPSK	12	6	22.27	22.29	22.41		
5	QPSK	12	11	22.31	22.41	22.41		
5	QPSK	25	0	22.33	22.39	22.36		
5	16QAM	1	0	22.20	22.15	22.27	23	1
5	16QAM	1	12	22.19	22.19	22.26		
5	16QAM	1	24	22.20	22.31	22.30		
5	16QAM	12	0	21.31	21.28	21.39	22	2
5	16QAM	12	6	21.33	21.32	21.41		
5	16QAM	12	11	21.32	21.41	21.40		
5	16QAM	25	0	21.35	21.40	21.39		

<LTE Band 5 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)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.92	23.17	23.02	24	0
10	QPSK	1	24	23.05	23.05	23.14		
10	QPSK	1	49	23.18	23.08	23.07		
10	QPSK	25	0	22.15	22.24	22.27	23	1
10	QPSK	25	12	22.23	22.26	22.27		
10	QPSK	25	24	22.24	22.31	22.15		
10	QPSK	50	0	22.25	22.19	22.19		
10	16QAM	1	0	21.94	22.14	21.94	23	1
10	16QAM	1	24	22.01	22.01	22.05		
10	16QAM	1	49	22.16	22.02	22.04		
10	16QAM	25	0	21.49	21.57	21.51	23	2
10	16QAM	25	12	21.60	21.57	21.53		
10	16QAM	25	24	21.58	21.50	21.47		
10	16QAM	50	0	21.53	21.53	21.48		
Channel				20425	20525	20625	v	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.94	23.13	23.02	24	0
5	QPSK	1	12	23.02	23.01	23.03		
5	QPSK	1	24	23.04	23.03	23.01		
5	QPSK	12	0	22.15	22.19	22.22	23	1
5	QPSK	12	6	22.14	22.23	22.23		
5	QPSK	12	11	22.14	22.10	22.23		
5	QPSK	25	0	22.14	22.24	22.14		
5	16QAM	1	0	21.91	22.09	22.01	23	1
5	16QAM	1	12	22.00	21.99	21.99		
5	16QAM	1	24	22.02	21.95	21.96		
5	16QAM	12	0	21.48	21.54	21.47	23	2
5	16QAM	12	6	21.49	21.54	21.45		
5	16QAM	12	11	21.50	21.46	21.43		
5	16QAM	25	0	21.45	21.56	21.45		
Channel				20415	20525	20635	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.96	23.14	23.01	24	0
3	QPSK	1	7	23.04	23.00	22.96		
3	QPSK	1	14	23.09	23.04	23.01		
3	QPSK	8	0	22.17	22.23	22.10	23	1
3	QPSK	8	4	22.13	22.09	22.17		
3	QPSK	8	7	22.12	22.12	22.23		
3	QPSK	15	0	22.16	22.21	22.13		
3	16QAM	1	0	21.94	22.13	22.03	23	1
3	16QAM	1	7	21.99	22.00	21.99		
3	16QAM	1	14	22.02	22.00	21.97		
3	16QAM	8	0	21.52	21.56	21.43	23	2
3	16QAM	8	4	21.48	21.49	21.44		
3	16QAM	8	7	21.48	21.47	21.46		
3	16QAM	15	0	21.47	21.52	21.42		

Channel				20407	20525	20643	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.99	23.06	23.08	24	0
1.4	QPSK	1	2	22.98	23.04	23.00		
1.4	QPSK	1	5	23.12	23.07	23.07		
1.4	QPSK	3	0	23.02	23.04	23.09		
1.4	QPSK	3	1	23.01	23.07	23.01		
1.4	QPSK	3	2	23.00	23.05	23.07		
1.4	QPSK	6	0	22.10	22.15	22.13	23	1
1.4	16QAM	1	0	21.98	22.05	21.98	23	1
1.4	16QAM	1	2	21.98	22.08	21.99		
1.4	16QAM	1	5	22.10	22.00	22.02		
1.4	16QAM	3	0	22.00	22.08	22.04		
1.4	16QAM	3	1	21.96	22.02	21.97		
1.4	16QAM	3	2	21.97	22.02	22.00		
1.4	16QAM	6	0	21.46	21.41	21.40	23	2

<LTE Band 4 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)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	23.14	23.30	23.20	24	0
20	QPSK	1	49	23.27	23.32	23.02		
20	QPSK	1	99	23.15	23.19	23.06		
20	QPSK	50	0	22.38	22.44	22.20	23	1
20	QPSK	50	24	22.39	22.31	22.12		
20	QPSK	50	49	22.30	22.37	22.02		
20	QPSK	100	0	22.32	22.34	22.17		
20	16QAM	1	0	22.30	22.30	22.11	23	1
20	16QAM	1	49	22.27	22.24	21.96		
20	16QAM	1	99	22.27	22.03	22.07		
20	16QAM	50	0	21.34	21.34	21.24	22	2
20	16QAM	50	24	21.35	21.31	21.08		
20	16QAM	50	49	21.38	21.31	21.08		
20	16QAM	100	0	21.39	21.35	21.20		
Channel				20025	20175	20325	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	23.10	23.27	23.15	24	0
15	QPSK	1	37	23.22	23.23	23.02		
15	QPSK	1	74	23.21	23.11	23.07		
15	QPSK	36	0	22.27	22.31	22.16	23	1
15	QPSK	36	18	22.22	22.26	22.07		
15	QPSK	36	37	22.25	22.25	22.11		
15	QPSK	75	0	22.30	22.35	22.23		
15	16QAM	1	0	22.05	22.23	22.13	23	1
15	16QAM	1	37	22.16	22.20	21.97		
15	16QAM	1	74	22.20	22.08	22.06		
15	16QAM	36	0	21.22	21.26	21.20	22	2
15	16QAM	36	18	21.26	21.29	21.04		
15	16QAM	36	37	21.26	21.23	21.11		
15	16QAM	75	0	21.27	21.30	21.21		
Channel				20000	20175	20350	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	23.08	23.24	22.99	24	0
10	QPSK	1	24	23.16	23.22	23.00		
10	QPSK	1	49	23.20	23.10	23.07		
10	QPSK	25	0	22.16	22.31	22.04	23	1
10	QPSK	25	12	22.21	22.27	21.99		
10	QPSK	25	24	22.23	22.26	22.11		
10	QPSK	50	0	22.28	22.34	22.08		
10	16QAM	1	0	21.98	22.24	22.01	23	1
10	16QAM	1	24	22.21	22.18	21.97		
10	16QAM	1	49	22.16	22.10	22.09		
10	16QAM	25	0	21.17	21.32	21.12	22	2
10	16QAM	25	12	21.32	21.36	21.08		
10	16QAM	25	24	21.26	21.33	21.17		
10	16QAM	50	0	21.27	21.31	21.07		

Channel				19975	20175	20375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	23.07	23.22	23.09	24	0
5	QPSK	1	12	23.07	23.20	23.12		
5	QPSK	1	24	23.18	23.21	23.15		
5	QPSK	12	0	22.10	22.33	22.17	23	1
5	QPSK	12	6	22.14	22.30	22.13		
5	QPSK	12	11	22.13	22.29	22.14		
5	QPSK	25	0	22.15	22.29	22.12		
5	16QAM	1	0	22.06	22.20	21.95	23	1
5	16QAM	1	12	22.06	22.19	22.06		
5	16QAM	1	24	22.10	22.15	22.03		
5	16QAM	12	0	21.18	21.34	21.22	22	2
5	16QAM	12	6	21.19	21.33	21.21		
5	16QAM	12	11	21.17	21.33	21.21		
5	16QAM	25	0	21.14	21.30	21.21		
Channel				19965	20175	20385	v	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	23.07	23.22	23.17	24	0
3	QPSK	1	7	23.08	23.22	23.10		
3	QPSK	1	14	23.09	23.22	23.11		
3	QPSK	8	0	22.17	22.28	22.17	23	1
3	QPSK	8	4	22.16	22.25	22.12		
3	QPSK	8	7	22.15	22.31	22.14		
3	QPSK	15	0	22.14	22.32	22.16		
3	16QAM	1	0	22.03	22.33	22.07	23	1
3	16QAM	1	7	22.06	22.27	22.06		
3	16QAM	1	14	22.01	22.21	22.07		
3	16QAM	8	0	21.22	21.33	21.18	22	2
3	16QAM	8	4	21.22	21.46	21.23		
3	16QAM	8	7	21.21	21.37	21.18		
3	16QAM	15	0	21.15	21.37	21.16		
Channel				19957	20175	20393	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	23.10	23.26	23.22	24	0
1.4	QPSK	1	2	23.07	23.22	23.16		
1.4	QPSK	1	5	23.12	23.26	23.15		
1.4	QPSK	3	0	23.14	23.30	23.18		
1.4	QPSK	3	1	23.09	23.28	23.15		
1.4	QPSK	3	2	23.08	23.27	23.14		
1.4	QPSK	6	0	22.20	22.32	22.22	23	1
1.4	16QAM	1	0	22.11	22.24	22.12	23	1
1.4	16QAM	1	2	22.07	22.26	22.09		
1.4	16QAM	1	5	22.06	22.31	22.09		
1.4	16QAM	3	0	22.11	22.27	22.12		
1.4	16QAM	3	1	22.07	22.23	22.08		
1.4	16QAM	3	2	22.10	22.35	22.12		
1.4	16QAM	6	0	21.07	21.22	21.08	22	2

<LTE Band 2 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)	MPR (dB)
Channel				18700	18900	19100		
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	0	23.07	22.93	22.89	24	0
20	QPSK	1	49	23.36	22.98	23.03		
20	QPSK	1	99	23.22	23.05	22.88		
20	QPSK	50	0	22.40	22.00	22.19	23	1
20	QPSK	50	24	22.39	22.02	22.10		
20	QPSK	50	49	22.26	22.06	21.96		
20	QPSK	100	0	22.36	22.06	22.10		
20	16QAM	1	0	22.02	21.91	21.89	23	1
20	16QAM	1	49	22.42	22.00	21.99		
20	16QAM	1	99	22.17	22.01	21.90		
20	16QAM	50	0	21.46	21.00	21.16	22	2
20	16QAM	50	24	21.51	21.02	21.09		
20	16QAM	50	49	21.38	21.06	21.05		
20	16QAM	100	0	21.43	21.09	21.08		
Channel				18675	18900	19125	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	0	23.05	23.08	23.17	24	0
15	QPSK	1	37	23.32	22.95	22.97		
15	QPSK	1	74	23.34	22.98	22.90		
15	QPSK	36	0	22.50	22.01	22.16	23	1
15	QPSK	36	18	22.70	22.22	22.24		
15	QPSK	36	37	22.54	22.29	22.10		
15	QPSK	75	0	22.56	22.33	22.10		
15	16QAM	1	0	22.03	22.04	22.19	23	1
15	16QAM	1	37	22.32	21.98	21.87		
15	16QAM	1	74	22.23	21.95	21.82		
15	16QAM	36	0	21.43	21.04	21.17	22	2
15	16QAM	36	18	21.57	21.19	21.15		
15	16QAM	36	37	21.64	21.24	21.21		
15	16QAM	75	0	21.53	21.10	21.09		
Channel				18650	18900	19150	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	0	23.05	23.13	23.03	24	0
10	QPSK	1	24	23.35	22.93	22.85		
10	QPSK	1	49	23.31	23.04	23.00		
10	QPSK	25	0	22.07	21.95	21.88	23	1
10	QPSK	25	12	22.36	22.21	22.04		
10	QPSK	25	24	22.69	22.19	22.24		
10	QPSK	50	0	22.29	21.97	21.86		
10	16QAM	1	0	22.02	22.03	21.96	23	1
10	16QAM	1	24	22.31	21.93	22.00		
10	16QAM	1	49	22.38	22.01	22.04		
10	16QAM	25	0	21.16	21.07	20.94	22	2
10	16QAM	25	12	21.39	21.05	20.95		
10	16QAM	25	24	21.43	21.06	21.00		
10	16QAM	50	0	21.28	21.08	20.94		

Channel				18625	18900	19175	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	0	22.85	23.04	22.85	24	0
5	QPSK	1	12	22.92	22.96	22.86		
5	QPSK	1	24	23.33	22.99	22.88		
5	QPSK	12	0	21.96	21.97	21.99	23	1
5	QPSK	12	6	21.88	21.99	21.90		
5	QPSK	12	11	21.89	22.03	21.87		
5	QPSK	25	0	21.96	22.03	21.96		
5	16QAM	1	0	21.84	21.98	21.73	23	1
5	16QAM	1	12	21.88	21.90	21.92		
5	16QAM	1	24	22.27	21.91	21.95		
5	16QAM	12	0	20.97	21.07	21.02	22	2
5	16QAM	12	6	20.99	21.05	21.02		
5	16QAM	12	11	21.30	21.07	21.11		
5	16QAM	25	0	21.01	21.03	21.03		
Channel				18615	18900	19185	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1851.5	1880	1908.5		
3	QPSK	1	0	22.82	23.07	23.01	24	0
3	QPSK	1	7	22.84	22.97	22.98		
3	QPSK	1	14	23.01	23.03	22.98		
3	QPSK	8	0	21.85	22.12	22.05	23	1
3	QPSK	8	4	21.85	22.06	22.03		
3	QPSK	8	7	21.89	22.06	22.01		
3	QPSK	15	0	21.90	22.11	22.01		
3	16QAM	1	0	21.74	21.98	21.95	23	1
3	16QAM	1	7	21.79	21.98	21.93		
3	16QAM	1	14	21.97	21.97	21.94		
3	16QAM	8	0	20.91	21.16	21.10	22	2
3	16QAM	8	4	20.92	21.15	21.12		
3	16QAM	8	7	20.96	21.12	21.11		
3	16QAM	15	0	20.90	21.12	21.08		
Channel				18607	18900	19193	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1850.7	1880	1909.3		
1.4	QPSK	1	0	22.96	23.20	23.11	24	0
1.4	QPSK	1	2	22.93	23.12	23.09		
1.4	QPSK	1	5	22.89	23.21	23.12		
1.4	QPSK	3	0	23.00	23.20	23.14		
1.4	QPSK	3	1	22.93	23.13	23.13		
1.4	QPSK	3	2	22.88	23.08	23.11		
1.4	QPSK	6	0	22.02	22.24	22.17	23	1
1.4	16QAM	1	0	21.93	22.12	22.06	23	1
1.4	16QAM	1	2	22.03	22.17	22.05		
1.4	16QAM	1	5	21.92	22.12	22.05		
1.4	16QAM	3	0	21.91	22.17	22.09		
1.4	16QAM	3	1	21.88	22.18	22.06		
1.4	16QAM	3	2	21.85	22.13	22.05		
1.4	16QAM	6	0	20.90	21.10	21.07	22	2

<WLAN 2.4GHz Conducted Power>

WLAN 2.4GHz 802.11b Average Power (dBm)					
Power vs. Channel			Power vs. Data Rate		
Channel	Frequency (MHz)	Data Rate 1Mbps	2Mbps	5.5Mbps	11Mbps
CH 1	2412	17.92	18.11	18.24	18.22
CH 6	2437	18.25			
CH 11	2462	17.80			

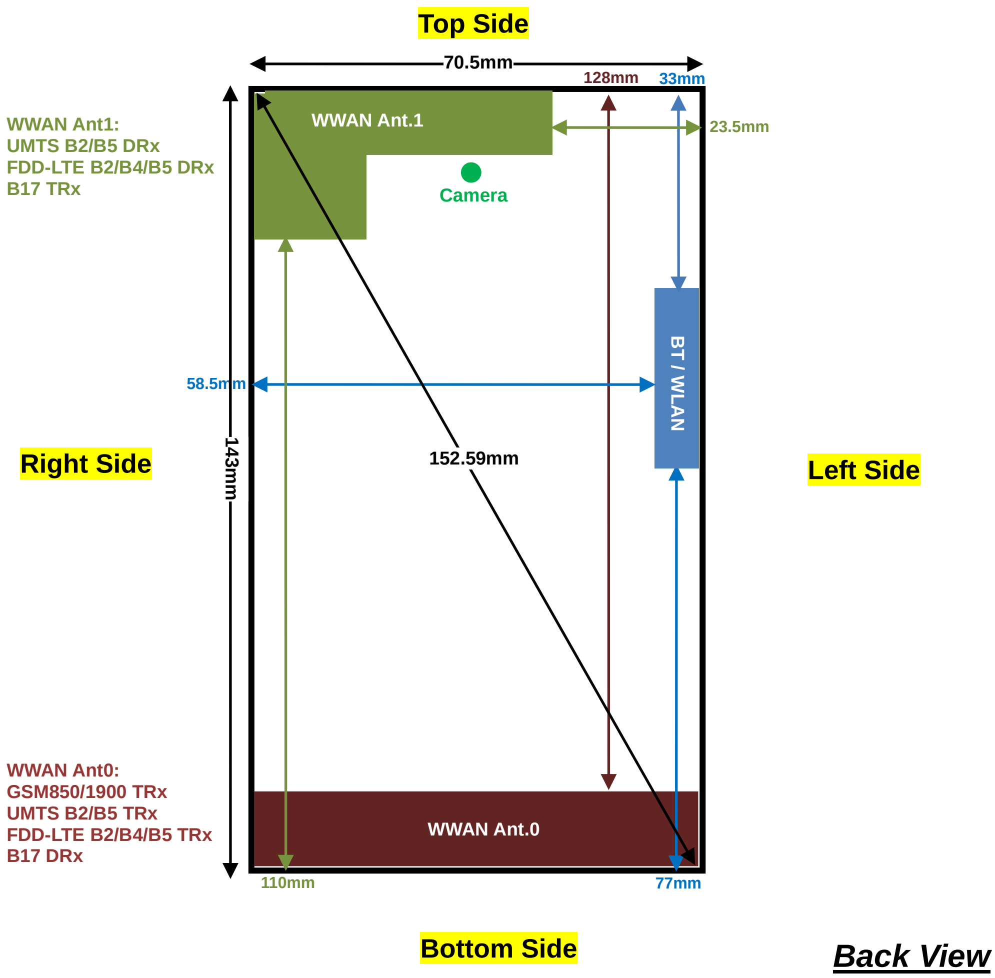
WLAN 2.4GHz 802.11g Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate 6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 1	2412	12.77	12.93	12.92	12.90	12.87	12.89	12.89	12.88
CH 6	2437	12.94							
CH 11	2462	12.61							

WLAN 2.4GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 1	2412	12.80	12.89	12.94	12.90	12.82	12.91	12.93	12.92
CH 6	2437	12.95							
CH 11	2462	12.69							

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate
3. Apply the test exclusion rule in KDB 248227 D01 v01r02 11g, 11n-HT20 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

12. Antenna Location



Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Ant. 0	≤ 25mm	≤ 25mm	128mm	≤ 25mm	≤ 25mm	≤ 25mm
WWAN Ant. 1	≤ 25mm	≤ 25mm	≤ 25mm	110mm	≤ 25mm	≤ 25mm
BT / WLAN	≤ 25mm	≤ 25mm	33mm	77mm	58.5mm	≤ 25mm
Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Ant. 0	Yes	Yes	No	Yes	Yes	Yes
WWAN Ant. 1	Yes	Yes	Yes	No	Yes	Yes
BT&WLAN	Yes	Yes	No	No	No	Yes

Note:

1. Referring to KDB 941225 D06 v01r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

13. SAR Test Results

Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 648474 D04v01r02, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is < 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

13.1 Head SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS (2 Tx slots)	Right Cheek	128	824.2	30.94	32.00	1.276	-0.018	0.132	0.168
	GSM850	GPRS (2 Tx slots)	Right Tilted	128	824.2	30.94	32.00	1.276	0.001	0.072	0.092
01	GSM850	GPRS (2 Tx slots)	Left Cheek	128	824.2	30.94	32.00	1.276	-0.035	0.196	0.250
	GSM850	GPRS (2 Tx slots)	Left Tilted	128	824.2	30.94	32.00	1.276	0.039	0.105	0.134
	GSM1900	GPRS (2 Tx slots)	Right Cheek	810	1909.8	28.30	29.00	1.175	0.124	0.095	0.112
	GSM1900	GPRS (2 Tx slots)	Right Tilted	810	1909.8	28.30	29.00	1.175	-0.041	0.064	0.075
02	GSM1900	GPRS (2 Tx slots)	Left Cheek	810	1909.8	28.30	29.00	1.175	0.03	0.231	0.271
	GSM1900	GPRS (2 Tx slots)	Left Tilted	810	1909.8	28.30	29.00	1.175	-0.057	0.059	0.069

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA V	RMC 12.2Kbps	Right Cheek	4182	836.4	23.71	24.00	1.069	-0.016	0.303	0.324
	WCDMA V	RMC 12.2Kbps	Right Tilted	4182	836.4	23.71	24.00	1.069	-0.012	0.145	0.155
	WCDMA V	RMC 12.2Kbps	Left Cheek	4182	836.4	23.71	24.00	1.069	0.012	0.271	0.290
	WCDMA V	RMC 12.2Kbps	Left Tilted	4182	836.4	23.71	24.00	1.069	-0.012	0.161	0.172
	WCDMA II	RMC 12.2Kbps	Right Cheek	9262	1852.4	23.92	24.00	1.019	0.068	0.220	0.224
	WCDMA II	RMC 12.2Kbps	Right Tilted	9262	1852.4	23.92	24.00	1.019	0.093	0.075	0.076
04	WCDMA II	RMC 12.2Kbps	Left Cheek	9262	1852.4	23.92	24.00	1.019	-0.029	0.474	0.483
	WCDMA II	RMC 12.2Kbps	Left Tilted	9262	1852.4	23.92	24.00	1.019	-0.096	0.113	0.115

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 17	10M	QPSK	1	49	Right Cheek	23780	709	23.43	24.00	1.140	-0.009	0.285	0.325
	LTE Band 17	10M	QPSK	25	24	Right Cheek	23800	711	22.43	23.00	1.140	0.005	0.238	0.271
	LTE Band 17	10M	QPSK	1	49	Right Tilted	23780	709	23.43	24.00	1.140	-0.077	0.206	0.235
	LTE Band 17	10M	QPSK	25	24	Right Tilted	23800	711	22.43	23.00	1.140	0.045	0.171	0.195
05	LTE Band 17	10M	QPSK	1	49	Left Cheek	23780	709	23.43	24.00	1.140	0.095	0.447	0.510
	LTE Band 17	10M	QPSK	25	24	Left Cheek	23800	711	22.43	23.00	1.140	0.078	0.369	0.421
	LTE Band 17	10M	QPSK	1	49	Left Tilted	23780	709	23.43	24.00	1.140	0.061	0.254	0.290
	LTE Band 17	10M	QPSK	25	24	Left Tilted	23800	711	22.43	23.00	1.140	-0.06	0.212	0.242
06	LTE Band 5	10M	QPSK	1	49	Right Cheek	20450	829	23.18	24.00	1.208	-0.047	0.211	0.255
	LTE Band 5	10M	QPSK	25	24	Right Cheek	20525	836.5	22.31	23.00	1.172	-0.091	0.174	0.204
	LTE Band 5	10M	QPSK	1	49	Right Tilted	20450	829	23.18	24.00	1.208	-0.041	0.084	0.101
	LTE Band 5	10M	QPSK	25	24	Right Tilted	20525	836.5	22.31	23.00	1.172	-0.009	0.067	0.079
	LTE Band 5	10M	QPSK	1	49	Left Cheek	20450	829	23.18	24.00	1.208	0.015	0.203	0.245
	LTE Band 5	10M	QPSK	25	24	Left Cheek	20525	829	22.31	23.00	1.172	0.005	0.205	0.240
	LTE Band 5	10M	QPSK	1	49	Left Tilted	20450	829	23.18	24.00	1.208	-0.009	0.089	0.107
	LTE Band 5	10M	QPSK	25	24	Left Tilted	20525	836.5	22.31	23.00	1.172	-0.109	0.069	0.081
	LTE Band 4	20M	QPSK	1	49	Right Cheek	20175	1732.5	23.32	24.00	1.169	0.148	0.173	0.202
	LTE Band 4	20M	QPSK	50	0	Right Cheek	20175	1732.5	22.44	23.00	1.138	0.162	0.143	0.163
	LTE Band 4	20M	QPSK	1	49	Right Tilted	20175	1732.5	23.32	24.00	1.169	-0.014	0.094	0.110
	LTE Band 4	20M	QPSK	50	0	Right Tilted	20175	1732.5	22.44	23.00	1.138	0.057	0.080	0.091
07	LTE Band 4	20M	QPSK	1	49	Left Cheek	20175	1732.5	23.32	24.00	1.169	0.057	0.378	0.442
	LTE Band 4	20M	QPSK	50	0	Left Cheek	20175	1732.5	22.44	23.00	1.138	0.043	0.320	0.364
	LTE Band 4	20M	QPSK	1	49	Left Tilted	20175	1732.5	23.32	24.00	1.169	0.003	0.084	0.098
	LTE Band 4	20M	QPSK	50	0	Left Tilted	20175	1732.5	22.44	23.00	1.138	-0.04	0.095	0.108
	LTE Band 2	20M	QPSK	1	49	Right Cheek	18700	1860	23.36	24.00	1.159	-0.031	0.097	0.112
	LTE Band 2	20M	QPSK	50	0	Right Cheek	18700	1860	22.40	23.00	1.148	-0.057	0.076	0.087
	LTE Band 2	20M	QPSK	1	49	Right Tilted	18700	1860	23.36	24.00	1.159	-0.08	0.088	0.102
	LTE Band 2	20M	QPSK	50	0	Right Tilted	18700	1860	22.40	23.00	1.148	-0.165	0.068	0.078
08	LTE Band 2	20M	QPSK	1	49	Left Cheek	18700	1860	23.36	24.00	1.159	0.069	0.331	0.384
	LTE Band 2	20M	QPSK	50	0	Left Cheek	18700	1860	22.40	23.00	1.148	0.057	0.266	0.305
	LTE Band 2	20M	QPSK	1	49	Left Tilted	18700	1860	23.36	24.00	1.159	-0.017	0.098	0.114
	LTE Band 2	20M	QPSK	50	0	Left Tilted	18700	1860	22.40	23.00	1.148	0.142	0.074	0.085

<WLAN SAR DTS>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
09	WLAN2.4GHz	802.11b 1Mbps	Right Cheek	6	2437	18.25	18.50	1.059	97.64	1.024	-0.016	0.105	0.114
	WLAN2.4GHz	802.11b 1Mbps	Right Tilted	6	2437	18.25	18.50	1.059	97.64	1.024	0.052	0.062	0.067
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	6	2437	18.25	18.50	1.059	97.64	1.024	0.047	0.063	0.068
	WLAN2.4GHz	802.11b 1Mbps	Left Tilted	6	2437	18.25	18.50	1.059	97.64	1.024	0.058	0.032	0.035

13.2 Hotspot SAR

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Ant. 0	≤ 25mm	≤ 25mm	128mm	≤ 25mm	≤ 25mm	≤ 25mm
WWAN Ant. 1	≤ 25mm	≤ 25mm	≤ 25mm	110mm	≤ 25mm	≤ 25mm
BT / WLAN	≤ 25mm	≤ 25mm	33mm	77mm	58.5mm	≤ 25mm
Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Ant. 0	Yes	Yes	No	Yes	Yes	Yes
WWAN Ant. 1	Yes	Yes	Yes	No	Yes	Yes
BT&WLAN	Yes	Yes	No	No	No	Yes

Note:

1. Referring to KDB 941225 D06 v01r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

<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)
	GSM850	GPRS (2 Tx slots)	Front	1cm	128	824.2	30.94	32.00	1.276	-0.013	0.318	0.406
10	GSM850	GPRS (2 Tx slots)	Back	1cm	128	824.2	30.94	32.00	1.276	-0.131	0.494	**0.631**
	GSM850	GPRS (2 Tx slots)	Left Side	1cm	128	824.2	30.94	32.00	1.276	-0.07	0.329	0.420
	GSM850	GPRS (2 Tx slots)	Right Side	1cm	128	824.2	30.94	32.00	1.276	-0.001	0.323	0.412
	GSM850	GPRS (2 Tx slots)	Bottom Side	1cm	128	824.2	30.94	32.00	1.276	0.004	0.099	0.126
	GSM1900	GPRS (2 Tx slots)	Front	1cm	810	1909.8	28.30	29.00	1.175	-0.024	0.243	0.286
	GSM1900	GPRS (2 Tx slots)	Back	1cm	810	1909.8	28.30	29.00	1.175	0.011	0.455	0.535
	GSM1900	GPRS (2 Tx slots)	Left Side	1cm	810	1909.8	28.30	29.00	1.175	-0.083	0.208	0.244
	GSM1900	GPRS (2 Tx slots)	Right Side	1cm	810	1909.8	28.30	29.00	1.175	-0.112	0.050	0.059
11	GSM1900	GPRS (2 Tx slots)	Bottom Side	1cm	810	1909.8	28.30	29.00	1.175	-0.008	0.580	**0.681**

<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)
12	WCDMA V	RMC 12.2Kbps	Front	1cm	4182	836.4	23.71	24.00	1.069	-0.021	0.498	0.532
	WCDMA V	RMC 12.2Kbps	Back	1cm	4182	836.4	23.71	24.00	1.069	0.007	0.493	0.527
	WCDMA V	RMC 12.2Kbps	Right Side	1cm	4182	836.4	23.71	24.00	1.069	-0.064	0.475	0.508
	WCDMA V	RMC 12.2Kbps	Left Side	1cm	4182	836.4	23.71	24.00	1.069	-0.069	0.434	0.464
	WCDMA V	RMC 12.2Kbps	Bottom Side	1cm	4182	836.4	23.71	24.00	1.069	-0.129	0.166	0.177
	WCDMA II	RMC 12.2Kbps	Front	1cm	9262	1852.4	23.92	24.00	1.019	-0.047	0.588	0.599
	WCDMA II	RMC 12.2Kbps	Back	1cm	9262	1852.4	23.92	24.00	1.019	-0.027	0.844	0.860
	WCDMA II	RMC 12.2Kbps	Back	1cm	9400	1880	23.18	24.00	1.208	-0.022	0.742	0.896
	WCDMA II	RMC 12.2Kbps	Back	1cm	9538	1907.6	23.63	24.00	1.089	-0.08	0.763	0.831
	WCDMA II	RMC 12.2Kbps	Left Side	1cm	9262	1852.4	23.92	24.00	1.019	-0.082	0.367	0.374
	WCDMA II	RMC 12.2Kbps	Right Side	1cm	9262	1852.4	23.92	24.00	1.019	0.012	0.158	0.161
	WCDMA II	RMC 12.2Kbps	Bottom Side	1cm	9262	1852.4	23.92	24.00	1.019	-0.003	0.962	0.980
13	WCDMA II	RMC 12.2Kbps	Bottom Side	1cm	9400	1880	23.18	24.00	1.208	-0.065	0.834	1.007
	WCDMA II	RMC 12.2Kbps	Bottom Side	1cm	9538	1907.6	23.63	24.00	1.089	-0.058	0.847	0.922

<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)
	LTE Band 17	10M	QPSK	1	49	Front	1cm	23780	709	23.43	24.00	1.140	0.041	0.234	0.267
	LTE Band 17	10M	QPSK	25	24	Front	1cm	23800	711	22.43	23.00	1.140	-0.149	0.197	0.225
14	LTE Band 17	10M	QPSK	1	49	Back	1cm	23780	709	23.43	24.00	1.140	-0.002	0.552	0.629
	LTE Band 17	10M	QPSK	25	24	Back	1cm	23800	711	22.43	23.00	1.140	0	0.458	0.522
	LTE Band 17	10M	QPSK	1	49	Left Side	1cm	23780	709	23.43	24.00	1.140	0.037	0.097	0.111
	LTE Band 17	10M	QPSK	25	24	Left Side	1cm	23800	711	22.43	23.00	1.140	-0.031	0.080	0.091
	LTE Band 17	10M	QPSK	1	49	Right Side	1cm	23780	709	23.43	24.00	1.140	0.035	0.198	0.226
	LTE Band 17	10M	QPSK	25	24	Right Side	1cm	23800	711	22.43	23.00	1.140	-0.011	0.164	0.187
	LTE Band 17	10M	QPSK	1	49	Top Side	1cm	23780	709	23.43	24.00	1.140	0.03	0.081	0.092
	LTE Band 17	10M	QPSK	25	24	Top Side	1cm	23800	711	22.43	23.00	1.140	0.057	0.068	0.078
	LTE Band 5	10M	QPSK	1	49	Front	1cm	20450	829	23.18	24.00	1.208	-0.111	0.298	0.360
	LTE Band 5	10M	QPSK	25	24	Front	1cm	20525	836.5	22.31	23.00	1.172	-0.048	0.381	0.447
15	LTE Band 5	10M	QPSK	1	49	Back	1cm	20450	829	23.18	24.00	1.208	-0.016	0.461	0.557
	LTE Band 5	10M	QPSK	25	24	Back	1cm	20525	836.5	22.31	23.00	1.172	-0.071	0.379	0.444
	LTE Band 5	10M	QPSK	1	49	Left Side	1cm	20450	829	23.18	24.00	1.208	-0.082	0.326	0.394
	LTE Band 5	10M	QPSK	25	24	Left Side	1cm	20525	836.5	22.31	23.00	1.172	-0.026	0.264	0.309
	LTE Band 5	10M	QPSK	1	49	Right Side	1cm	20450	829	23.18	24.00	1.208	-0.082	0.356	0.430
	LTE Band 5	10M	QPSK	25	24	Right Side	1cm	20525	836.5	22.31	23.00	1.172	-0.063	0.276	0.324
	LTE Band 5	10M	QPSK	1	49	Bottom Side	1cm	20450	829	23.18	24.00	1.208	-0.106	0.123	0.149
	LTE Band 5	10M	QPSK	25	24	Bottom Side	1cm	20525	836.5	22.31	23.00	1.172	-0.083	0.095	0.111

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)
	LTE Band 4	20M	QPSK	1	49	Front	1cm	20175	1732.5	23.32	24.00	1.169	0.011	0.518	0.606
	LTE Band 4	20M	QPSK	50	0	Front	1cm	20175	1732.5	22.44	23.00	1.138	-0.033	0.281	0.320
	LTE Band 4	20M	QPSK	1	49	Back	1cm	20175	1732.5	23.32	24.00	1.169	-0.052	0.797	0.932
	LTE Band 4	20M	QPSK	1	49	Back	1cm	20050	1720	23.27	24.00	1.183	-0.066	0.806	0.954
16	LTE Band 4	20M	QPSK	1	49	Back	1cm	20300	1745	23.02	24.00	1.253	-0.031	0.813	**1.019**
	LTE Band 4	20M	QPSK	50	0	Back	1cm	20175	1732.5	22.44	23.00	1.138	-0.033	0.655	0.745
	LTE Band 4	20M	QPSK	100	0	Back	1cm	20175	1732.5	22.34	23.00	1.164	0.036	0.665	0.774
	LTE Band 4	20M	QPSK	1	49	Left Side	1cm	20175	1732.5	23.32	24.00	1.169	-0.021	0.338	0.395
	LTE Band 4	20M	QPSK	50	0	Left Side	1cm	20175	1732.5	22.44	23.00	1.138	0.027	0.279	0.317
	LTE Band 4	20M	QPSK	1	49	Right Side	1cm	20175	1732.5	23.32	24.00	1.169	-0.053	0.075	0.088
	LTE Band 4	20M	QPSK	50	0	Right Side	1cm	20175	1732.5	22.44	23.00	1.138	0.066	0.020	0.023
	LTE Band 4	20M	QPSK	1	49	Bottom Side	1cm	20175	1732.5	23.32	24.00	1.169	-0.041	0.624	0.730
	LTE Band 4	20M	QPSK	50	0	Bottom Side	1cm	20175	1732.5	22.44	23.00	1.138	-0.049	0.504	0.573
	LTE Band 2	20M	QPSK	1	49	Front	1cm	18700	1860	23.36	24.00	1.159	0.071	0.511	0.592
	LTE Band 2	20M	QPSK	50	0	Front	1cm	18700	1860	22.40	23.00	1.148	-0.015	0.406	0.466
	LTE Band 2	20M	QPSK	1	49	Back	1cm	18700	1860	23.36	24.00	1.159	-0.028	0.633	0.734
	LTE Band 2	20M	QPSK	50	0	Back	1cm	18700	1860	22.40	23.00	1.148	-0.034	0.510	0.586
	LTE Band 2	20M	QPSK	1	49	Left Side	1cm	18700	1860	23.36	24.00	1.159	-0.042	0.282	0.327
	LTE Band 2	20M	QPSK	50	0	Left Side	1cm	18700	1860	22.40	23.00	1.148	-0.035	0.225	0.258
	LTE Band 2	20M	QPSK	1	49	Right Side	1cm	18700	1860	23.36	24.00	1.159	-0.045	0.064	0.074
	LTE Band 2	20M	QPSK	50	0	Right Side	1cm	18700	1860	22.40	23.00	1.148	-0.059	0.051	0.059
	LTE Band 2	20M	QPSK	1	49	Bottom Side	1cm	18700	1860	23.36	24.00	1.159	-0.081	0.808	0.936
17	LTE Band 2	20M	QPSK	1	49	Bottom Side	1cm	18900	1880	22.98	24.00	1.265	0	0.863	**1.091**
	LTE Band 2	20M	QPSK	1	49	Bottom Side	1cm	19100	1900	23.03	24.00	1.250	-0.042	0.721	0.901
	LTE Band 2	20M	QPSK	50	0	Bottom Side	1cm	18700	1860	22.40	23.00	1.148	-0.089	0.642	0.737
	LTE Band 2	20M	QPSK	100	0	Bottom Side	1cm	18700	1860	22.36	23.00	1.159	0.046	0.654	0.758

<WLAN SAR DTS>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	1cm	6	2437	18.25	18.50	1.059	97.64	1.024	0.04	0.047	0.051
18	WLAN2.4GHz	802.11b 1Mbps	Back	1cm	6	2437	18.25	18.50	1.059	97.64	1.024	0.044	0.478	**0.518**
	WLAN2.4GHz	802.11b 1Mbps	Left Side	1cm	6	2437	18.25	18.50	1.059	97.64	1.024	-0.024	0.237	0.257

13.3 Body Worn 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)
	GSM850	GPRS (2 Tx slots)	Front	1cm	128	824.2	30.94	32.00	1.276	-0.013	0.318	0.406
19	GSM850	GPRS (2 Tx slots)	Back	1cm	128	824.2	30.94	32.00	1.276	-0.131	0.494	0.631
	GSM1900	GPRS (2 Tx slots)	Front	1cm	810	1909.8	28.30	29.00	1.175	-0.024	0.243	0.286
20	GSM1900	GPRS (2 Tx slots)	Back	1cm	810	1909.8	28.30	29.00	1.175	0.011	0.455	0.535

<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)
21	WCDMA V	RMC 12.2Kbps	Front	1cm	4182	836.4	23.71	24.00	1.069	-0.021	0.498	0.532
	WCDMA V	RMC 12.2Kbps	Back	1cm	4182	836.4	23.71	24.00	1.069	0.007	0.493	0.527
	WCDMA II	RMC 12.2Kbps	Front	1cm	9262	1852.4	23.92	24.00	1.019	-0.047	0.588	0.599
	WCDMA II	RMC 12.2Kbps	Back	1cm	9262	1852.4	23.92	24.00	1.019	-0.027	0.844	0.860
22	WCDMA II	RMC 12.2Kbps	Back	1cm	9400	1880	23.18	24.00	1.208	-0.022	0.742	0.896
	WCDMA II	RMC 12.2Kbps	Back	1cm	9538	1907.6	23.63	24.00	1.089	-0.08	0.763	0.831

<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)
	LTE Band 17	10M	QPSK	1	49	Front	1cm	23780	709	23.43	24.00	1.140	0.041	0.234	0.267
	LTE Band 17	10M	QPSK	25	24	Front	1cm	23800	711	22.43	23.00	1.140	-0.149	0.197	0.225
23	LTE Band 17	10M	QPSK	1	49	Back	1cm	23780	709	23.43	24.00	1.140	-0.002	0.552	0.629
	LTE Band 17	10M	QPSK	25	24	Back	1cm	23800	711	22.43	23.00	1.140	0	0.458	0.522
	LTE Band 5	10M	QPSK	1	49	Front	1cm	20450	829	23.18	24.00	1.208	-0.111	0.298	0.360
	LTE Band 5	10M	QPSK	25	24	Front	1cm	20525	836.5	22.31	23.00	1.172	-0.048	0.381	0.447
24	LTE Band 5	10M	QPSK	1	49	Back	1cm	20450	829	23.18	24.00	1.208	-0.016	0.461	0.557
	LTE Band 5	10M	QPSK	25	24	Back	1cm	20525	836.5	22.31	23.00	1.172	-0.071	0.379	0.444
	LTE Band 4	20M	QPSK	1	49	Front	1cm	20175	1732.5	23.32	24.00	1.169	0.011	0.518	0.606
	LTE Band 4	20M	QPSK	50	0	Front	1cm	20175	1732.5	22.44	23.00	1.138	-0.033	0.281	0.320
	LTE Band 4	20M	QPSK	1	49	Back	1cm	20175	1732.5	23.32	24.00	1.169	-0.052	0.797	0.932
	LTE Band 4	20M	QPSK	1	49	Back	1cm	20050	1720	23.27	24.00	1.183	-0.066	0.806	0.954
25	LTE Band 4	20M	QPSK	1	49	Back	1cm	20300	1745	23.02	24.00	1.253	-0.031	0.813	1.019
	LTE Band 4	20M	QPSK	50	0	Back	1cm	20175	1732.5	22.44	23.00	1.138	-0.033	0.655	0.745
	LTE Band 4	20M	QPSK	100	0	Back	1cm	20175	1732.5	22.34	23.00	1.164	0.036	0.665	0.774
	LTE Band 2	20M	QPSK	1	49	Front	1cm	18700	1860	23.36	24.00	1.159	0.071	0.511	0.592
	LTE Band 2	20M	QPSK	50	0	Front	1cm	18700	1860	22.40	23.00	1.148	-0.015	0.406	0.466
26	LTE Band 2	20M	QPSK	1	49	Back	1cm	18700	1860	23.36	24.00	1.159	-0.028	0.633	0.734
	LTE Band 2	20M	QPSK	50	0	Back	1cm	18700	1860	22.40	23.00	1.148	-0.034	0.510	0.586

<WLAN SAR DTS>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	1cm	6	2437	18.25	18.50	1.059	97.64	1.024	0.04	0.047	0.051
27	WLAN2.4GHz	802.11b 1Mbps	Back	1cm	6	2437	18.25	18.50	1.059	97.64	1.024	0.044	0.478	0.518

13.4 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WCDMA II					RMC 12.2Kbps	Bottom Side	1cm	9262	1852.4	23.92	24.00	1.019	-0.003	0.962	-	0.980
2nd	WCDMA II					RMC 12.2Kbps	Bottom Side	1cm	9262	1852.4	23.92	24.00	1.019	-0.061	0.942	1.02	0.960
1st	LTE Band 4	20M	QPSK	1	49		Back	1cm	20300	1745	23.02	24.00	1.253	-0.031	0.813	-	1.019
2nd	LTE Band 4	20M	QPSK	1	0		Back	1cm	20300	1745	23.02	24.00	1.253	-0.029	0.809	1.01	1.014

Note:

1. Per KDB 865664 D01v01r03, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01r03, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/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.

14. Simultaneous Transmission Analysis

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

Note:

1. This device supports VoIP in GSM, WCDMA, LTE (e.g. 3rd party VoIP).
2. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. The Scaled SAR summation is calculated based on the same configuration and test position.
4. Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan
   If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary
   iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg
5. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f(GHz)}$/*x*] W/kg for *test separation distances* ≤ 50 mm; where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.
   ii) When the minimum test separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.

Max Power	Exposure Position	Head	Hotspot / Body worn
	Test separation	5 mm	10 mm
7 dBm	Estimated SAR (W/kg)	0.210 W/kg	0.105 W/kg

14.1 Head Exposure Conditions

<WWAN + WLAN>

	WWAN		WLAN	**Summed SAR (W/kg)**
Position	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Right Cheek	GSM850	0.168	0.114	**0.28**
	GSM1900	0.112	0.114	**0.23**
	WCDMA II	0.224	0.114	**0.34**
	WCDMA V	0.324	0.114	**0.44**
	LTE Band 2	0.112	0.114	**0.23**
	LTE Band 4	0.202	0.114	**0.32**
	LTE Band 5	0.255	0.114	**0.37**
	LTE Band 17	0.325	0.114	**0.44**
Right Tilted	GSM850	0.092	0.067	**0.16**
	GSM1900	0.075	0.067	**0.14**
	WCDMA II	0.076	0.067	**0.14**
	WCDMA V	0.155	0.067	**0.22**
	LTE Band 2	0.102	0.067	**0.17**
	LTE Band 4	0.110	0.067	**0.18**
	LTE Band 5	0.101	0.067	**0.17**
	LTE Band 17	0.235	0.067	**0.30**
Left Cheek	GSM850	0.250	0.068	**0.32**
	GSM1900	0.271	0.068	**0.34**
	WCDMA II	0.483	0.068	**0.55**
	WCDMA V	0.290	0.068	**0.36**
	LTE Band 2	0.384	0.068	**0.45**
	LTE Band 4	0.442	0.068	**0.51**
	LTE Band 5	0.245	0.068	**0.31**
	LTE Band 17	0.510	0.068	**0.58**
Left Tilted	GSM850	0.134	0.035	**0.17**
	GSM1900	0.069	0.035	**0.10**
	WCDMA II	0.115	0.035	**0.15**
	WCDMA V	0.172	0.035	**0.21**
	LTE Band 2	0.114	0.035	**0.15**
	LTE Band 4	0.108	0.035	**0.14**
	LTE Band 5	0.107	0.035	**0.14**
	LTE Band 17	0.290	0.035	**0.33**

<WWAN + Bluetooth>

	WWAN		Bluetooth	**Summed SAR (W/kg)**
Position	WWAN Band	SAR (W/kg)	Estimated SAR (W/kg)	
Right Cheek	GSM850	0.168	0.210	**0.38**
	GSM1900	0.112	0.210	**0.32**
	WCDMA II	0.224	0.210	**0.43**
	WCDMA V	0.324	0.210	**0.53**
	LTE Band 2	0.112	0.210	**0.32**
	LTE Band 4	0.202	0.210	**0.41**
	LTE Band 5	0.255	0.210	**0.47**
	LTE Band 17	0.325	0.210	**0.54**
Right Tilted	GSM850	0.092	0.210	**0.30**
	GSM1900	0.075	0.210	**0.29**
	WCDMA II	0.076	0.210	**0.29**
	WCDMA V	0.155	0.210	**0.37**
	LTE Band 2	0.102	0.210	**0.31**
	LTE Band 4	0.110	0.210	**0.32**
	LTE Band 5	0.101	0.210	**0.31**
	LTE Band 17	0.235	0.210	**0.45**
Left Cheek	GSM850	0.250	0.210	**0.46**
	GSM1900	0.271	0.210	**0.48**
	WCDMA II	0.483	0.210	**0.69**
	WCDMA V	0.290	0.210	**0.50**
	LTE Band 2	0.384	0.210	**0.59**
	LTE Band 4	0.442	0.210	**0.65**
	LTE Band 5	0.245	0.210	**0.46**
	LTE Band 17	0.510	0.210	**0.72**
Left Tilted	GSM850	0.134	0.210	**0.34**
	GSM1900	0.069	0.210	**0.28**
	WCDMA II	0.115	0.210	**0.33**
	WCDMA V	0.172	0.210	**0.38**
	LTE Band 2	0.114	0.210	**0.32**
	LTE Band 4	0.108	0.210	**0.32**
	LTE Band 5	0.107	0.210	**0.32**
	LTE Band 17	0.290	0.210	**0.50**

14.2 Hotspot Exposure Conditions

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Ant. 0	≤ 25mm	≤ 25mm	128mm	≤ 25mm	≤ 25mm	≤ 25mm
WWAN Ant. 1	≤ 25mm	≤ 25mm	≤ 25mm	110mm	≤ 25mm	≤ 25mm
BT / WLAN	≤ 25mm	≤ 25mm	33mm	77mm	58.5mm	≤ 25mm
Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Ant. 0	Yes	Yes	No	Yes	Yes	Yes
WWAN Ant. 1	Yes	Yes	Yes	No	Yes	Yes
BT&WLAN	Yes	Yes	No	No	No	Yes
Simultaneous Transmission						
WWAN Ant 0 + WLAN / BT	Yes	Yes	No	No	No	Yes
WWAN Ant 1 + WLAN / BT	Yes	Yes	No	No	No	Yes

<WWAN + WLAN>

	WWAN		WLAN	**Summed SAR (W/kg)**
Position	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Front	GSM850	0.406	0.051	**0.46**
	GSM1900	0.286	0.051	**0.34**
	WCDMA II	0.599	0.051	**0.65**
	WCDMA V	0.532	0.051	**0.58**
	LTE Band 2	0.592	0.051	**0.64**
	LTE Band 4	0.606	0.051	**0.66**
	LTE Band 5	0.447	0.051	**0.50**
	LTE Band 17	0.267	0.051	**0.32**
Back	GSM850	0.631	0.518	**1.15**
	GSM1900	0.535	0.518	**1.05**
	WCDMA II	0.896	0.518	**1.41**
	WCDMA V	0.527	0.518	**1.05**
	LTE Band 2	0.734	0.518	**1.25**
	LTE Band 4	1.019	0.518	**1.54**
	LTE Band 5	0.557	0.518	**1.08**
	LTE Band 17	0.629	0.518	**1.15**
Left Side	GSM850	0.420	0.257	**0.68**
	GSM1900	0.244	0.257	**0.50**
	WCDMA II	0.374	0.257	**0.63**
	WCDMA V	0.464	0.257	**0.72**
	LTE Band 2	0.327	0.257	**0.58**
	LTE Band 4	0.395	0.257	**0.65**
	LTE Band 5	0.394	0.257	**0.65**
	LTE Band 17	0.111	0.257	**0.37**

<WWAN + Bluetooth>

	WWAN		Bluetooth	**Summed SAR (W/kg)**
Position	WWAN Band	SAR (W/kg)	Estimated SAR (W/kg)	
Front	GSM850	0.406	0.105	**0.51**
	GSM1900	0.286	0.105	**0.39**
	WCDMA II	0.599	0.105	**0.70**
	WCDMA V	0.532	0.105	**0.64**
	LTE Band 2	0.592	0.105	**0.70**
	LTE Band 4	0.606	0.105	**0.71**
	LTE Band 5	0.447	0.105	**0.55**
	LTE Band 17	0.267	0.105	**0.37**
Back	GSM850	0.631	0.105	**0.74**
	GSM1900	0.535	0.105	**0.64**
	WCDMA II	0.896	0.105	**1.00**
	WCDMA V	0.527	0.105	**0.63**
	LTE Band 2	0.734	0.105	**0.84**
	LTE Band 4	1.019	0.105	**1.12**
	LTE Band 5	0.557	0.105	**0.66**
	LTE Band 17	0.629	0.105	**0.73**
Left Side	GSM850	0.420	0.105	**0.53**
	GSM1900	0.244	0.105	**0.35**
	WCDMA II	0.374	0.105	**0.48**
	WCDMA V	0.464	0.105	**0.57**
	LTE Band 2	0.327	0.105	**0.43**
	LTE Band 4	0.395	0.105	**0.50**
	LTE Band 5	0.394	0.105	**0.50**
	LTE Band 17	0.111	0.105	**0.22**

14.3 Body-Worn Exposure Conditions

<WWAN + WLAN>

Position	WWAN Ant0		WLAN	Summed SAR (W/kg)
	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Front	GSM850	0.406	0.051	**0.46**
	GSM1900	0.286	0.051	**0.34**
	WCDMA II	0.599	0.051	**0.65**
	WCDMA V	0.532	0.051	**0.58**
	LTE Band 2	0.592	0.051	**0.64**
	LTE Band 4	0.606	0.051	**0.66**
	LTE Band 5	0.447	0.051	**0.50**
	LTE Band 17	0.267	0.051	**0.32**
Back	GSM850	0.631	0.518	**1.15**
	GSM1900	0.535	0.518	**1.05**
	WCDMA II	0.896	0.518	**1.41**
	WCDMA V	0.527	0.518	**1.05**
	LTE Band 2	0.734	0.518	**1.25**
	LTE Band 4	1.019	0.518	**1.54**
	LTE Band 5	0.557	0.518	**1.08**
	LTE Band 17	0.629	0.518	**1.15**

<WWAN + Bluetooth>

Position	WWAN Ant0		Bluetooth	Summed SAR (W/kg)
	WWAN Band	SAR (W/kg)	Estimated SAR (W/kg)	
Front	GSM850	0.406	0.105	**0.51**
	GSM1900	0.286	0.105	**0.39**
	WCDMA II	0.599	0.105	**0.70**
	WCDMA V	0.532	0.105	**0.64**
	LTE Band 2	0.592	0.105	**0.70**
	LTE Band 4	0.606	0.105	**0.71**
	LTE Band 5	0.447	0.105	**0.55**
	LTE Band 17	0.267	0.105	**0.37**
Back	GSM850	0.631	0.105	**0.74**
	GSM1900	0.535	0.105	**0.64**
	WCDMA II	0.896	0.105	**1.00**
	WCDMA V	0.527	0.105	**0.63**
	LTE Band 2	0.734	0.105	**0.84**
	LTE Band 4	1.019	0.105	**1.12**
	LTE Band 5	0.557	0.105	**0.66**
	LTE Band 17	0.629	0.105	**0.73**

Test Engineer： Domo Hsiao, Frank Wu, Lawrence Chen and Jerry Hu

15. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An 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 14.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	1/√3	1/√6	1/√2

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

(b) *κ* is the coverage factor

Table 15.1. Standard Uncertainty for Assumed Distribution

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

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

Error Description	Uncertainty Value (±%)	Probability 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 15.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

16. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007

[6] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014

[7] FCC KDB 648474 D03 v01r02, “Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers” May 2013.
FCC KDB 648474 D04 v01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013.

[8] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007

[9] FCC KDB 941225 D02 v02r02, “SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced”, May 2013.

[10] FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[11] FCC KDB 941225 D04 v01, “Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode”, January 2010

[12] FCC KDB 941225 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013

[13] FCC KDB 941225 D05A v01, “Rel. 10 LTE SAR Test Guidance and KDB Inquiries”, Feb 2014

[14] FCC KDB 941225 D06 v01r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", May 2013

[15] FCC KDB 941225 D07 v01r01, " SAR Evaluation Procedures for UMPC Mini-Tablet Devices", May 2013

[16] FCC KDB 644545 D01 v01r02, "Guidance for IEEE 802.11ac and Pre-ac Device Emission Testing", Apr 2013

[17] FCC KDB 865664 D01 v01r03, "SAR Measurement Requirements for 100 MHz to 6 GHz", Feb 2014.

[18] 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_Head_750MHz_140221

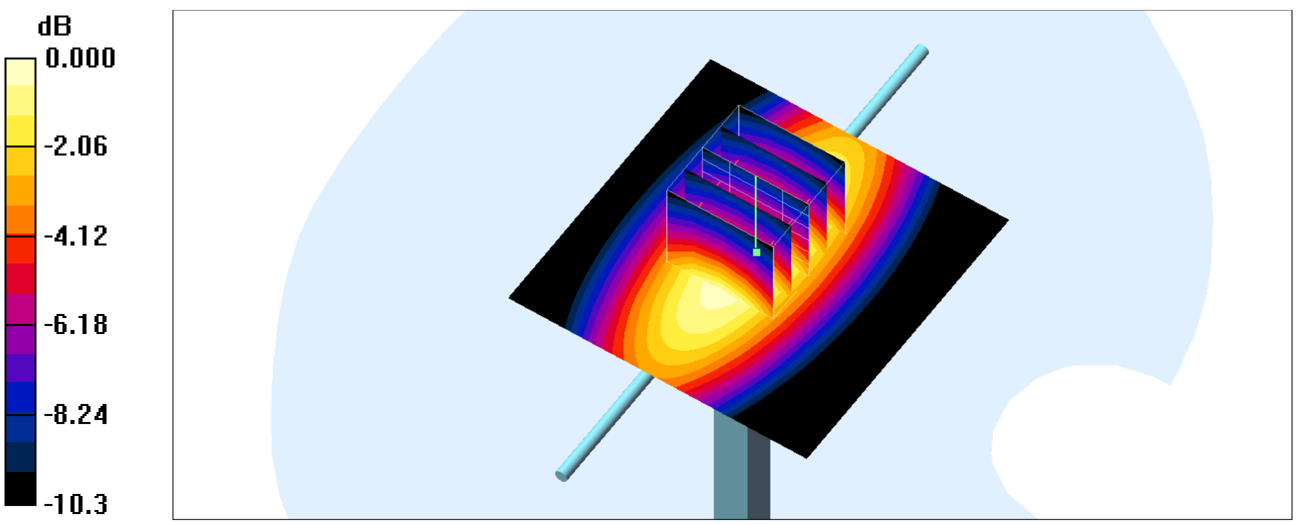
DUT: D750V3-1099

Communication System: LTE; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: HSL_750_140221 Medium parameters used: f = 750 MHz; σ = 0.882 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Ambient Temperature：23.2℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(10.34, 10.34, 10.34); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.64 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.3 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 3.09 W/kg
SAR(1 g) = 2.09 mW/g; SAR(10 g) = 1.38 mW/g
Maximum value of SAR (measured) = 2.63 mW/g



0 dB = 2.63mW/g

System Check_Body_750MHz_140221

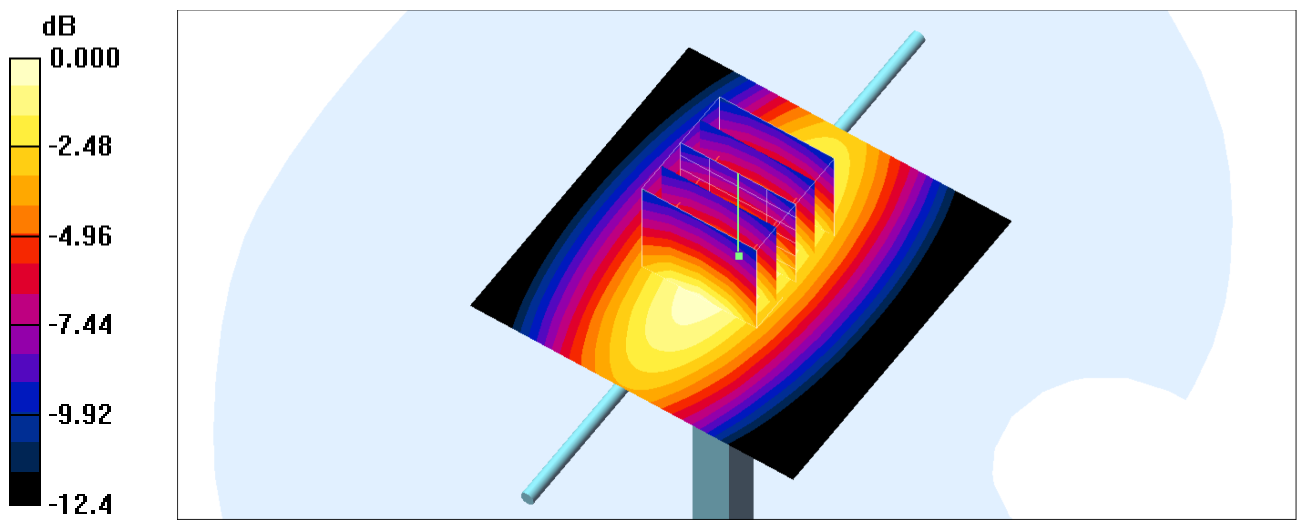
DUT: D750V3-1099

Communication System: LTE; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: MSL_750_140221 Medium parameters used: f = 750 MHz; σ = 0.963 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(10.24, 10.24, 10.24); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.88 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.6 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 3.34 W/kg
SAR(1 g) = 2.29 mW/g; SAR(10 g) = 1.52 mW/g
Maximum value of SAR (measured) = 2.88 mW/g



0 dB = 2.88mW/g

System Check_Head_835MHz_140219

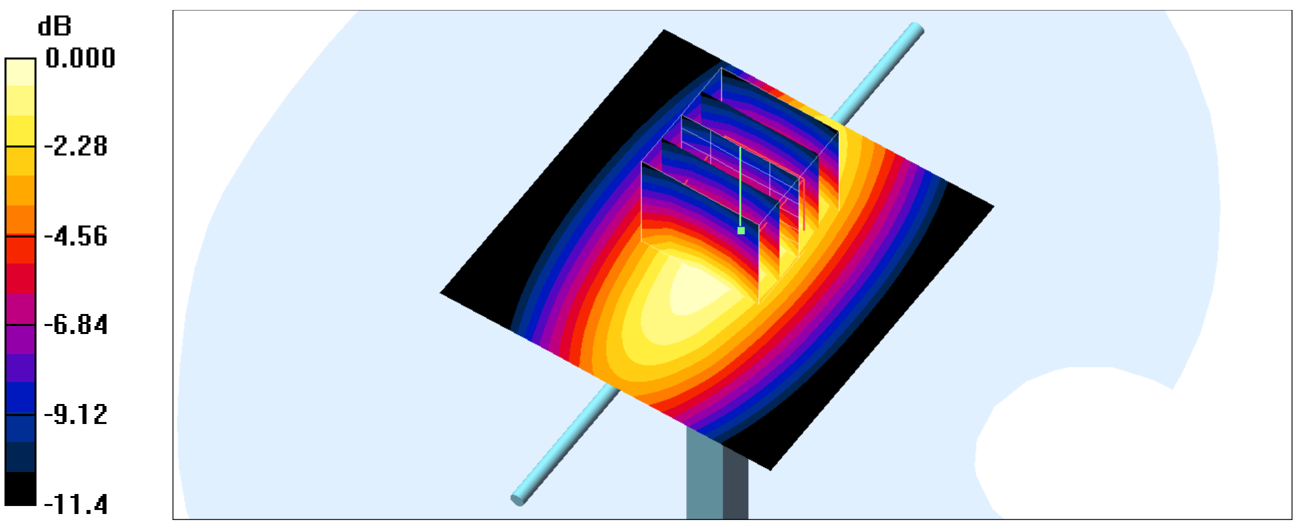
DUT: D835V2-4d162

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_850_140219 Medium parameters used: f = 835 MHz; $\sigma = 0.904$ mho/m; $\varepsilon_r = 41.1$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.87, 9.87, 9.87); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.10 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 59.4 V/m; Power Drift = -0.006 dB
Peak SAR (extrapolated) = 3.70 W/kg
SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.58 mW/g
Maximum value of SAR (measured) = 3.11 mW/g



0 dB = 3.11mW/g

System Check_Body_835MHz_140219

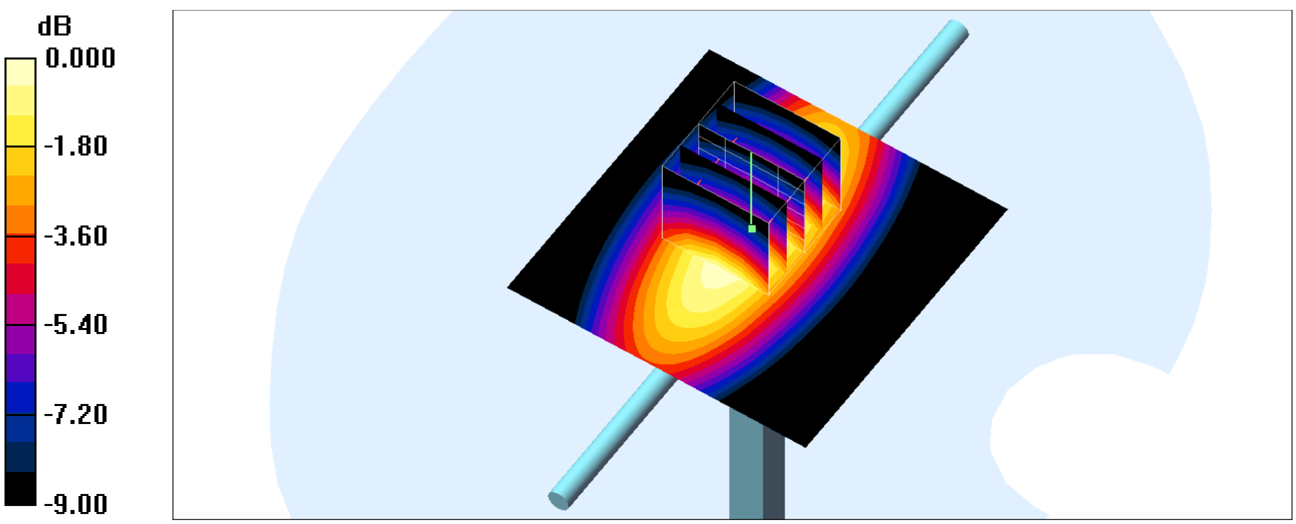
DUT: D835V2-4d162

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_850_140219 Medium parameters used: f = 835 MHz; σ = 0.963 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.05 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.0 V/m; Power Drift = 0.033 dB
Peak SAR (extrapolated) = 3.57 W/kg
SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.6 mW/g
Maximum value of SAR (measured) = 3.03 mW/g



0 dB = 3.03mW/g

System Check_Head_1750MHz_140220

DUT: D1750V2-1068

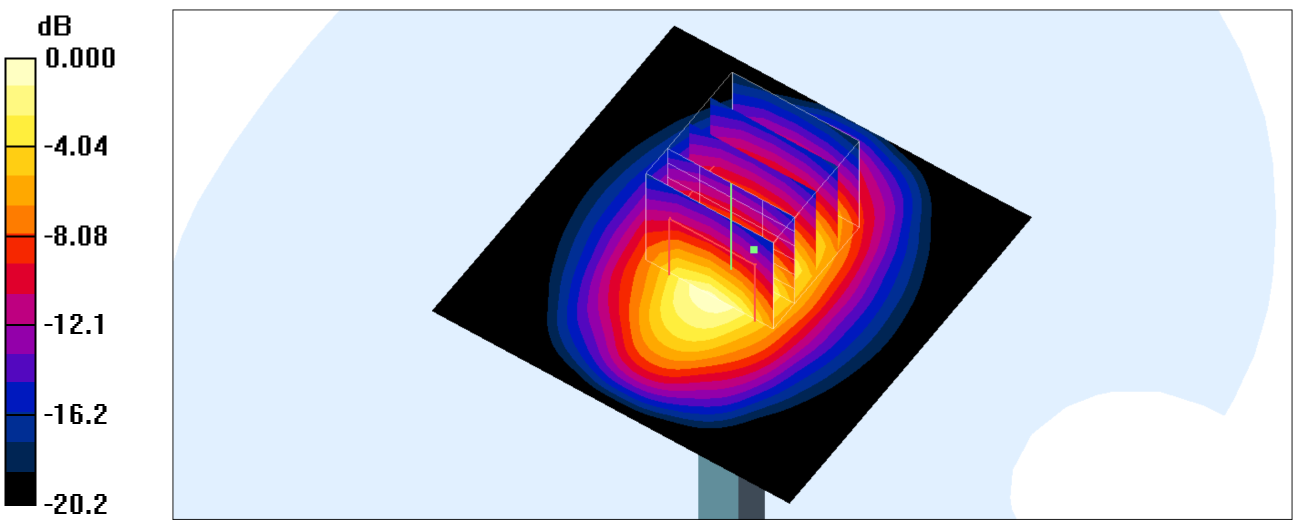
Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: HSL_1750_140220 Medium parameters used: f = 1750 MHz; σ = 1.39 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3

Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.82, 8.82, 8.82); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.1 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 99.5 V/m; Power Drift = -0.019 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.37 mW/g; SAR(10 g) = 4.91 mW/g
Maximum value of SAR (measured) = 13.2 mW/g



0 dB = 13.2mW/g

System Check_Body_1750MHz_140220

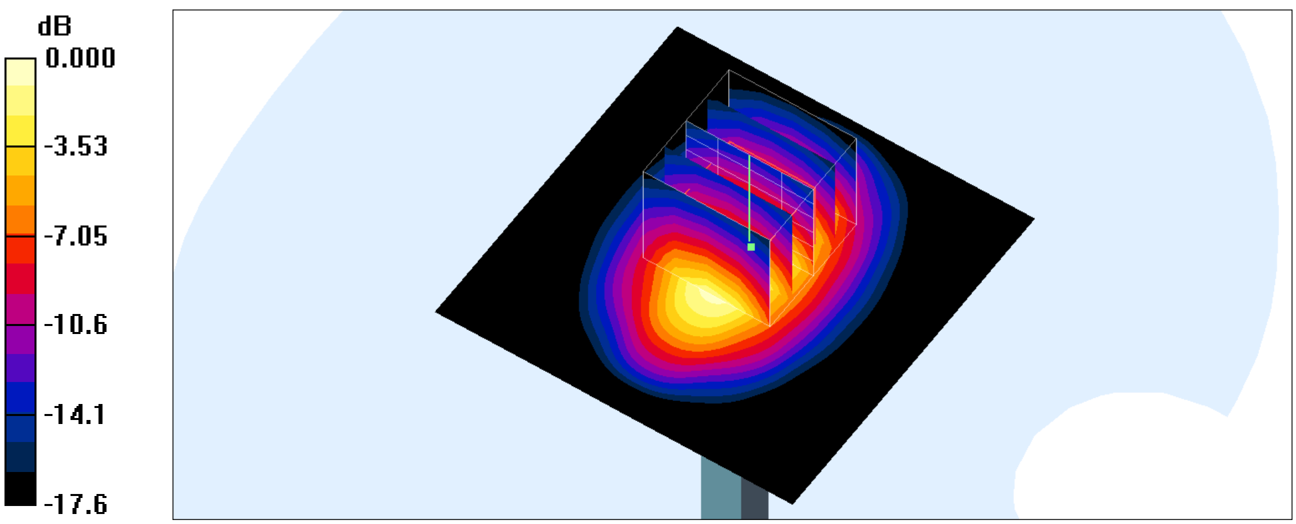
DUT: D1750V2-1068

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140220 Medium parameters used: f = 1750 MHz; σ = 1.55 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.99, 7.99, 7.99); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 13.8 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 93.3 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.36 mW/g; SAR(10 g) = 4.82 mW/g
Maximum value of SAR (measured) = 13.0 mW/g



0 dB = 13.0mW/g

System Check_Head_1900MHz_140219

DUT: D1900V2-5d182

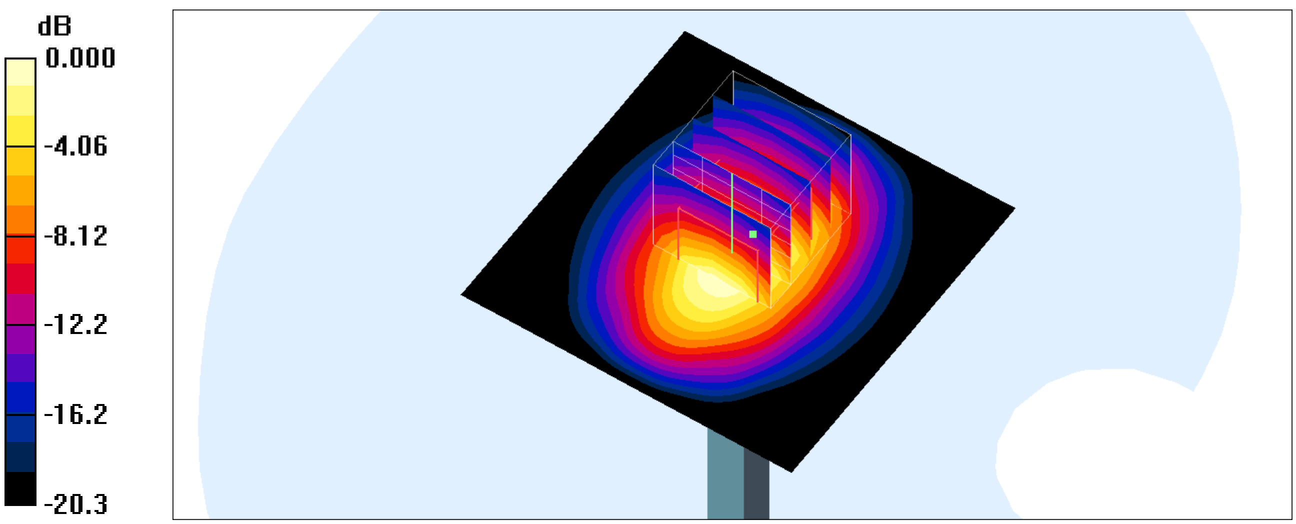
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_140219 Medium parameters used: f = 1900 MHz; σ = 1.43 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3

Ambient Temperature：23.2℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.4, 8.4, 8.4); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.6 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 105.8 V/m; Power Drift = 0.005 dB
Peak SAR (extrapolated) = 20.2 W/kg
SAR(1 g) = 10.8 mW/g; SAR(10 g) = 5.55 mW/g
Maximum value of SAR (measured) = 15.1 mW/g



0 dB = 15.1mW/g

System Check_Head_1900MHz_140220

DUT: D1900V2-5d182

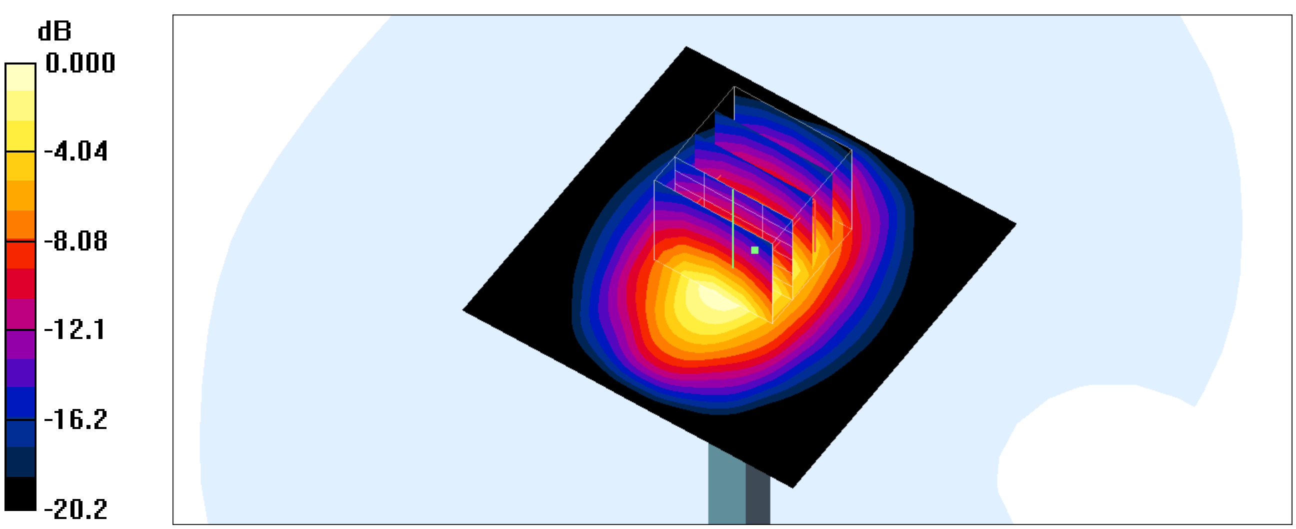
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_140220 Medium parameters used: f = 1900 MHz; σ = 1.45 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3

Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.4, 8.4, 8.4); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.3 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 104.4 V/m; Power Drift = 0.008 dB
Peak SAR (extrapolated) = 19.7 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.41 mW/g
Maximum value of SAR (measured) = 14.8 mW/g



0 dB = 14.8mW/g

System Check_Body_1900MHz_140218

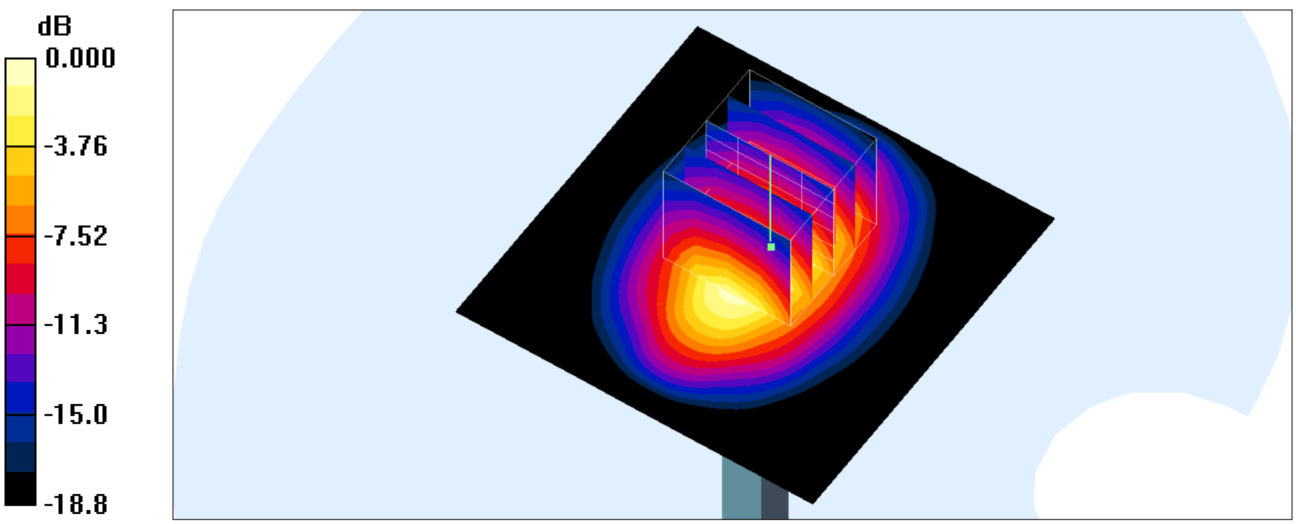
DUT: D1900V2-5d182

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140218 Medium parameters used: f = 1900 MHz; σ = 1.53 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.3 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 95.6 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.66 mW/g; SAR(10 g) = 4.99 mW/g
Maximum value of SAR (measured) = 13.4 mW/g



0 dB = 13.4mW/g

System Check_Body_1900MHz_140220

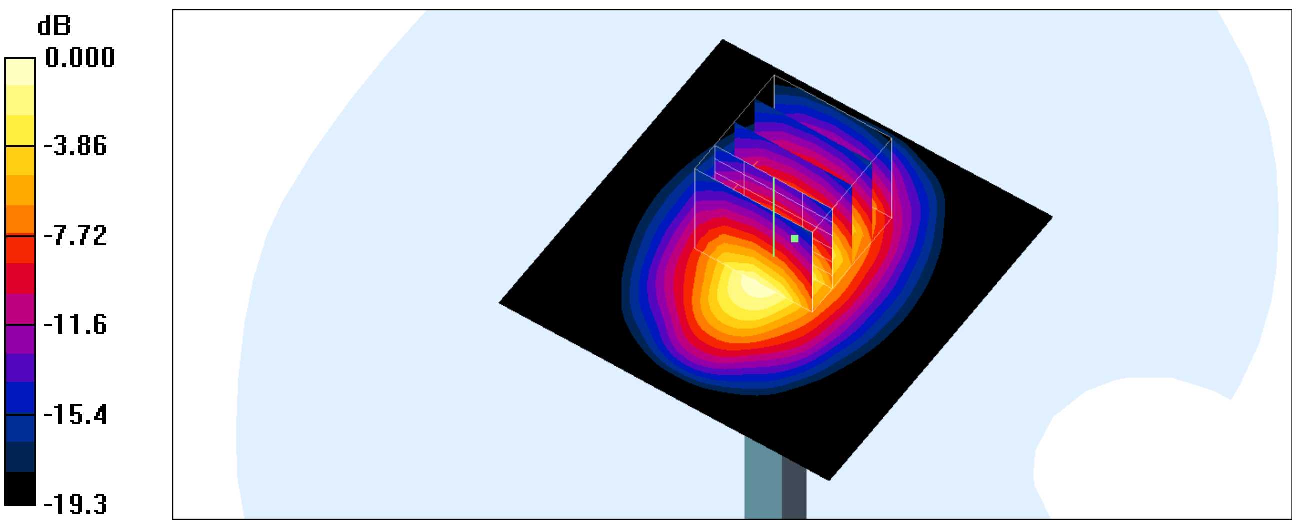
DUT: D1900V2-5d182

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140220 Medium parameters used: f = 1900 MHz; σ = 1.53 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 15.4 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.5 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 18.9 W/kg
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.35 mW/g
Maximum value of SAR (measured) = 14.4 mW/g



0 dB = 14.4mW/g

System Check_Head_2450MHz_140221

DUT: D2450V2-924

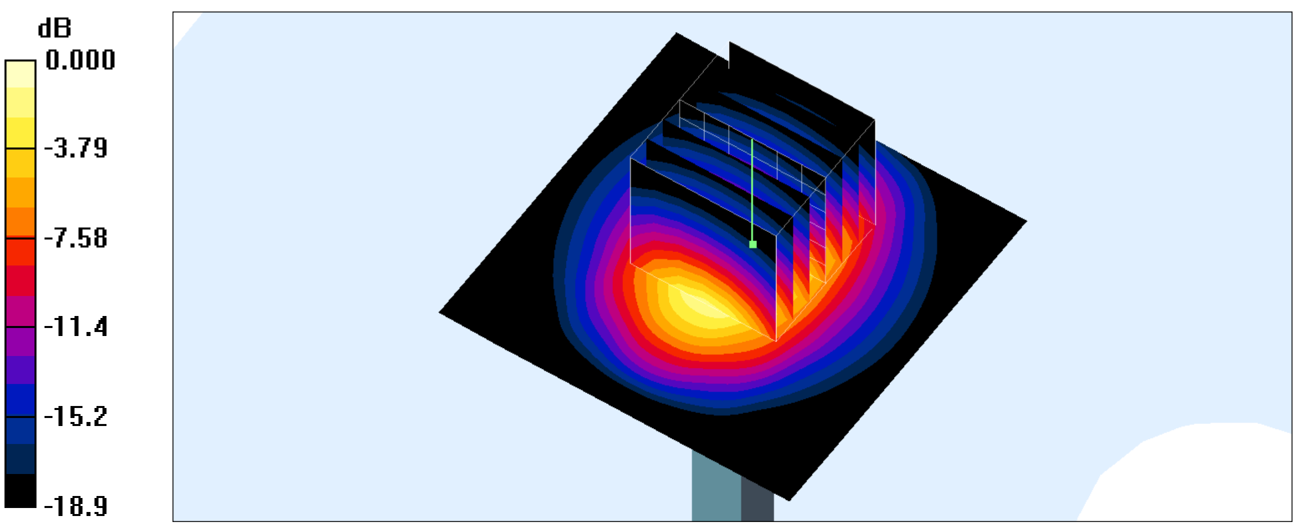
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450_140221 Medium parameters used: f = 2450 MHz; σ = 1.84 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3

Ambient Temperature：23.2℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.25, 7.25, 7.25); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 21.3 mW/g

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.6 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 5.84 mW/g
Maximum value of SAR (measured) = 19.7 mW/g



0 dB = 19.7mW/g

System Check_Body_2450MHz_140221

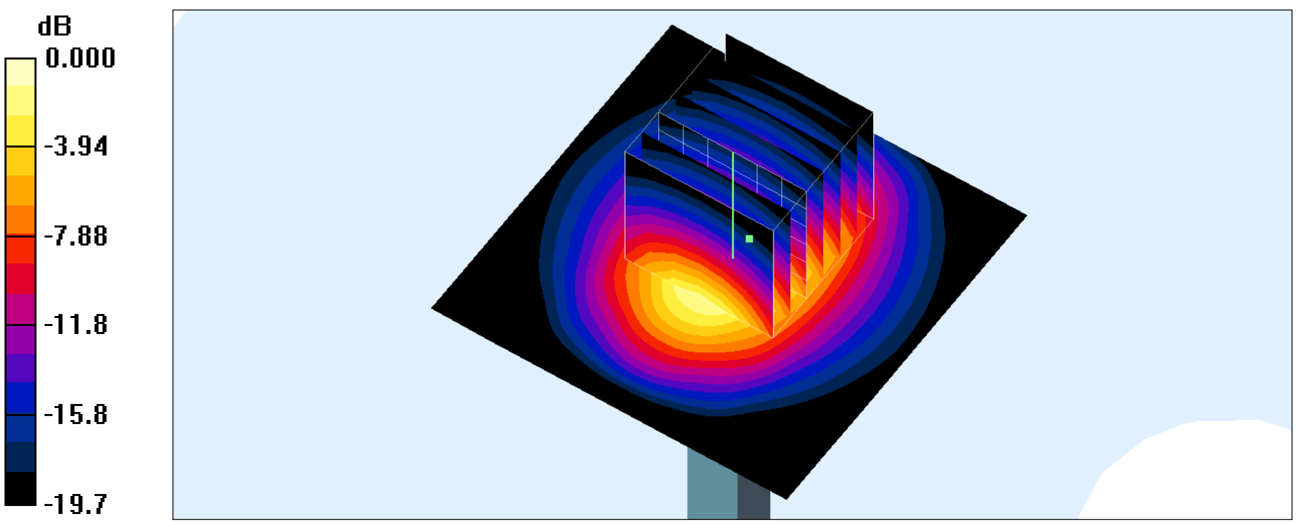
DUT: D2450V2-924

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_140221 Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.3 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.44, 7.44, 7.44); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 20.5 mW/g

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.8 V/m; Power Drift = 0.043 dB
Peak SAR (extrapolated) = 26.5 W/kg
SAR(1 g) = 12.3 mW/g; SAR(10 g) = 5.61 mW/g
Maximum value of SAR (measured) = 18.9 mW/g



0 dB = 18.9mW/g

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

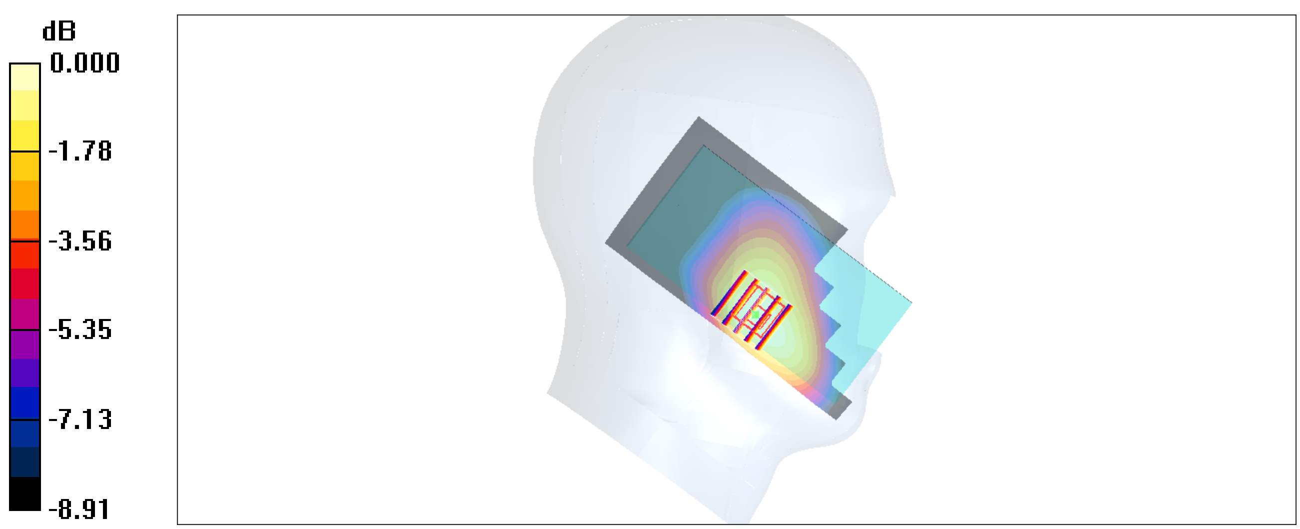
#01_GSM850_GPRS (2Tx slots)_Left Cheek_Ch128

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4.15
Medium: HSL_850_140219 Medium parameters used: f = 824.2 MHz; σ = 0.894 mho/m; ε_r = 41.2; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.87, 9.87, 9.87); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch128/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.238 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.3 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 0.259 W/kg
SAR(1 g) = 0.196 mW/g; SAR(10 g) = 0.146 mW/g
Maximum value of SAR (measured) = 0.225 mW/g



0 dB = 0.225mW/g

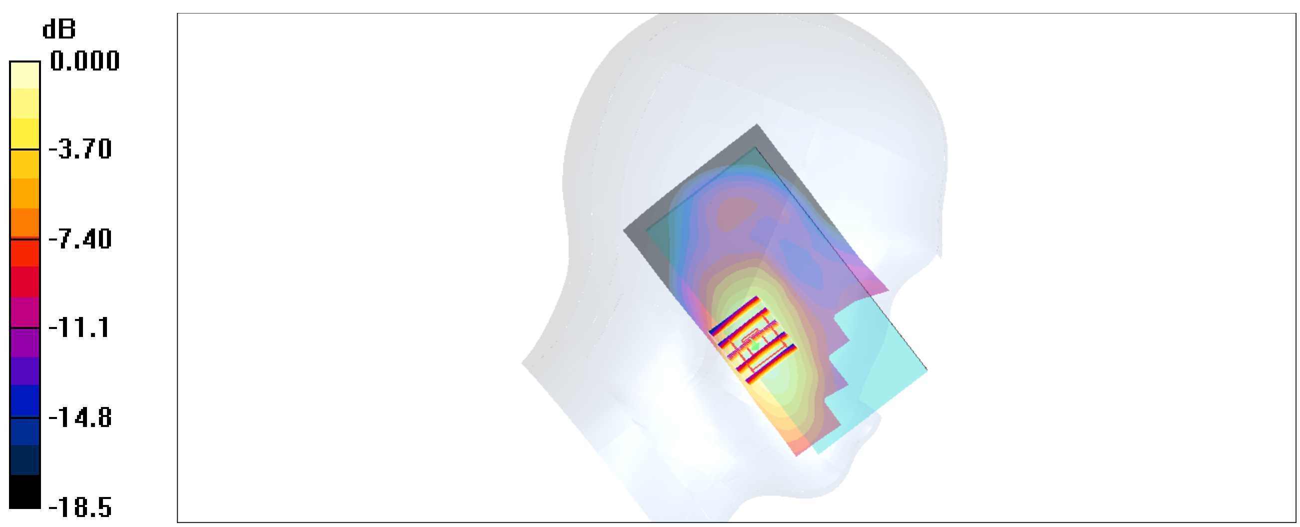
#02_GSM1900_GPRS (2Tx slots)_Left Cheek_Ch810

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15
Medium: HSL_1900_140220 Medium parameters used: f = 1910 MHz; σ = 1.46 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.4, 8.4, 8.4); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch810/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.327 mW/g

Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.8 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 0.376 W/kg
SAR(1 g) = 0.231 mW/g; SAR(10 g) = 0.136 mW/g
Maximum value of SAR (measured) = 0.307 mW/g



0 dB = 0.307mW/g

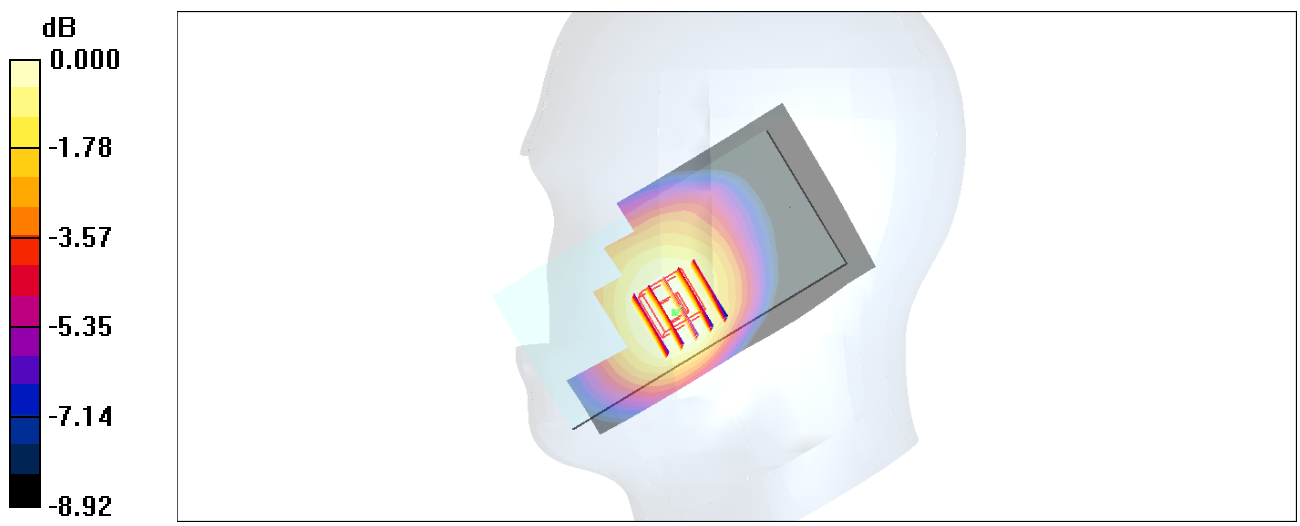
#03_WCDMA V_RMC 12.2Kbps_Right Cheek_Ch4182

Communication System: WCDMA; Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_850_140219 Medium parameters used : f = 836.4 MHz; σ = 0.906 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.87, 9.87, 9.87); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch4182/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.344 mW/g

Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.6 V/m; Power Drift = -0.016 dB
Peak SAR (extrapolated) = 0.352 W/kg
SAR(1 g) = 0.303 mW/g; SAR(10 g) = 0.245 mW/g
Maximum value of SAR (measured) = 0.334 mW/g



0 dB = 0.334mW/g

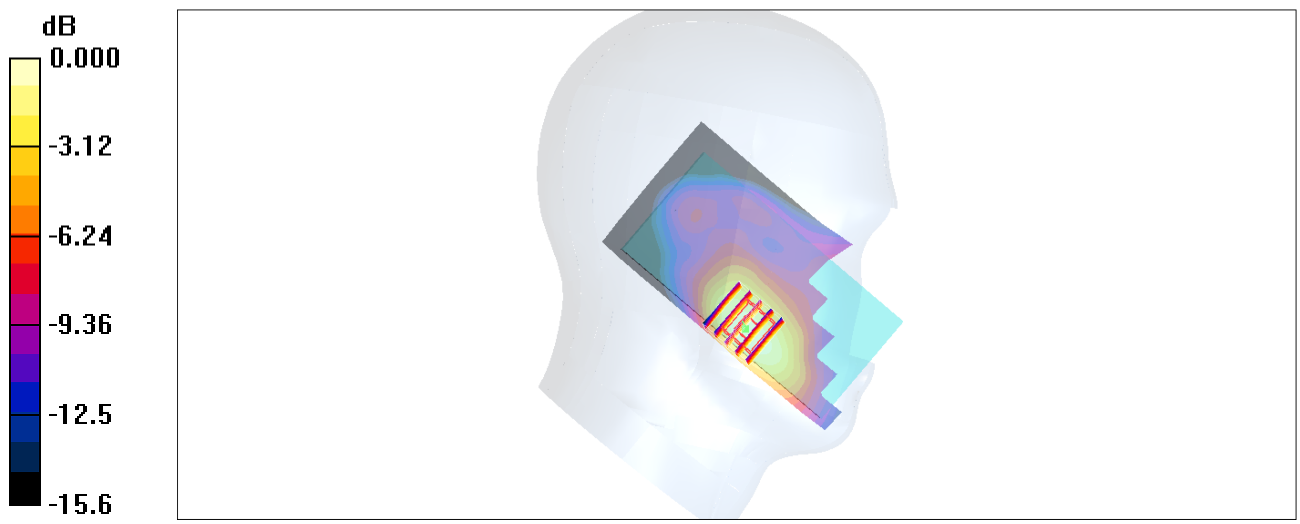
#04_WCDMA II_RMC 12.2Kbps_Left Cheek_Ch9262

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1
Medium: HSL_1900_140219 Medium parameters used: f = 1852.4 MHz; σ = 1.39 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Ambient Temperature：23.2℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.4, 8.4, 8.4); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch9262/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.619 mW/g

Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.2 V/m; Power Drift = -0.029 dB
Peak SAR (extrapolated) = 0.720 W/kg
SAR(1 g) = 0.474 mW/g; SAR(10 g) = 0.298 mW/g
Maximum value of SAR (measured) = 0.606 mW/g



0 dB = 0.606mW/g

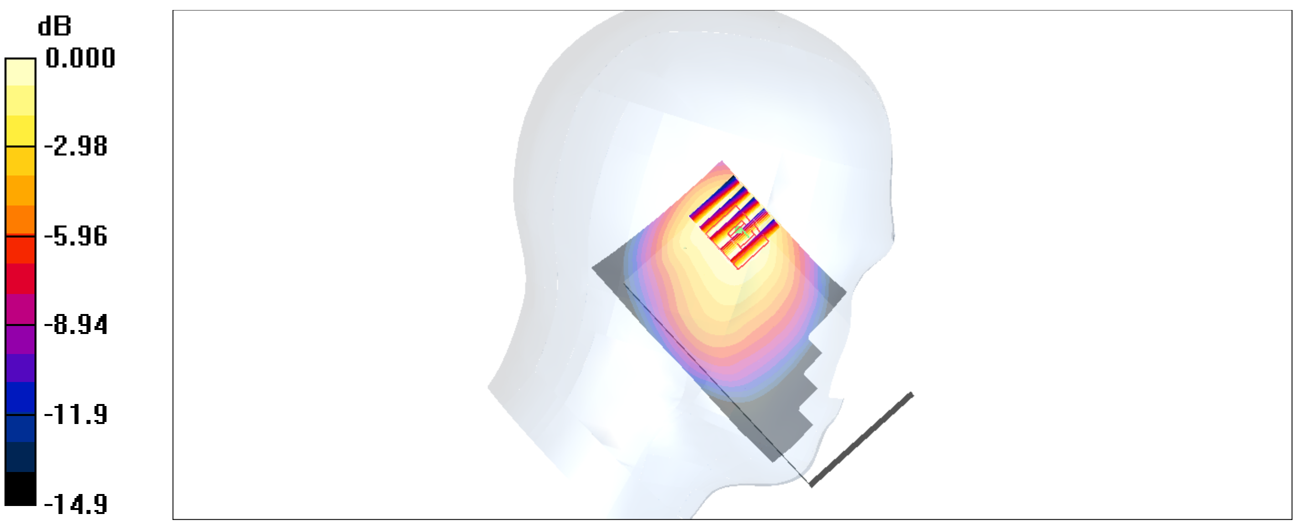
#05_LTE Band 17_10M_QPSK_1RB_49Offset_Left Cheek_Ch23780

Communication System: LTE; Frequency: 709 MHz;Duty Cycle: 1:1
Medium: HSL_750_140221 Medium parameters used: f = 709 MHz; σ = 0.861 mho/m; ε_r = 41.7; ρ = 1000 kg/m^3
Ambient Temperature：23.2℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(10.34, 10.34, 10.34); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch23780/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.588 mW/g

Ch23780/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.5 V/m; Power Drift = 0.095 dB
Peak SAR (extrapolated) = 0.747 W/kg
SAR(1 g) = 0.447 mW/g; SAR(10 g) = 0.301 mW/g
Maximum value of SAR (measured) = 0.565 mW/g



0 dB = 0.565mW/g

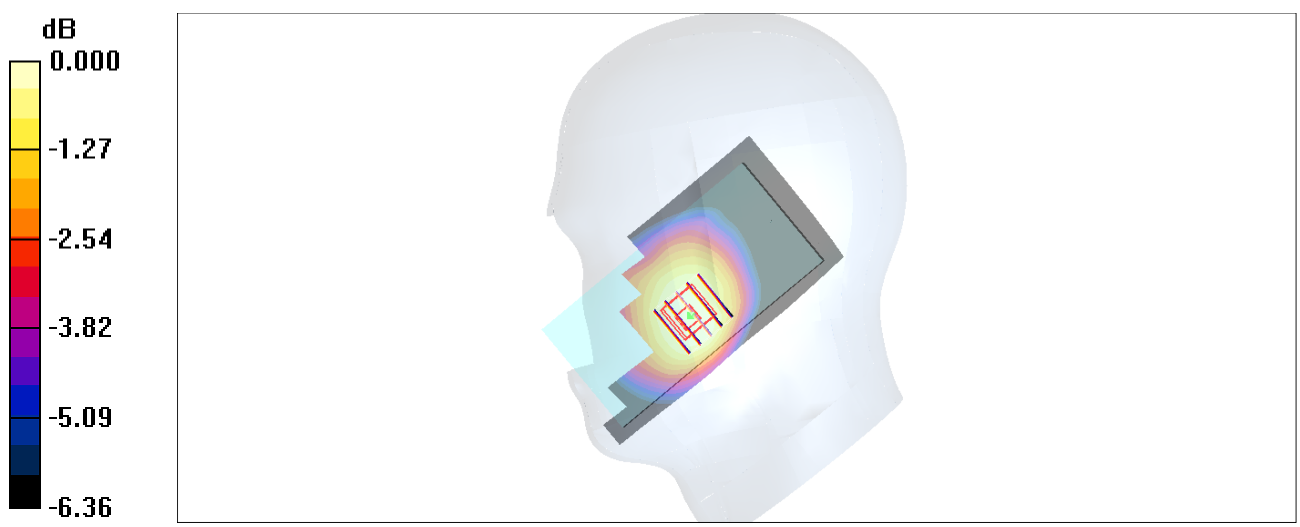
#06_LTE Band 5_10M_QPSK_1RB_49Offset_Right Cheek_Ch20450

Communication System: LTE; Frequency: 829 MHz;Duty Cycle: 1:1
Medium: HSL_850_140219 Medium parameters used: f = 829 MHz; $\sigma = 0.899$ mho/m; $\varepsilon_r = 41.2$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.87, 9.87, 9.87); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch20450/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.236 mW/g

Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.4 V/m; Power Drift = -0.047 dB
Peak SAR (extrapolated) = 0.242 W/kg
SAR(1 g) = 0.211 mW/g; SAR(10 g) = 0.172 mW/g
Maximum value of SAR (measured) = 0.230 mW/g



0 dB = 0.230mW/g

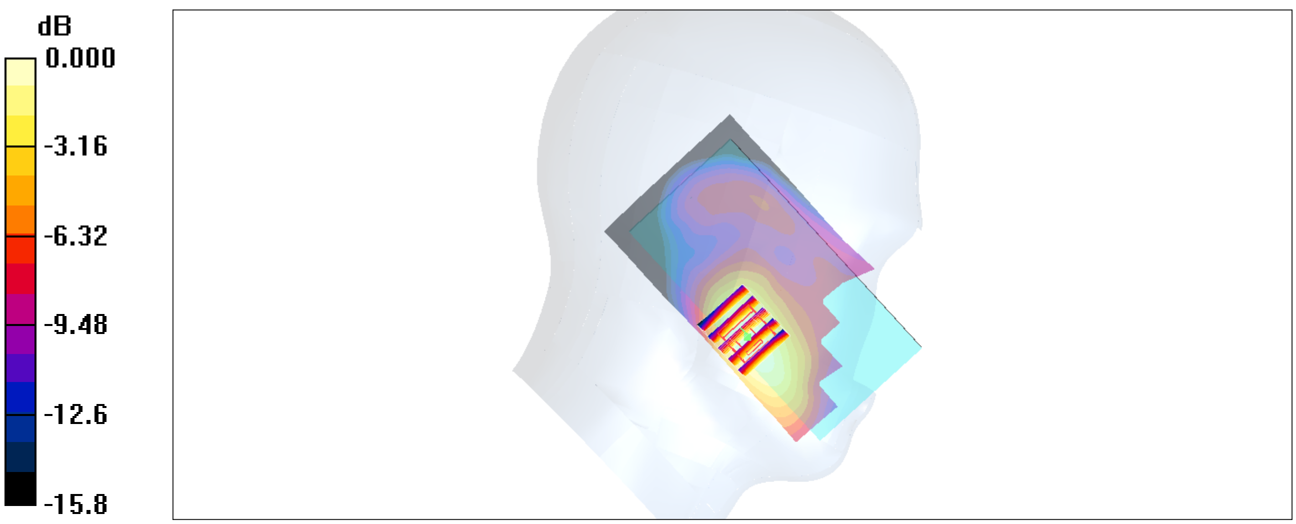
#07_LTE Band 4_20M_QPSK_1RB_49Offset_Left Cheek_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: HSL_1750_140220 Medium parameters used : f = 1732.5 MHz; σ = 1.38 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.82, 8.82, 8.82); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch20175/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.517 mW/g

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.9 V/m; Power Drift = 0.057 dB
Peak SAR (extrapolated) = 0.572 W/kg
SAR(1 g) = 0.378 mW/g; SAR(10 g) = 0.236 mW/g
Maximum value of SAR (measured) = 0.473 mW/g



0 dB = 0.473mW/g

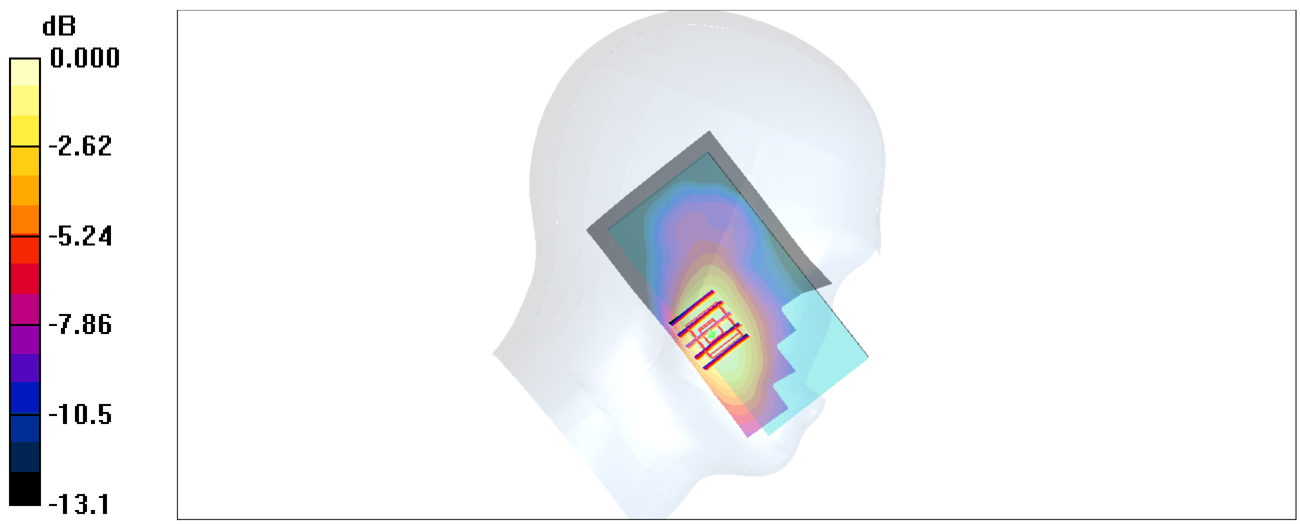
#08_LTE Band 2_20M_QPSK_1RB_49Offset_Left Cheek_Ch18700

Communication System: LTE; Frequency: 1860 MHz;Duty Cycle: 1:1
Medium: HSL_1900_140220 Medium parameters used: f = 1860 MHz; σ = 1.4 mho/m; ε_r = 38.3; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(8.4, 8.4, 8.4); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch18700/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.440 mW/g

Ch18700/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.3 V/m; Power Drift = 0.069 dB
Peak SAR (extrapolated) = 0.488 W/kg
SAR(1 g) = 0.331 mW/g; SAR(10 g) = 0.213 mW/g
Maximum value of SAR (measured) = 0.419 mW/g



0 dB = 0.419mW/g

#09_WLAN2.4GHz_802.11b 1Mbps_Right Cheek_Ch6

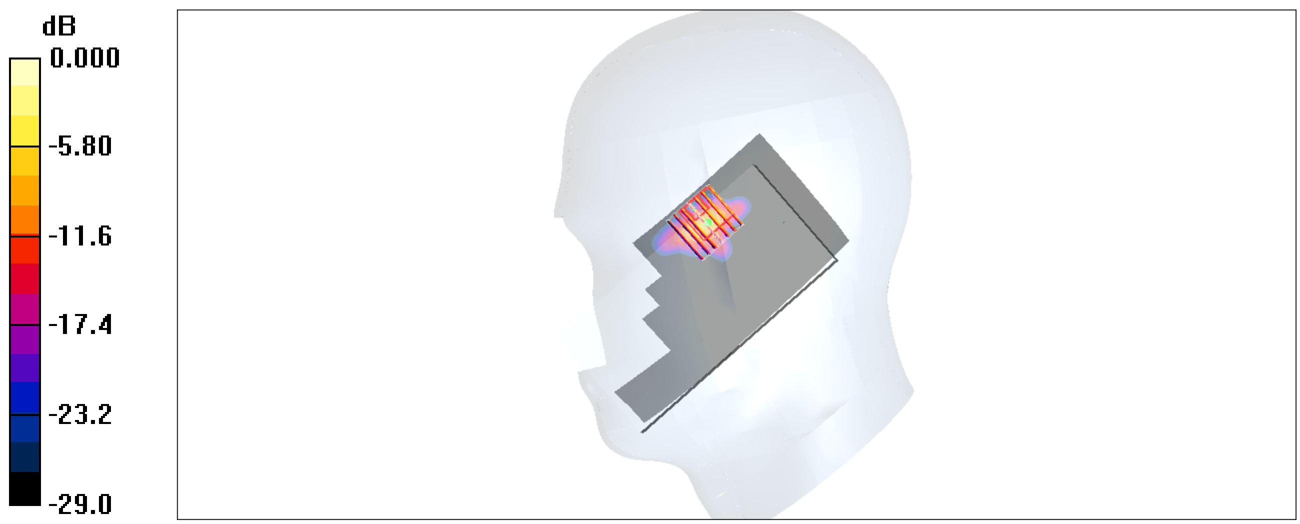
Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.024
Medium: HSL_2450_140221 Medium parameters used: f = 2437 MHz; σ = 1.82 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3

Ambient Temperature：23.2℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.25, 7.25, 7.25); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Left; Type: SAM; Serial: TP-1150
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (71x141x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.035 mW/g

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.14 V/m; Power Drift = -0.016 dB
Peak SAR (extrapolated) = 0.220 W/kg
SAR(1 g) = 0.105 mW/g; SAR(10 g) = 0.052 mW/g
Maximum value of SAR (measured) = 0.160 mW/g



0 dB = 0.160mW/g

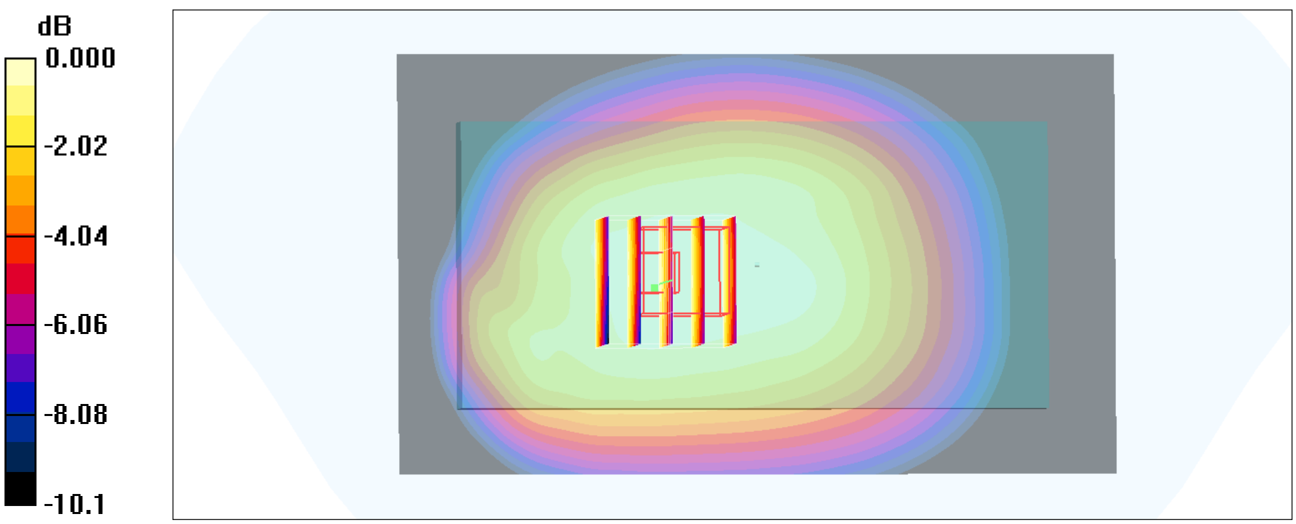
#10_GSM850_GPRS (2Tx slots)_Back_1cm_Ch128

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4.15
Medium: MSL_850_140219 Medium parameters used: f = 824.2 MHz; σ = 0.953 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch128/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.537 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.9 V/m; Power Drift = -0.131 dB
Peak SAR (extrapolated) = 0.610 W/kg
SAR(1 g) = 0.494 mW/g; SAR(10 g) = 0.387 mW/g
Maximum value of SAR (measured) = 0.556 mW/g



0 dB = 0.556mW/g

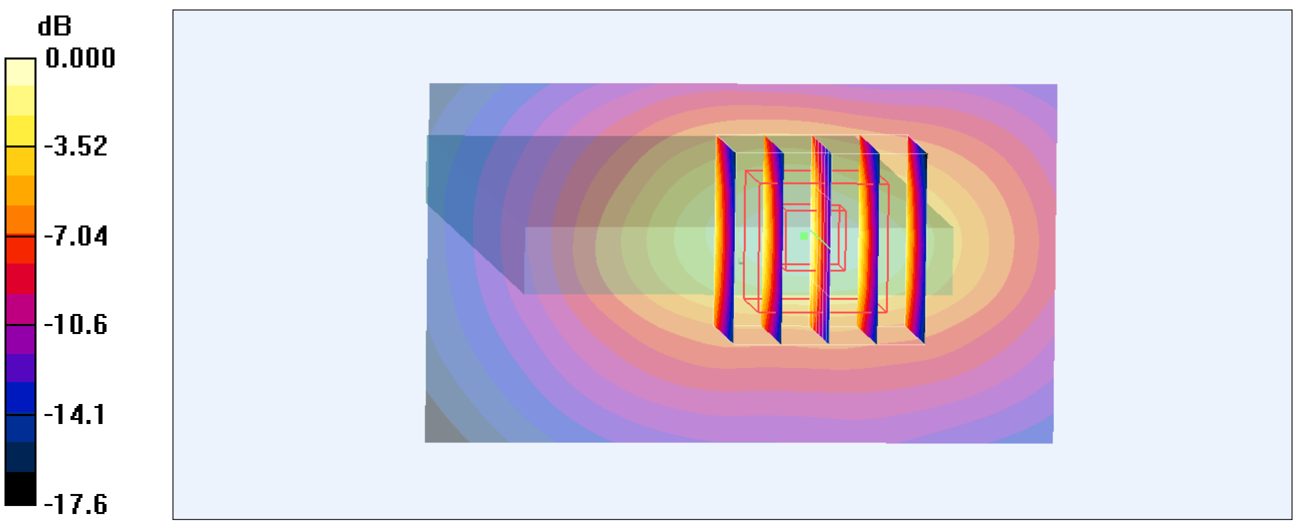
#11_GSM1900_GPRS (2Tx slots)_Bottom Side_1cm_Ch810

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15
Medium: MSL_1900_140220 Medium parameters used: f = 1910 MHz; σ = 1.54 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch810/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.756 mW/g

Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.2 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.976 W/kg
SAR(1 g) = 0.580 mW/g; SAR(10 g) = 0.314 mW/g
Maximum value of SAR (measured) = 0.793 mW/g



0 dB = 0.793mW/g

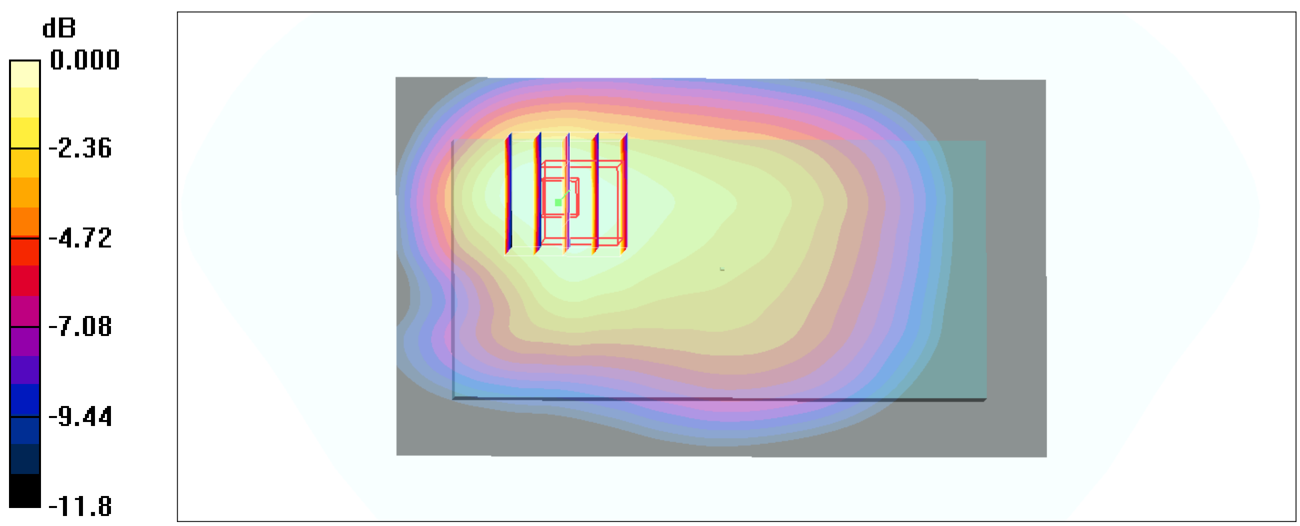
#12_WCDMA V_RMC 12.2Kbps_Front_1cm_Ch4182

Communication System: WCDMA; Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: MSL_850_140219 Medium parameters used : f = 836.4 MHz; σ = 0.964 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch4182/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.639 mW/g

Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.7 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 0.711 W/kg
SAR(1 g) = 0.498 mW/g; SAR(10 g) = 0.343 mW/g
Maximum value of SAR (measured) = 0.610 mW/g



0 dB = 0.610mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/2/18

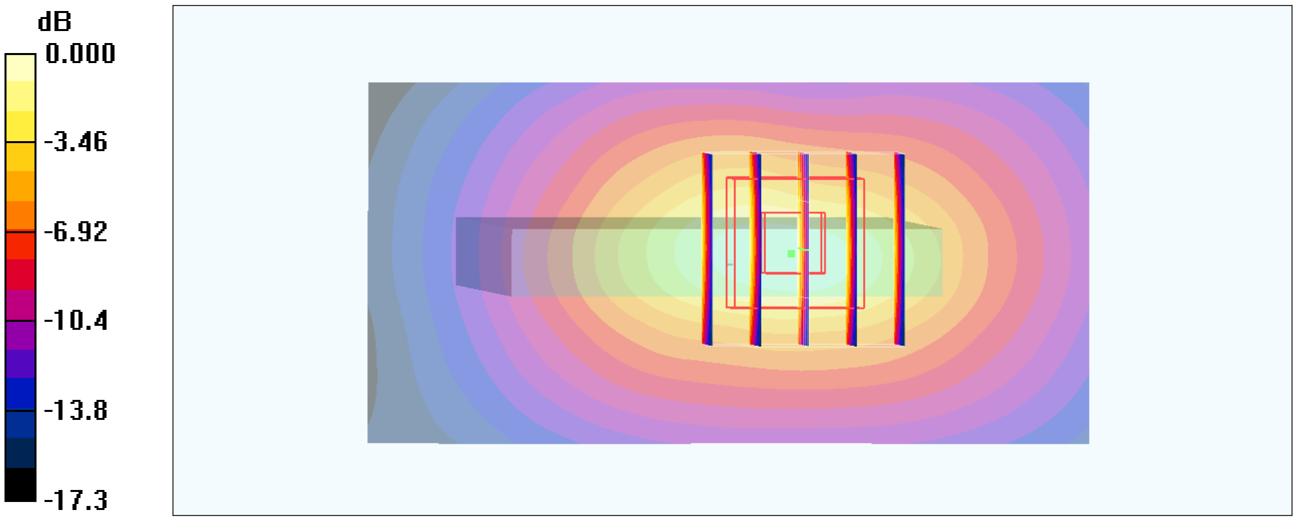
#13_WCDMA II_RMC 12.2Kbps_Bottom Side_1cm_Ch9400

Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140218 Medium parameters used: f = 1880 MHz; σ = 1.51 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch9400/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.14 mW/g

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.1 V/m; Power Drift = -0.065 dB
Peak SAR (extrapolated) = 1.40 W/kg
SAR(1 g) = 0.834 mW/g; SAR(10 g) = 0.449 mW/g
Maximum value of SAR (measured) = 1.16 mW/g



0 dB = 1.16mW/g

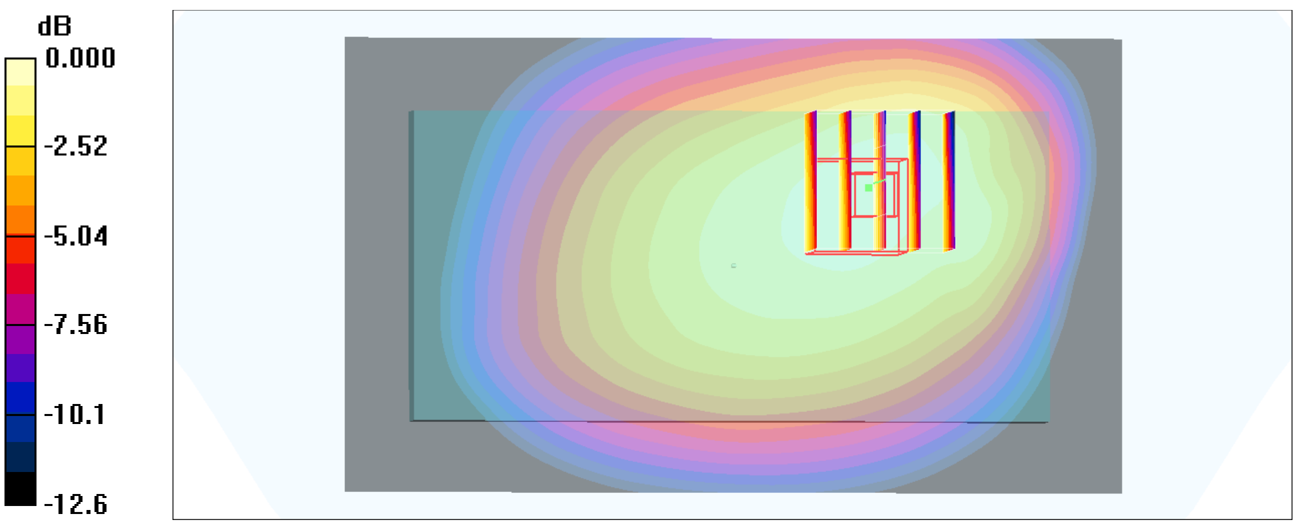
#14_LTE Band 17_10M_QPSK_1RB_49Offset_Back_1cm_Ch23780

Communication System: LTE; Frequency: 709 MHz;Duty Cycle: 1:1
Medium: MSL_750_140221 Medium parameters used: f = 709 MHz; σ = 0.935 mho/m; ε_r = 55.2; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(10.24, 10.24, 10.24); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch23780/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.648 mW/g

Ch23780/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.2 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 0.777 W/kg
SAR(1 g) = 0.552 mW/g; SAR(10 g) = 0.404 mW/g
Maximum value of SAR (measured) = 0.664 mW/g



0 dB = 0.664mW/g

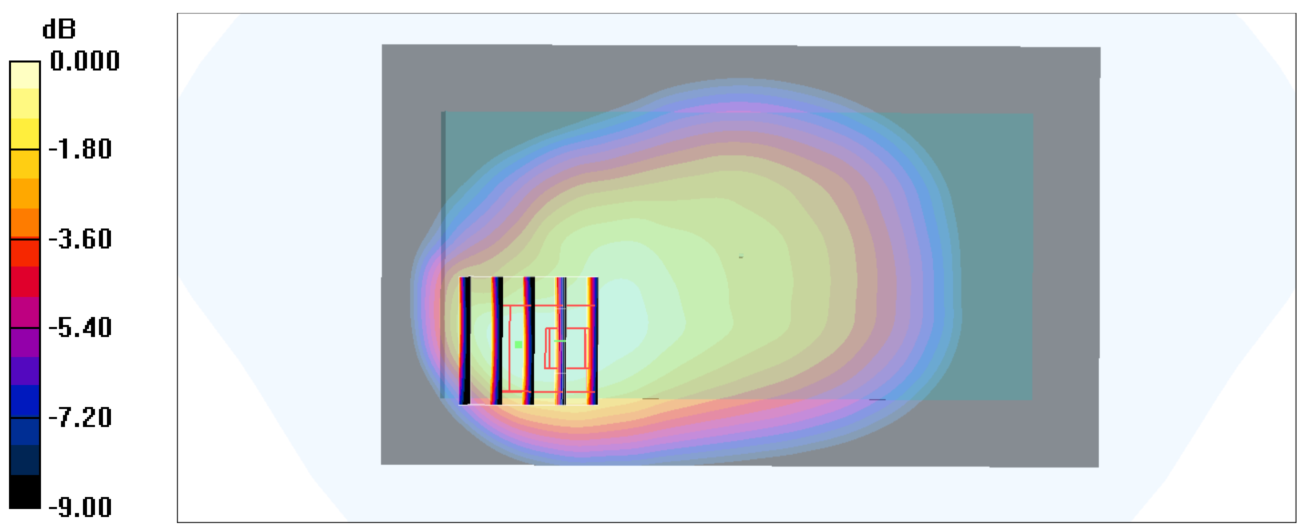
#15_LTE Band 5_10M_QPSK_1RB_49Offset_Back_1cm_Ch20450

Communication System: LTE; Frequency: 829 MHz;Duty Cycle: 1:1
Medium: MSL_850_140219 Medium parameters used: f = 829 MHz; σ = 0.957 mho/m; ε_r = 54.6; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch20450/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.648 mW/g

Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.2 V/m; Power Drift = -0.016 dB
Peak SAR (extrapolated) = 0.713 W/kg
SAR(1 g) = 0.461 mW/g; SAR(10 g) = 0.294 mW/g
Maximum value of SAR (measured) = 0.583 mW/g



0 dB = 0.583mW/g

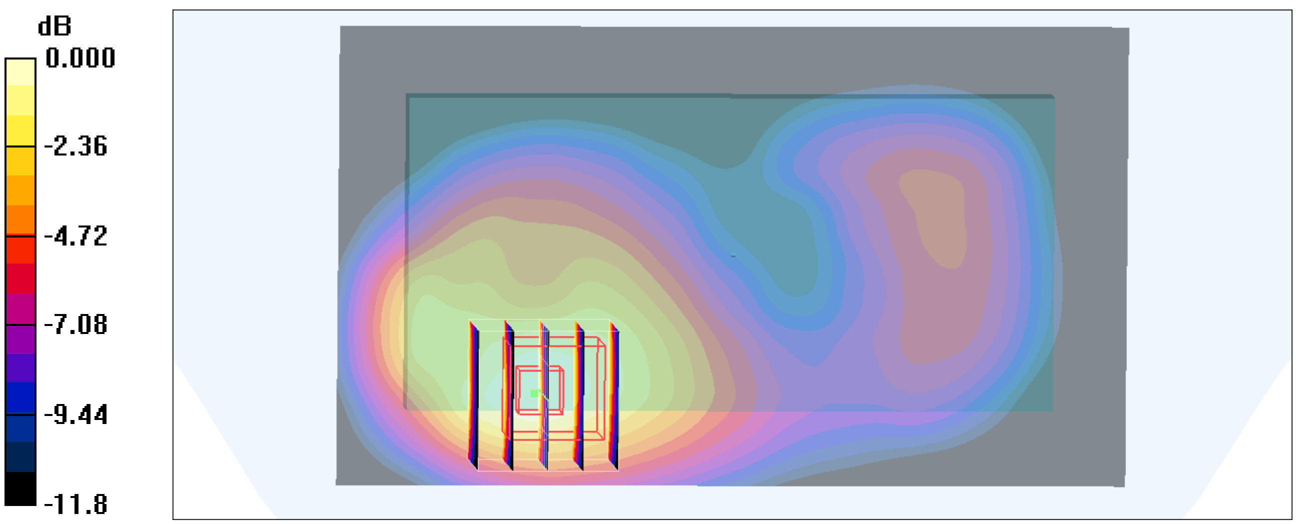
#16_LTE Band 4_20M_QPSK_1RB_49Offset_Back_1cm_Ch20300

Communication System: LTE; Frequency: 1745 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140220 Medium parameters used: f = 1745 MHz; σ = 1.54 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.99, 7.99, 7.99); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch20300/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.06 mW/g

Ch20300/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.3 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 0.813 mW/g; SAR(10 g) = 0.491 mW/g
Maximum value of SAR (measured) = 1.06 mW/g



0 dB = 1.06mW/g

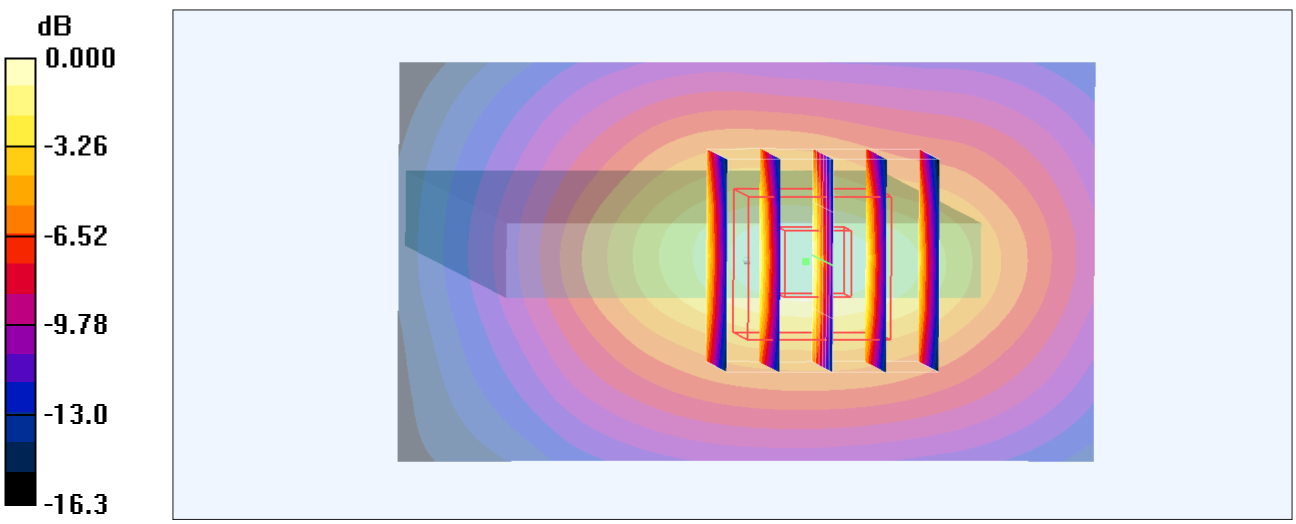
#17_LTE Band 2_20M_QPSK_1RB_49Offset_Bottom Side_1cm_Ch18900

Communication System: LTE; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140220 Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch18900/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.19 mW/g

Ch18900/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.1 V/m; Power Drift = 0.000 dB
Peak SAR (extrapolated) = 1.40 W/kg
SAR(1 g) = 0.863 mW/g; SAR(10 g) = 0.479 mW/g
Maximum value of SAR (measured) = 1.16 mW/g



0 dB = 1.16mW/g

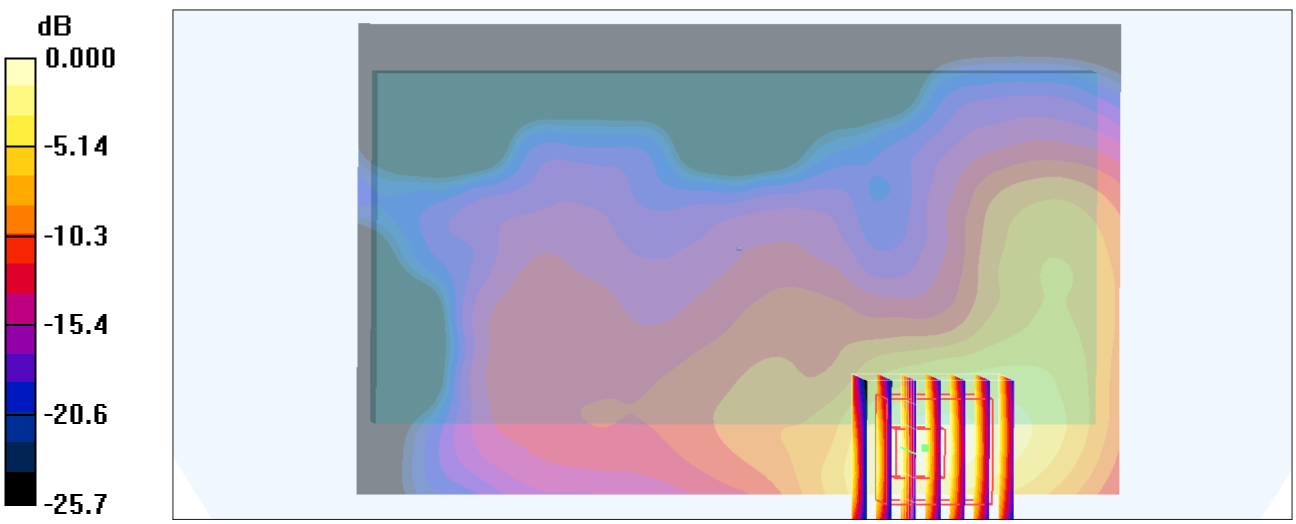
#18_WLAN2.4GHz_802.11b 1Mbps_Back_1cm_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.024
Medium: MSL_2450_140221 Medium parameters used: f = 2437 MHz; σ = 1.91 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.3 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.44, 7.44, 7.44); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (81x131x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.625 mW/g

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.4 V/m; Power Drift = 0.044 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.478 mW/g; SAR(10 g) = 0.223 mW/g
Maximum value of SAR (measured) = 0.714 mW/g



0 dB = 0.714mW/g

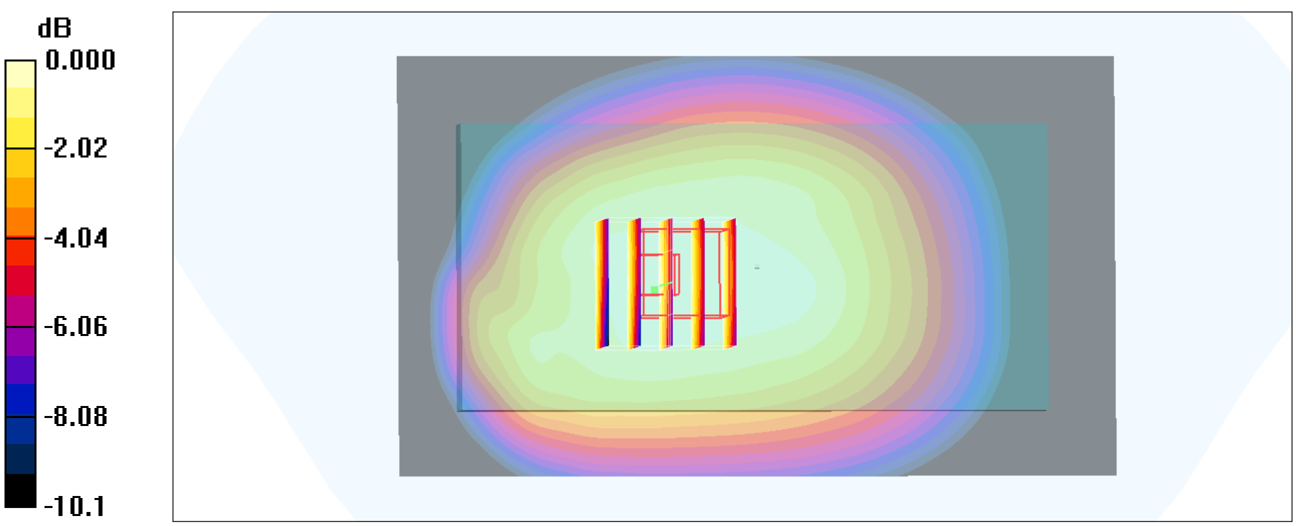
#19_GSM850_GPRS (2Tx slots)_Back_1cm_Ch128

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4.15
Medium: MSL_850_140219 Medium parameters used: f = 824.2 MHz; σ = 0.953 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch128/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.537 mW/g

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.9 V/m; Power Drift = -0.131 dB
Peak SAR (extrapolated) = 0.610 W/kg
SAR(1 g) = 0.494 mW/g; SAR(10 g) = 0.387 mW/g
Maximum value of SAR (measured) = 0.556 mW/g



0 dB = 0.556mW/g

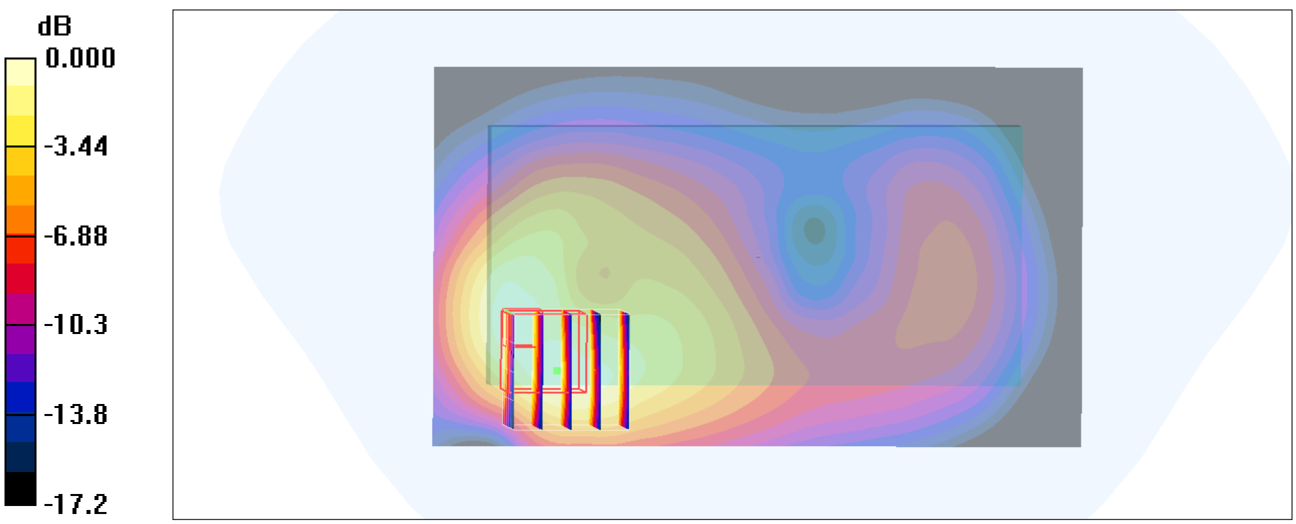
#20_GSM1900_GPRS (2Tx slots)_Back_1cm_Ch810

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15
Medium: MSL_1900_140220 Medium parameters used: f = 1910 MHz; σ = 1.54 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch810/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.586 mW/g

Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.0 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.781 W/kg
SAR(1 g) = 0.455 mW/g; SAR(10 g) = 0.251 mW/g
Maximum value of SAR (measured) = 0.628 mW/g



0 dB = 0.628mW/g

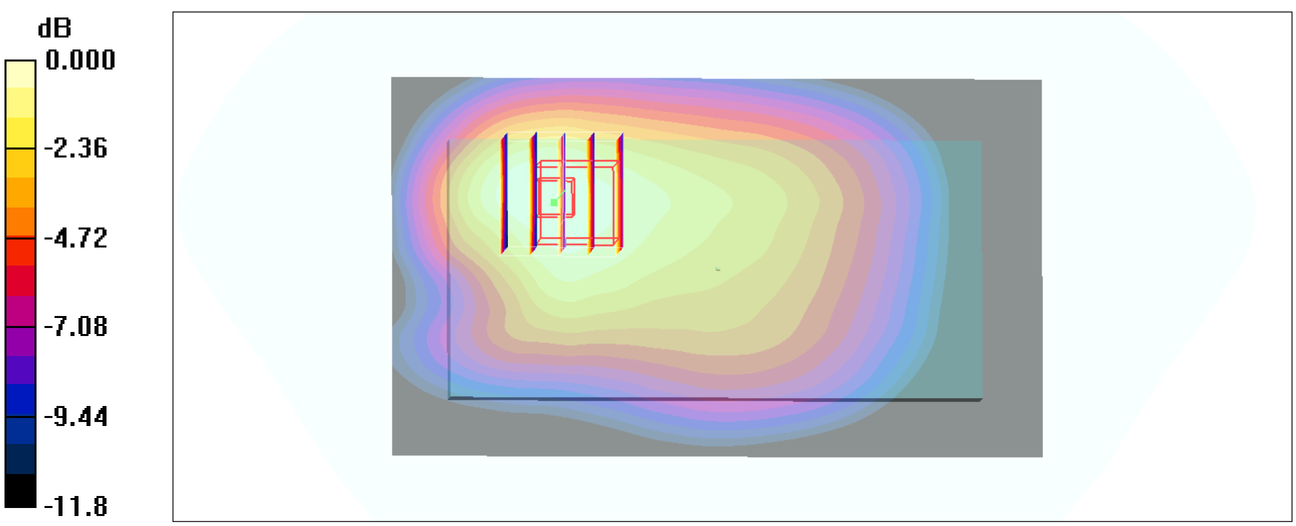
#21_WCDMA V_RMC 12.2Kbps_Front_1cm_Ch4182

Communication System: WCDMA; Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: MSL_850_140219 Medium parameters used : f = 836.4 MHz; σ = 0.964 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch4182/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.639 mW/g

Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.7 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 0.711 W/kg
SAR(1 g) = 0.498 mW/g; SAR(10 g) = 0.343 mW/g
Maximum value of SAR (measured) = 0.610 mW/g



0 dB = 0.610mW/g

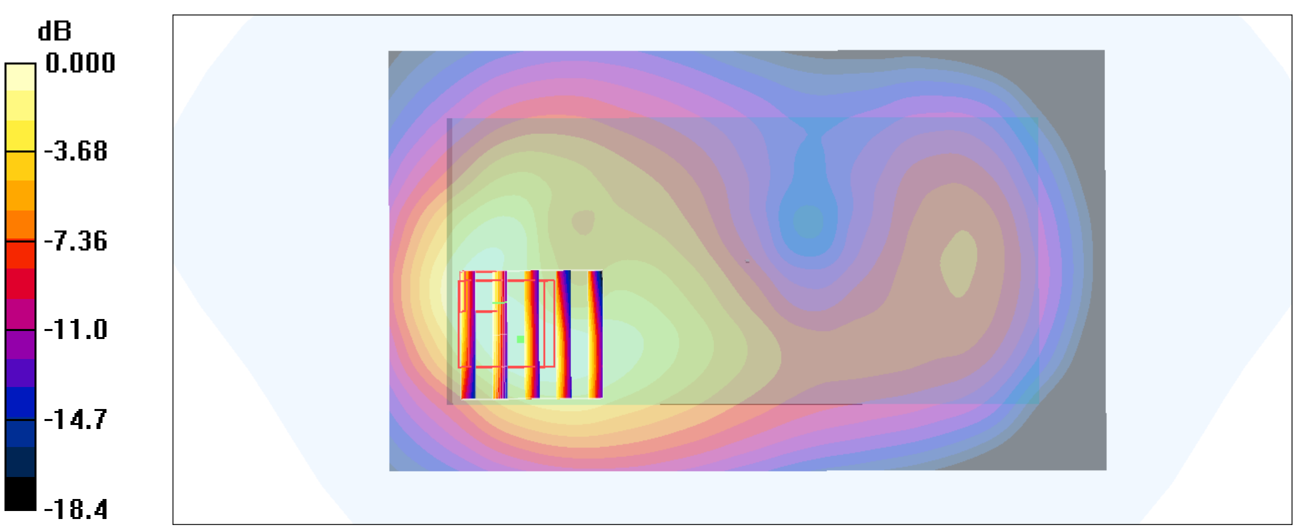
#22_WCDMA II_RMC 12.2Kbps_Back_1cm_Ch9400

Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140218 Medium parameters used: f = 1880 MHz; σ = 1.51 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch9400/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.05 mW/g

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.6 V/m; Power Drift = -0.022 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.742 mW/g; SAR(10 g) = 0.409 mW/g
Maximum value of SAR (measured) = 0.966 mW/g



0 dB = 0.966mW/g

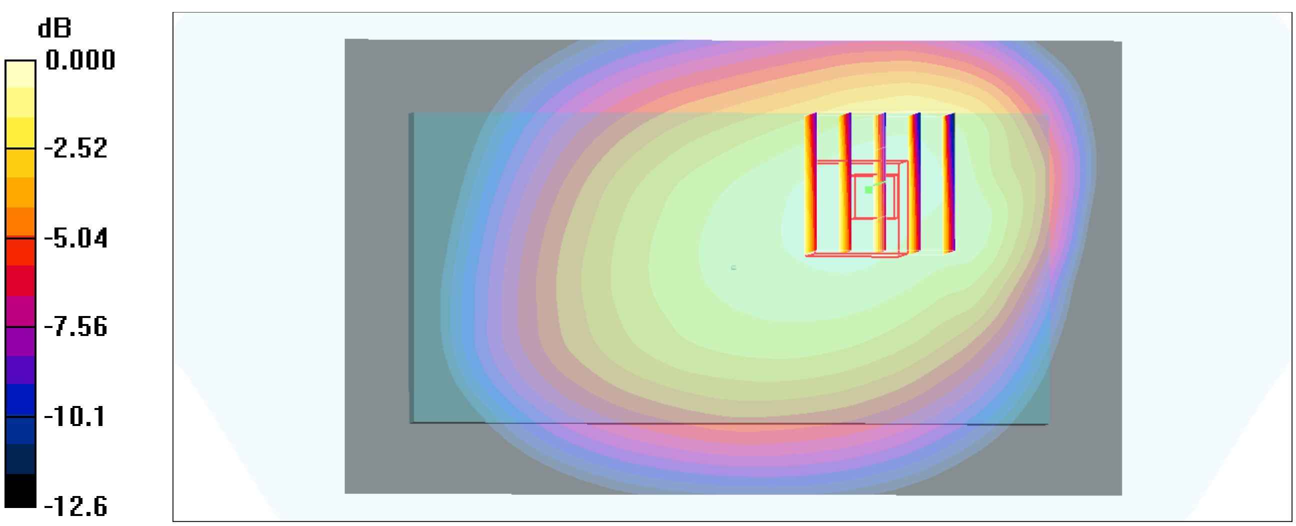
#23_LTE Band 17_10M_QPSK_1RB_49Offset_Back_1cm_Ch23780

Communication System: LTE; Frequency: 709 MHz;Duty Cycle: 1:1
Medium: MSL_750_140221 Medium parameters used: f = 709 MHz; σ = 0.935 mho/m; ε_r = 55.2; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(10.24, 10.24, 10.24); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch23780/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.648 mW/g

Ch23780/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.2 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 0.777 W/kg
SAR(1 g) = 0.552 mW/g; SAR(10 g) = 0.404 mW/g
Maximum value of SAR (measured) = 0.664 mW/g



0 dB = 0.664mW/g

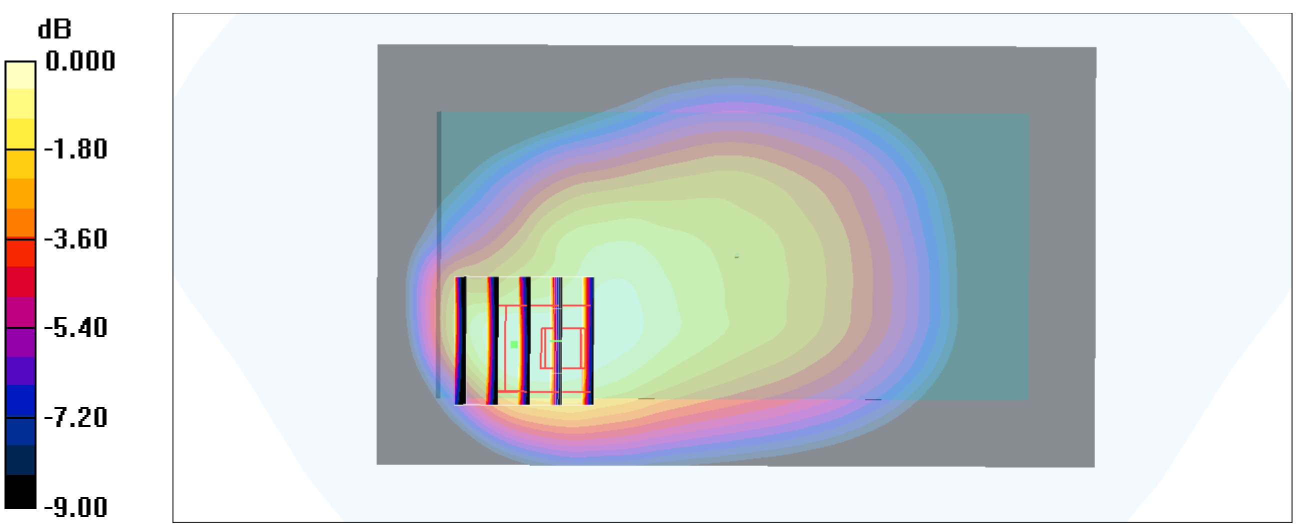
#24_LTE Band 5_10M_QPSK_1RB_49Offset_Back_1cm_Ch20450

Communication System: LTE; Frequency: 829 MHz;Duty Cycle: 1:1
Medium: MSL_850_140219 Medium parameters used: f = 829 MHz; σ = 0.957 mho/m; ε_r = 54.6; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(9.66, 9.66, 9.66); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch20450/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.648 mW/g

Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.2 V/m; Power Drift = -0.016 dB
Peak SAR (extrapolated) = 0.713 W/kg
SAR(1 g) = 0.461 mW/g; SAR(10 g) = 0.294 mW/g
Maximum value of SAR (measured) = 0.583 mW/g



0 dB = 0.583mW/g

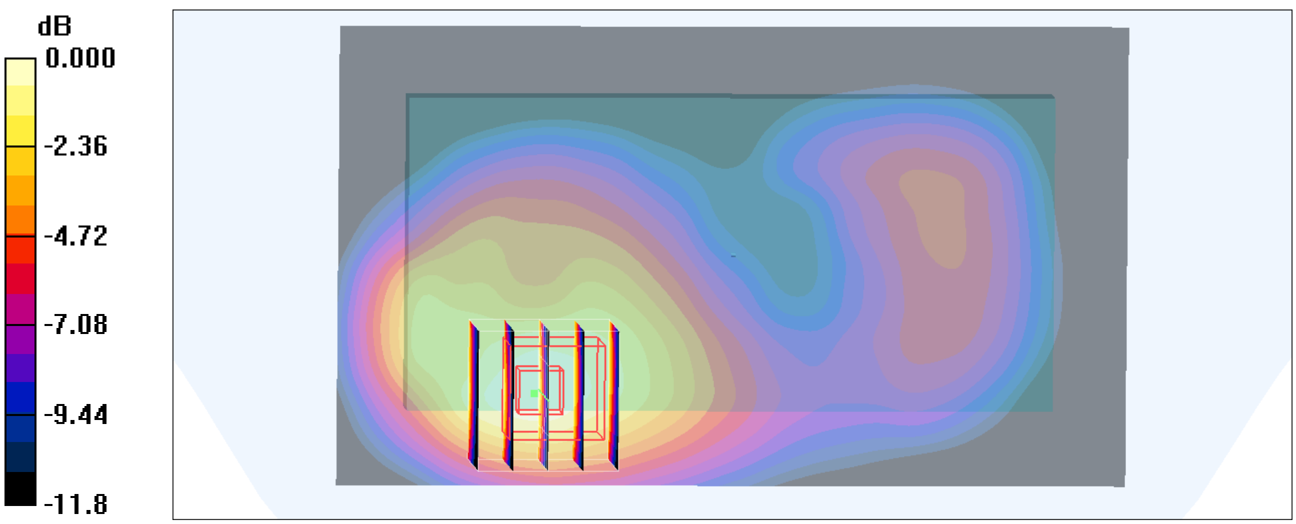
#25_LTE Band 4_20M_QPSK_1RB_49Offset_Back_1cm_Ch20300

Communication System: LTE; Frequency: 1745 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140220 Medium parameters used: f = 1745 MHz; σ = 1.54 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.5 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.99, 7.99, 7.99); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch20300/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.06 mW/g

Ch20300/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.3 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 0.813 mW/g; SAR(10 g) = 0.491 mW/g
Maximum value of SAR (measured) = 1.06 mW/g



0 dB = 1.06mW/g

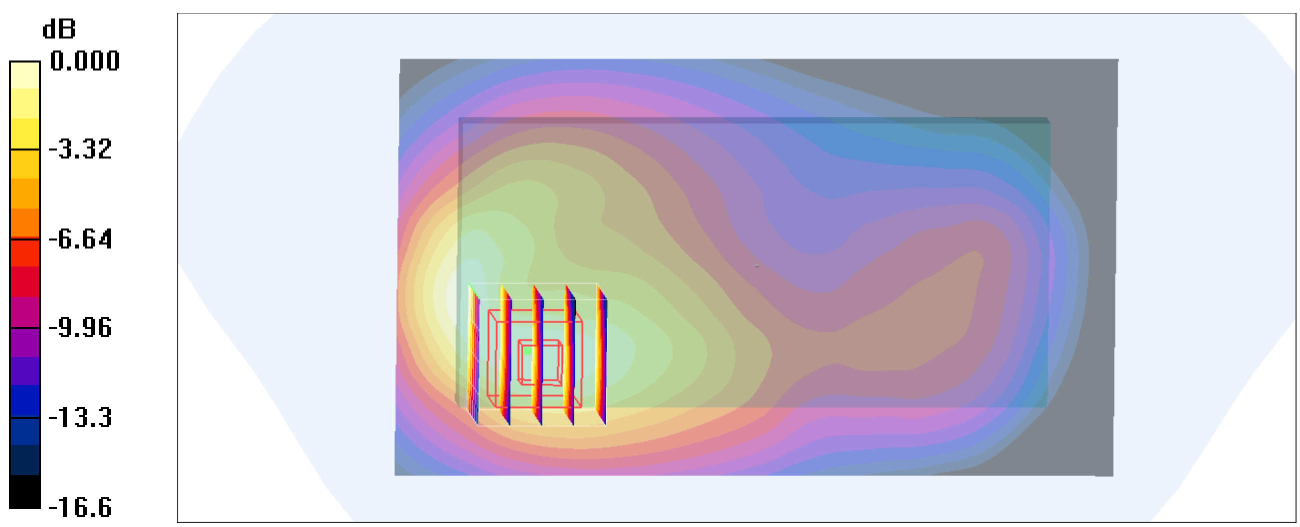
#26_LTE Band 2_20M_QPSK_1RB_49Offset_Back_1cm_Ch18700

Communication System: LTE; Frequency: 1860 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140220 Medium parameters used: f = 1860 MHz; σ = 1.5 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Ambient Temperature：23.7℃; Liquid Temperature：22.7 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3931; ConvF(7.61, 7.61, 7.61); Calibrated: 2013/9/10
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch18700/Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.865 mW/g

Ch18700/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.1 V/m; Power Drift = -0.028 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.633 mW/g; SAR(10 g) = 0.368 mW/g
Maximum value of SAR (measured) = 0.837 mW/g



0 dB = 0.837mW/g

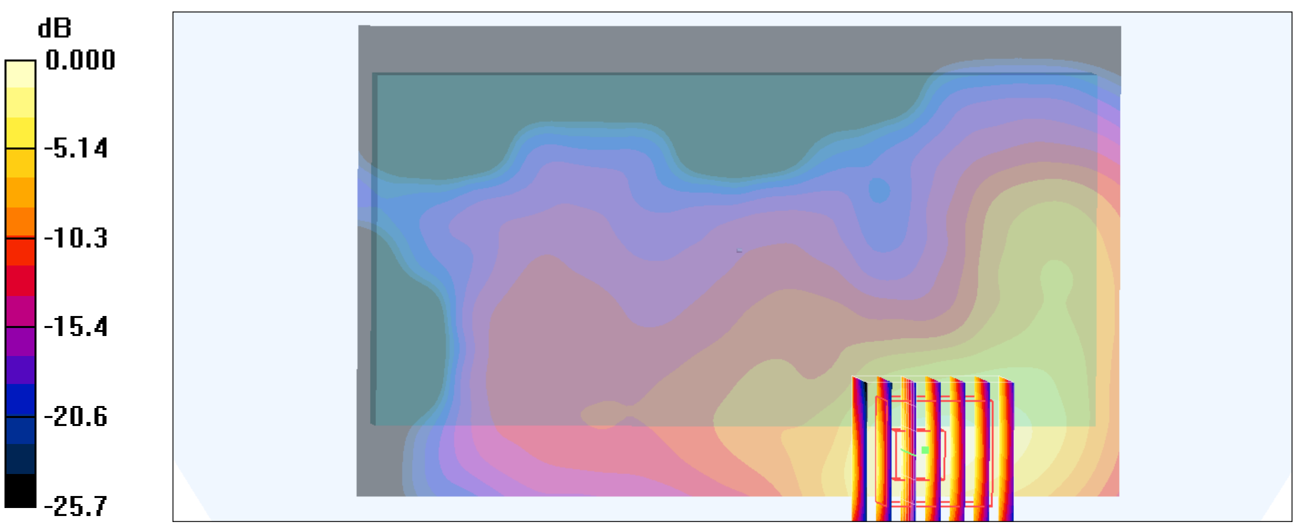
#27_WLAN2.4GHz_802.11b 1Mbps_Back_1cm_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.024
Medium: MSL_2450_140221 Medium parameters used: f = 2437 MHz; σ = 1.91 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.3 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.44, 7.44, 7.44); Calibrated: 2013/6/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2013/5/8
- Phantom: SAM_Right; Type: SAM; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (81x131x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.625 mW/g

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.4 V/m; Power Drift = 0.044 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.478 mW/g; SAR(10 g) = 0.223 mW/g
Maximum value of SAR (measured) = 0.714 mW/g



0 dB = 0.714mW/g

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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

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

Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: D750V3-1099_Nov13

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1099
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 12, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	0.92 mho/m ± 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.42 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.51 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	0.98 mho/m ± 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	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.56 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.64 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω - 1.9 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω - 3.9 jΩ
Return Loss	- 27.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.034 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 05, 2013

DASY5 Validation Report for Head TSL

Date: 04.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

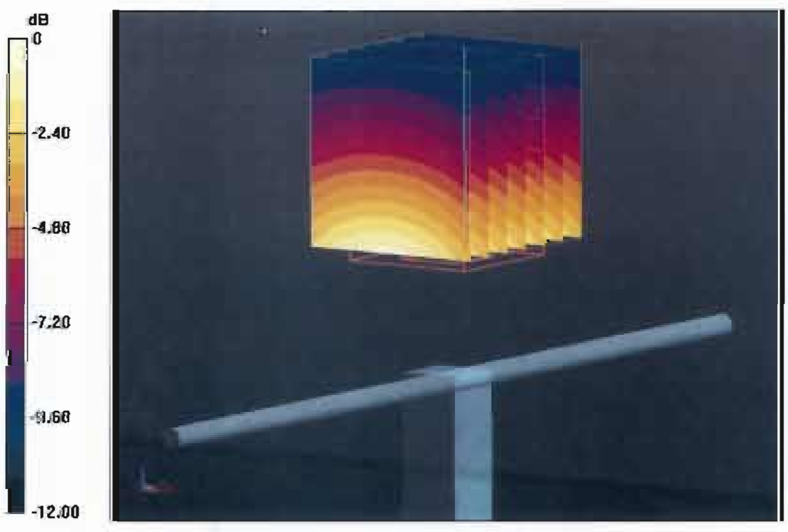
Communication System: UID 0 - CW ; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 S/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

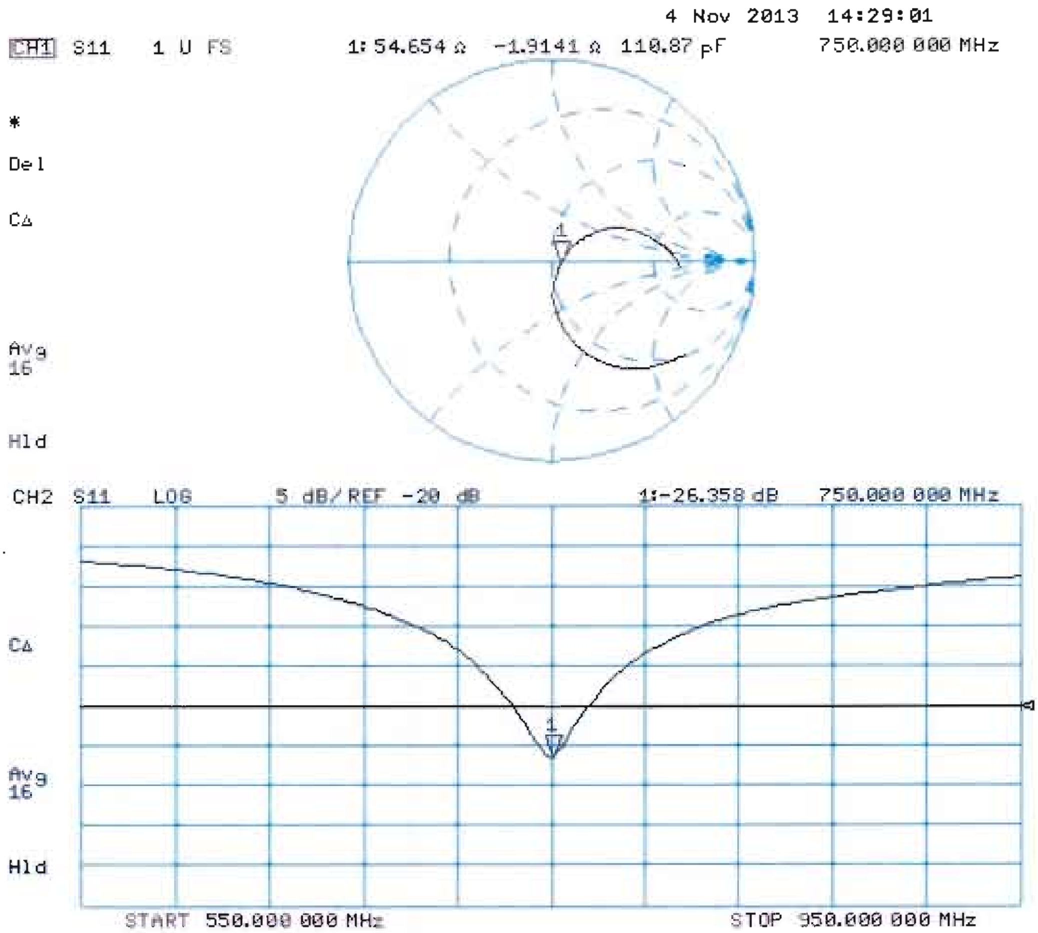
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.786 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.32 W/kg
SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.53 W/kg



0 dB = 2.53 W/kg = 4.03 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

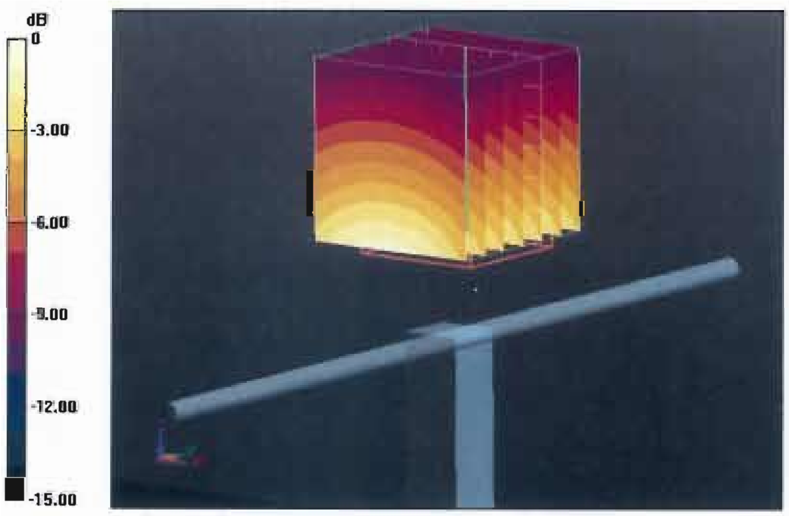
Communication System: UID 0 - CW ; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.98$ S/m; $\varepsilon_r = 54.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

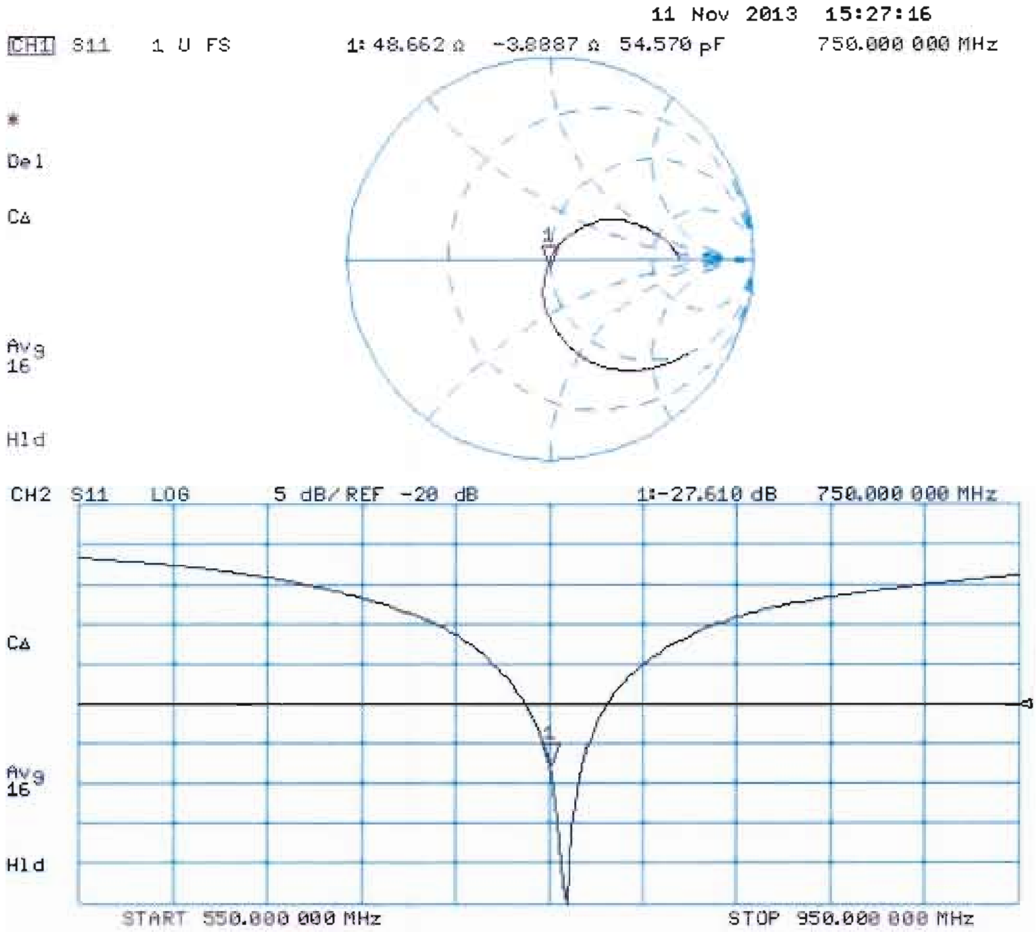
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.631 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.21 W/kg
SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.43 W/kg
Maximum value of SAR (measured) = 2.53 W/kg



0 dB = 2.53 W/kg = 4.03 dBW/kg

Impedance Measurement Plot for Body TSL



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

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

Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: D835V2-4d162_Nov13

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d162
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 12, 2013

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

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	0.94 mho/m ± 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	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.53 W/kg ± 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 ± 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 ± 0.2) °C	54.7 ± 6 %	1.01 mho/m ± 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	2.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.28 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.09 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω - 3.3 jΩ
Return Loss	- 27.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 5.9 jΩ
Return Loss	- 23.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.425 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 28, 2012

DASY5 Validation Report for Head TSL

Date: 11.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

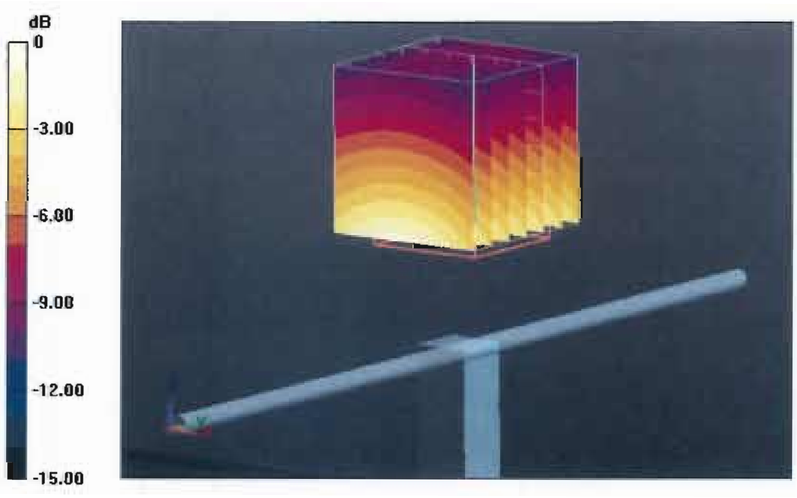
Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.94$ S/m; $\varepsilon_r = 40.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

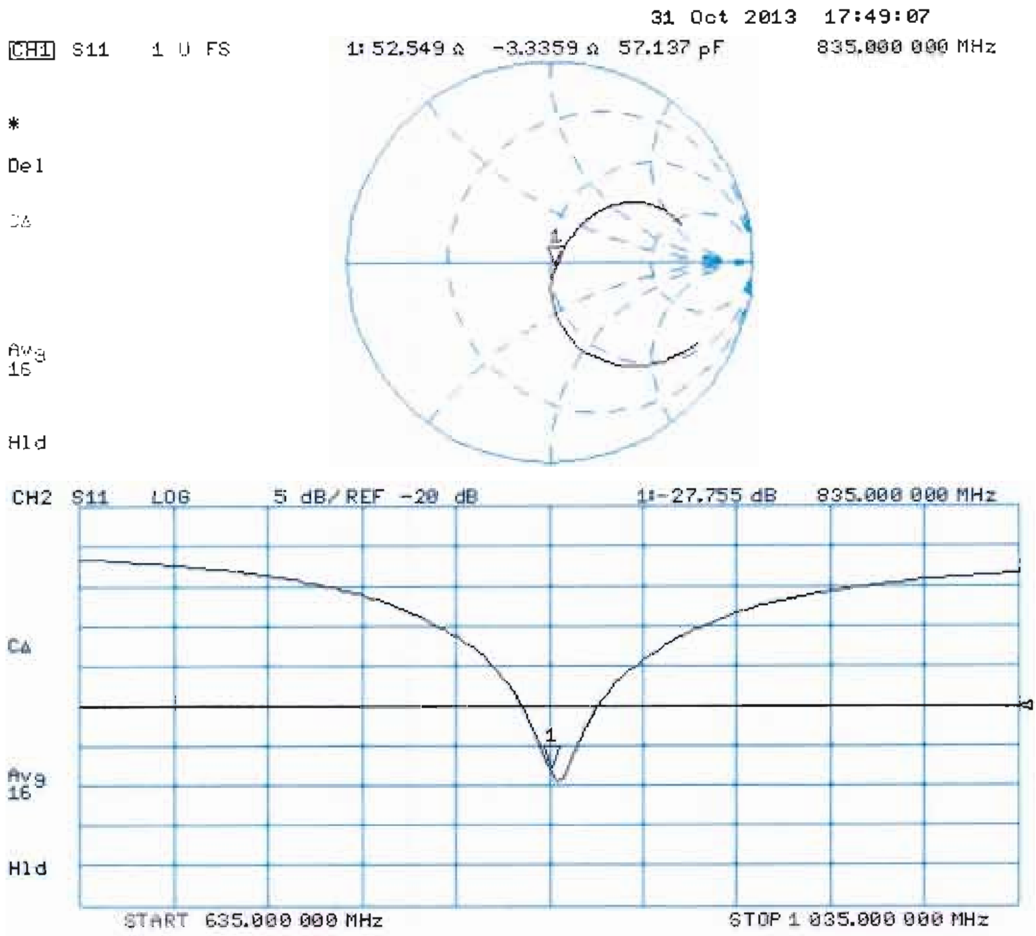
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.399 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.76 W/kg
SAR(1 g) = 2.47 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: 11.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

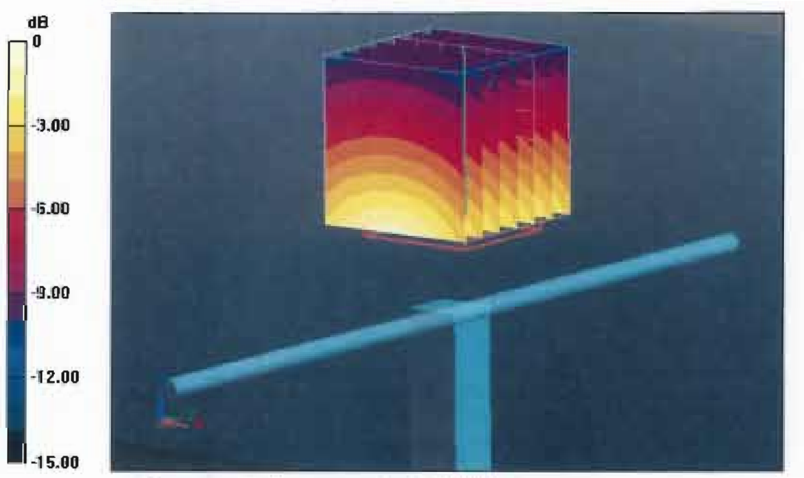
Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 1.007$ S/m; $\varepsilon_r = 54.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

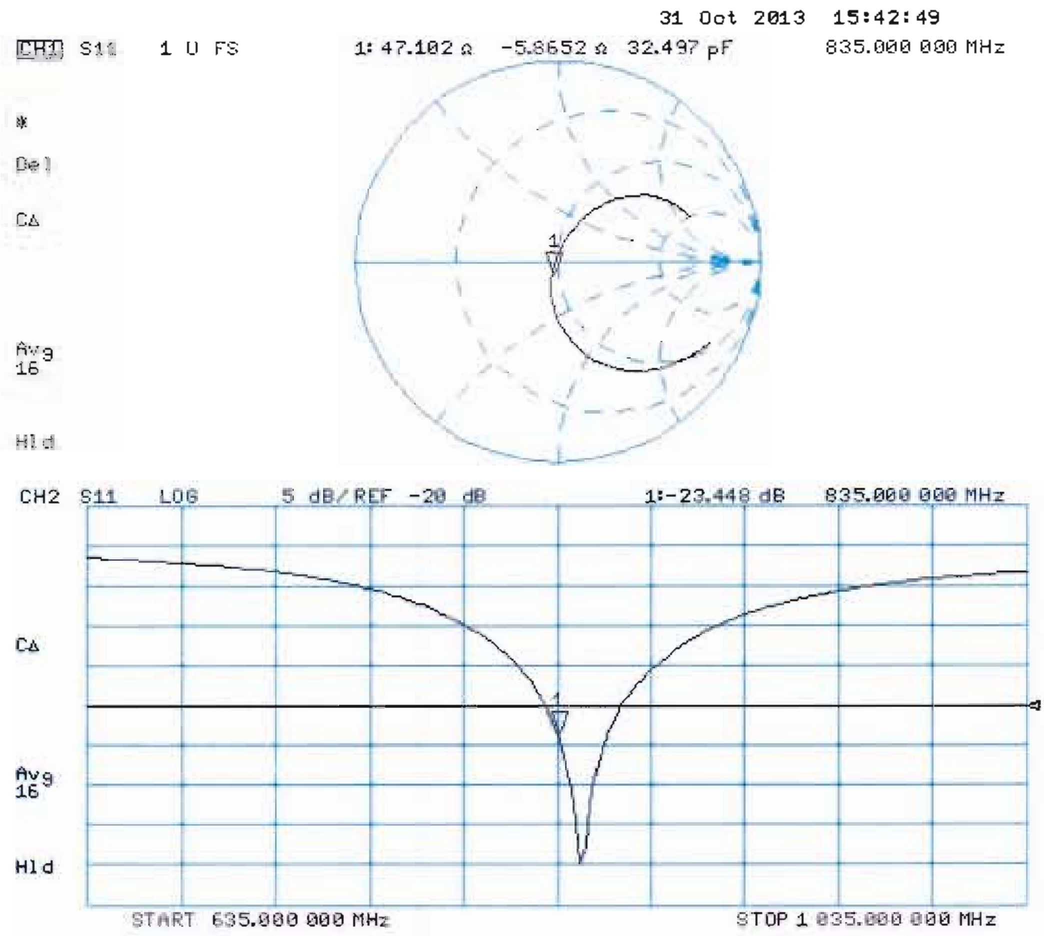
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.559 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 2.79 W/kg



0 dB = 2.79 W/kg = 4.46 dBW/kg

Impedance Measurement Plot for Body TSL



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

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **D1750V2-1068_Nov13**

CALIBRATION CERTIFICATE

Object	D1750V2 - SN: 1068
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 27, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.0 ± 6 %	1.37 mho/m ± 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	9.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**37.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.8 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.0 ± 6 %	1.48 mho/m ± 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	9.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 0.2 jΩ
Return Loss	- 51.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.4 Ω - 0.3 jΩ
Return Loss	- 26.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.221 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 15, 2010

DASY5 Validation Report for Head TSL

Date: 27.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1068

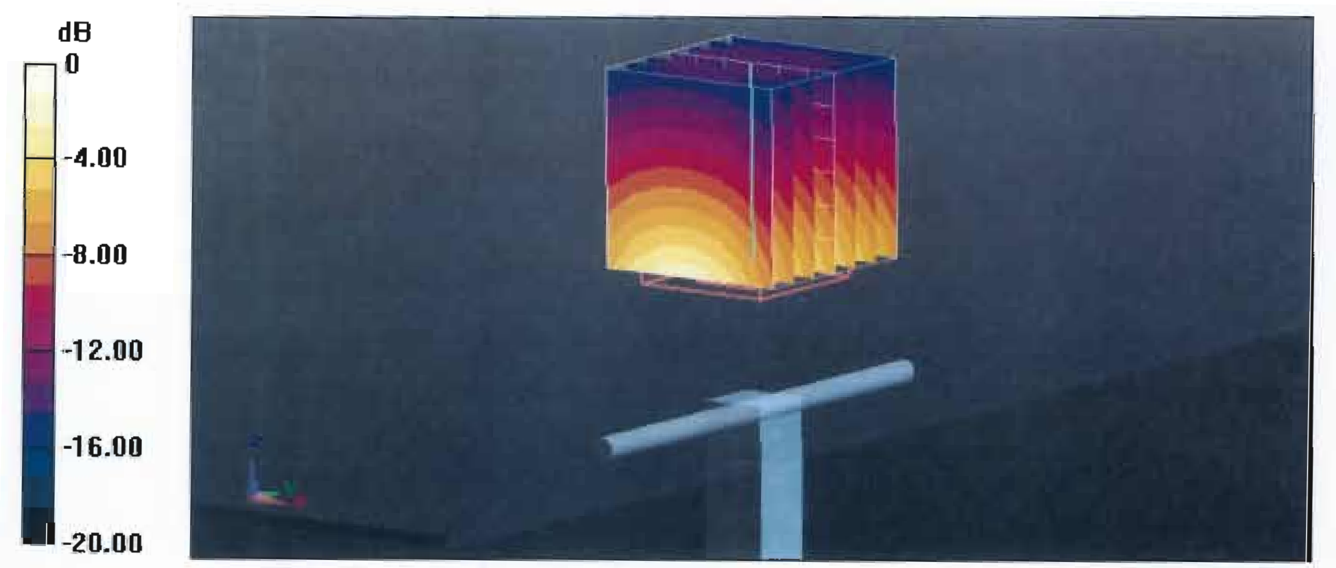
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.37 S/m; ε_r = 40; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.18, 5.18, 5.18); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

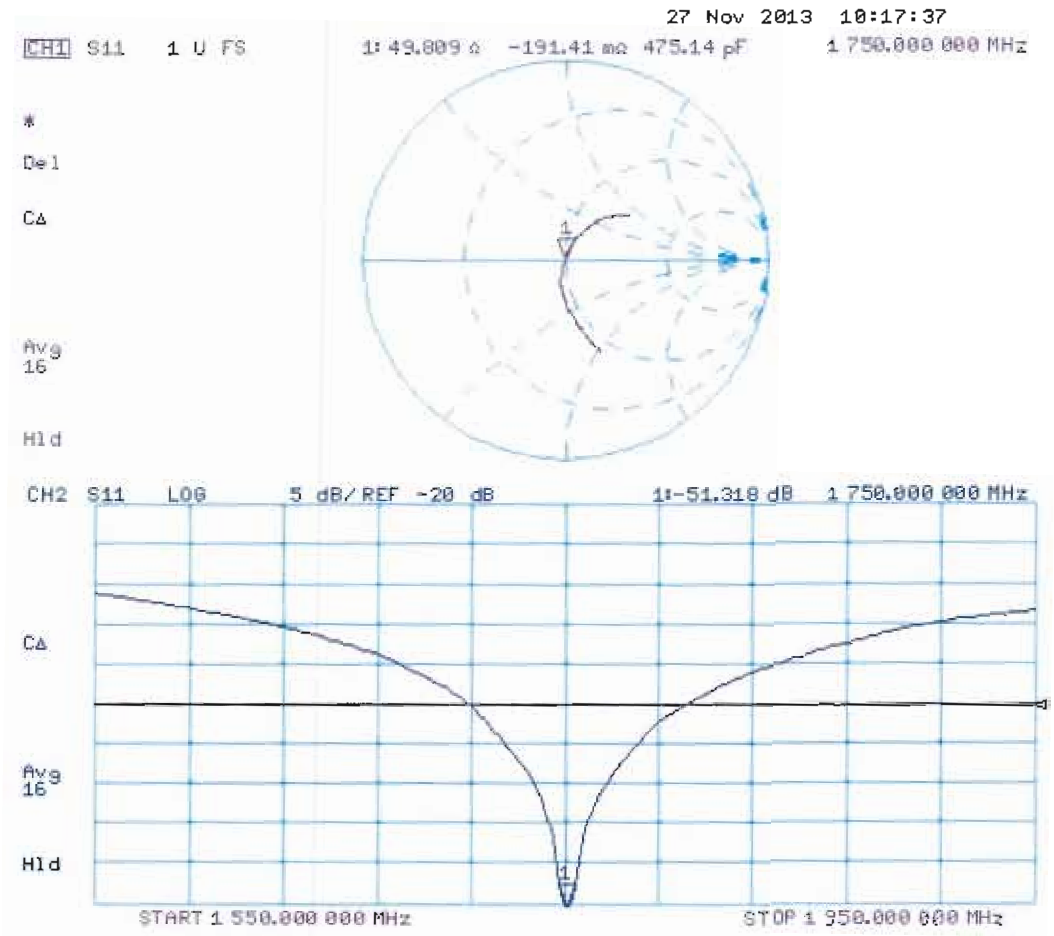
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.458 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 16.9 W/kg
SAR(1 g) = 9.33 W/kg; SAR(10 g) = 4.94 W/kg
Maximum value of SAR (measured) = 11.6 W/kg



0 dB = 11.6 W/kg = 10.64 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1068

Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.48 S/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

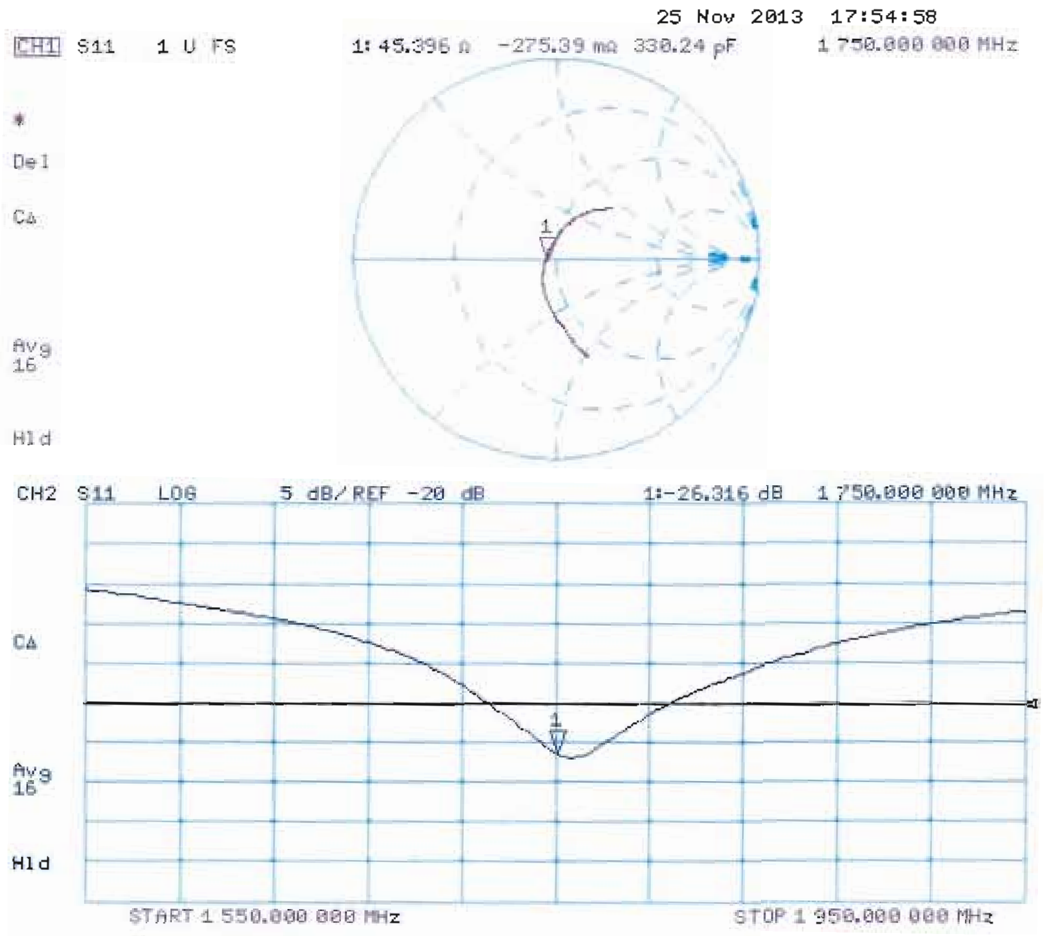
- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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 = 92.538 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.34 W/kg; SAR(10 g) = 5.02 W/kg
Maximum value of SAR (measured) = 11.7 W/kg

0 dB = 11.7 W/kg = 10.68 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: D1900V2-5d182_Nov13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d182
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 12, 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
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: November 12, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.39 mho/m ± 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	**40.1 W/kg ± 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	**21.0 W/kg ± 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 ± 0.2) °C	53.4 ± 6 %	1.51 mho/m ± 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	9.82 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.8 Ω + 4.7 jΩ
Return Loss	- 24.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.4 Ω + 5.3 jΩ
Return Loss	- 25.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 23, 2013

DASY5 Validation Report for Head TSL

Date: 12.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

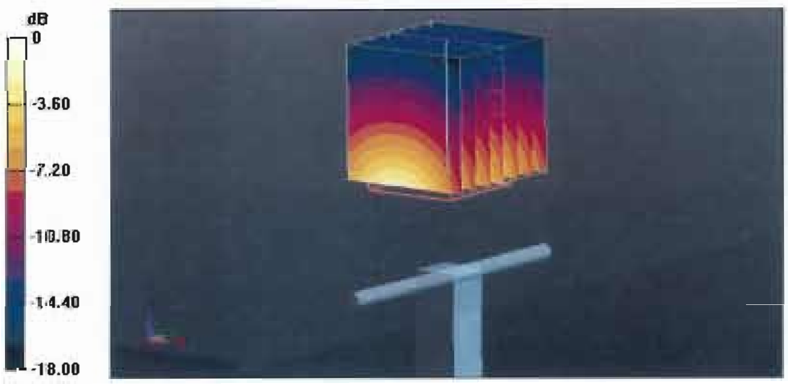
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.39 S/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

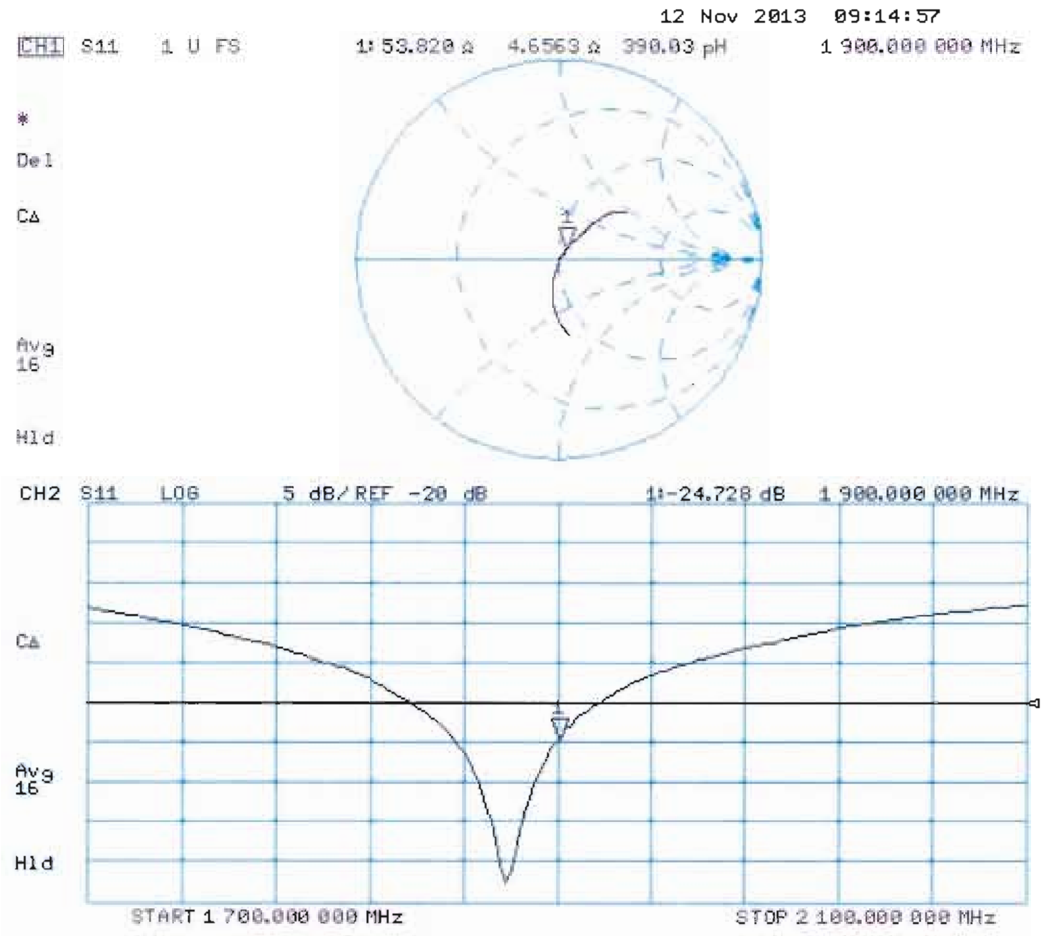
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.302 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 18.3 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.25 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg = 10.90 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.51 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

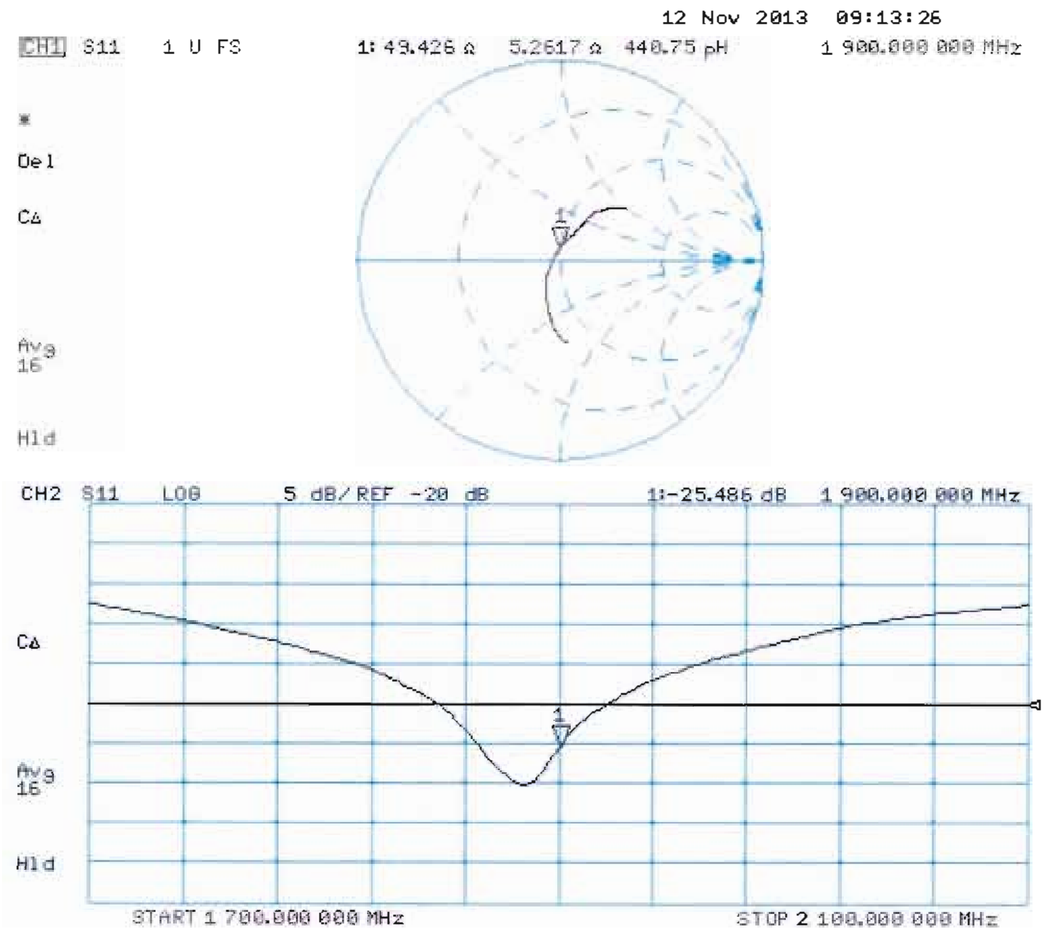
- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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 = 94.302 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 16.8 W/kg
SAR(1 g) = 9.82 W/kg; SAR(10 g) = 5.23 W/kg
Maximum value of SAR (measured) = 12.2 W/kg

0 dB = 12.2 W/kg = 10.86 dBW/kg

Impedance Measurement Plot for Body TSL



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

Accreditation No.: SCS 108

Client Sporton-TW (Auden)

Certificate No: D2450V2-924_Nov13

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 924
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 13, 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
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 13, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.7 ± 6 %	1.84 mho/m ± 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	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.1 ± 6 %	2.02 mho/m ± 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	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 2.6 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω + 4.3 jΩ
Return Loss	- 27.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 26, 2013

DASY5 Validation Report for Head TSL

Date: 13.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

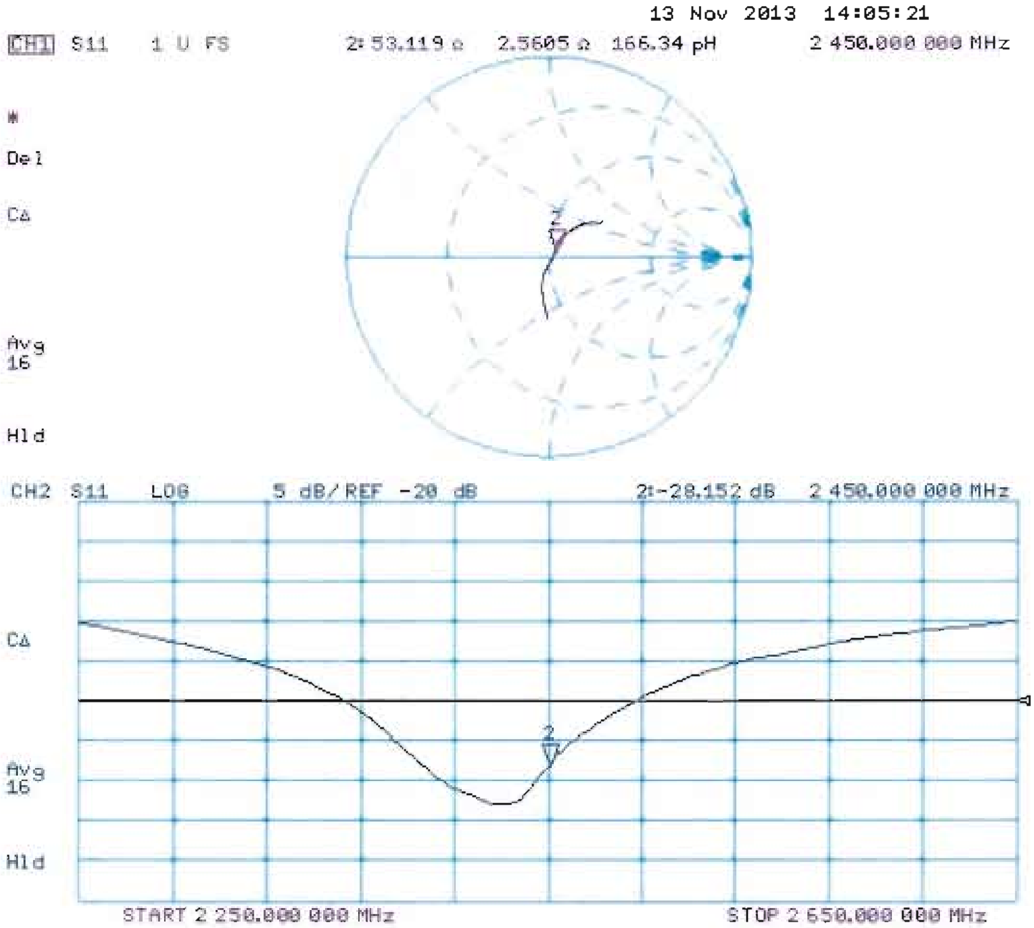
- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.75 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 16.7 W/kg

0 dB = 16.7 W/kg = 12.23 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

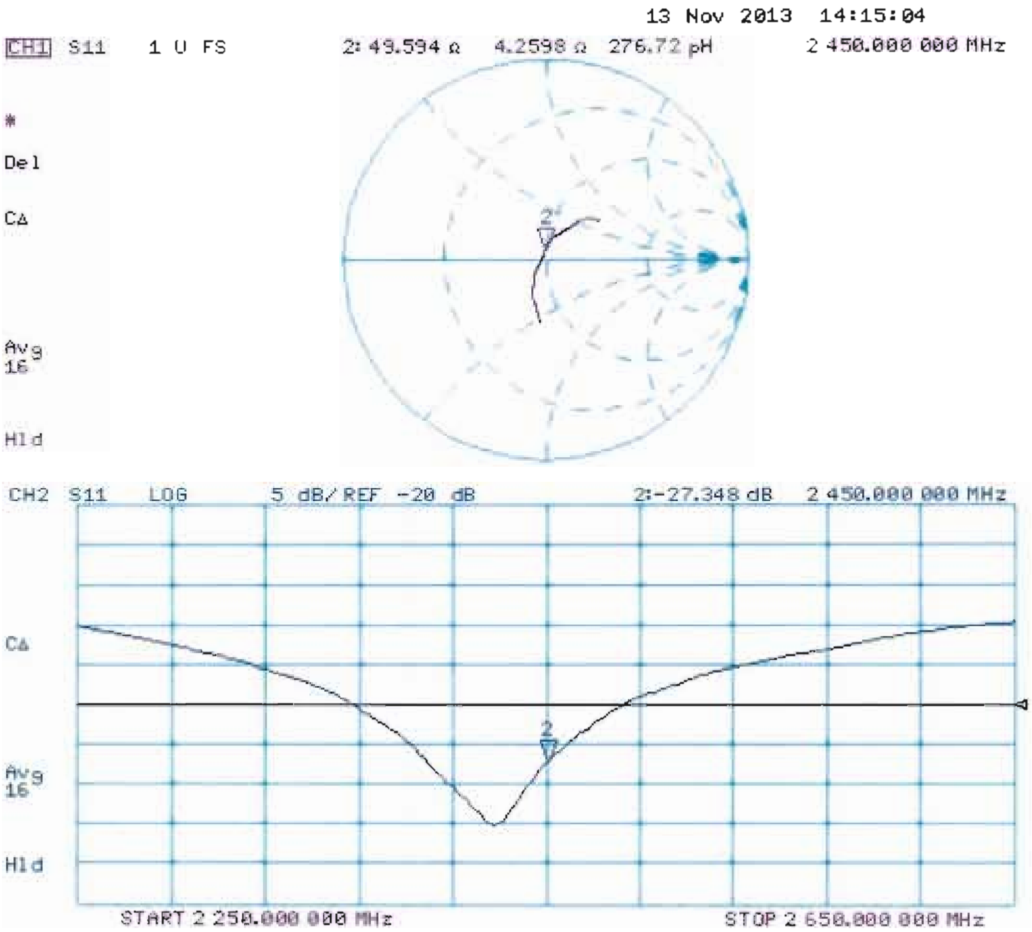
- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.726 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.92 W/kg
Maximum value of SAR (measured) = 16.8 W/kg

0 dB = 16.8 W/kg = 12.25 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: DAE3-577_May13

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 577
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 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

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	R. Mayoraz
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V. B. Müller

Issued: May 8, 2013

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 = 6.1µV , 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	403.397 ± 0.02% (k=2)	403.388 ± 0.02% (k=2)	403.687 ± 0.02% (k=2)
Low Range	3.91124 ± 1.50% (k=2)	3.94923 ± 1.50% (k=2)	3.96280 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	152.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199992.97	-2.03	-0.00
Channel X	+ Input	20006.56	6.78	0.03
Channel X	- Input	-19997.08	4.29	-0.02
Channel Y	+ Input	199993.74	-1.19	-0.00
Channel Y	+ Input	20001.32	1.47	0.01
Channel Y	- Input	-20001.58	-0.26	0.00
Channel Z	+ Input	199992.72	-2.44	-0.00
Channel Z	+ Input	19999.97	0.17	0.00
Channel Z	- Input	-20000.51	0.84	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.20	0.15	0.01
Channel X	+ Input	200.85	0.32	0.16
Channel X	- Input	-198.93	0.44	-0.22
Channel Y	+ Input	1999.33	-0.71	-0.04
Channel Y	+ Input	200.17	-0.49	-0.25
Channel Y	- Input	-200.58	-1.19	0.60
Channel Z	+ Input	1999.86	-0.07	-0.00
Channel Z	+ Input	199.59	-0.87	-0.43
Channel Z	- Input	-199.83	-0.36	0.18

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	-2.45	-3.91
	- 200	5.25	3.89
Channel Y	200	-15.26	-14.77
	- 200	14.00	12.70
Channel Z	200	3.50	3.05
	- 200	-5.18	-4.77

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	-	-0.78	-2.21
Channel Y	200	9.32	-	1.71
Channel Z	200	6.44	5.54	-

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	16138	16187
Channel Y	16101	15933
Channel Z	16163	16267

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-2.00	-2.93	-1.19	0.34
Channel Y	1.39	0.04	2.26	0.46
Channel Z	-0.90	-1.82	-0.10	0.37

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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Accreditation No.: SCS 108

Client **Amphenol-TW (Auden)**

Certificate No: DAE3-495_May13

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 495
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 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

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: May 8, 2013

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 = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

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

Calibration Factors	X	Y	Z
High Range	404.352 ± 0.02% (k=2)	405.328 ± 0.02% (k=2)	405.665 ± 0.02% (k=2)
Low Range	3.95207 ± 1.50% (k=2)	3.99043 ± 1.50% (k=2)	3.96554 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	78.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199989.76	-4.83	-0.00
Channel X	+ Input	20001.54	1.31	0.01
Channel X	- Input	-19995.66	4.92	-0.02
Channel Y	+ Input	199995.02	0.52	0.00
Channel Y	+ Input	19999.41	-0.85	-0.00
Channel Y	- Input	-19999.04	1.61	-0.01
Channel Z	+ Input	199994.06	-0.35	-0.00
Channel Z	+ Input	20002.32	2.10	0.01
Channel Z	- Input	-19998.30	2.51	-0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.20	0.48	0.02
Channel X	+ Input	201.11	0.01	0.00
Channel X	- Input	-198.46	0.25	-0.12
Channel Y	+ Input	2000.81	0.07	0.00
Channel Y	+ Input	200.89	-0.19	-0.09
Channel Y	- Input	-198.51	0.20	-0.10
Channel Z	+ Input	2000.56	-0.12	-0.01
Channel Z	+ Input	199.55	-1.51	-0.75
Channel Z	- Input	-199.07	-0.42	0.21

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	3.21	2.06
	- 200	-1.80	-2.79
Channel Y	200	0.11	-0.16
	- 200	-1.32	-1.56
Channel Z	200	3.11	2.75
	- 200	-4.96	-4.85

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	-	-1.15	-2.03
Channel Y	200	7.90	-	-0.39
Channel Z	200	5.07	5.33	-

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	15807	16438
Channel Y	15756	16559
Channel Z	15893	15989

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-3.55	-4.78	-2.32	0.53
Channel Y	0.18	-1.48	1.84	0.63
Channel Z	-0.04	-1.63	1.85	0.71

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3931_Sep13**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3931
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	September 10, 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
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	4-Sep-13 (No. DAE4-660_Sep13)	Apr-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:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 10, 2013

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,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 *NORMx,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:3931

Manufactured: July 24, 2013
Calibrated: September 10, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.42	0.58	0.50	± 10.1 %
DCP (mV)[B]	102.4	97.7	100.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	146.7	±2.5 %
		Y	0.0	0.0	1.0		133.5	
		Z	0.0	0.0	1.0		120.4	

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

[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:3931

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)
835	41.5	0.90	9.87	9.87	9.87	0.18	1.43	± 12.0 %
900	41.5	0.97	9.59	9.59	9.59	0.18	1.46	± 12.0 %
1750	40.1	1.37	8.82	8.82	8.82	0.30	0.99	± 12.0 %
1900	40.0	1.40	8.40	8.40	8.40	0.59	0.69	± 12.0 %
2000	40.0	1.40	8.41	8.41	8.41	0.46	0.78	± 12.0 %
2450	39.2	1.80	7.59	7.59	7.59	0.35	0.91	± 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:3931

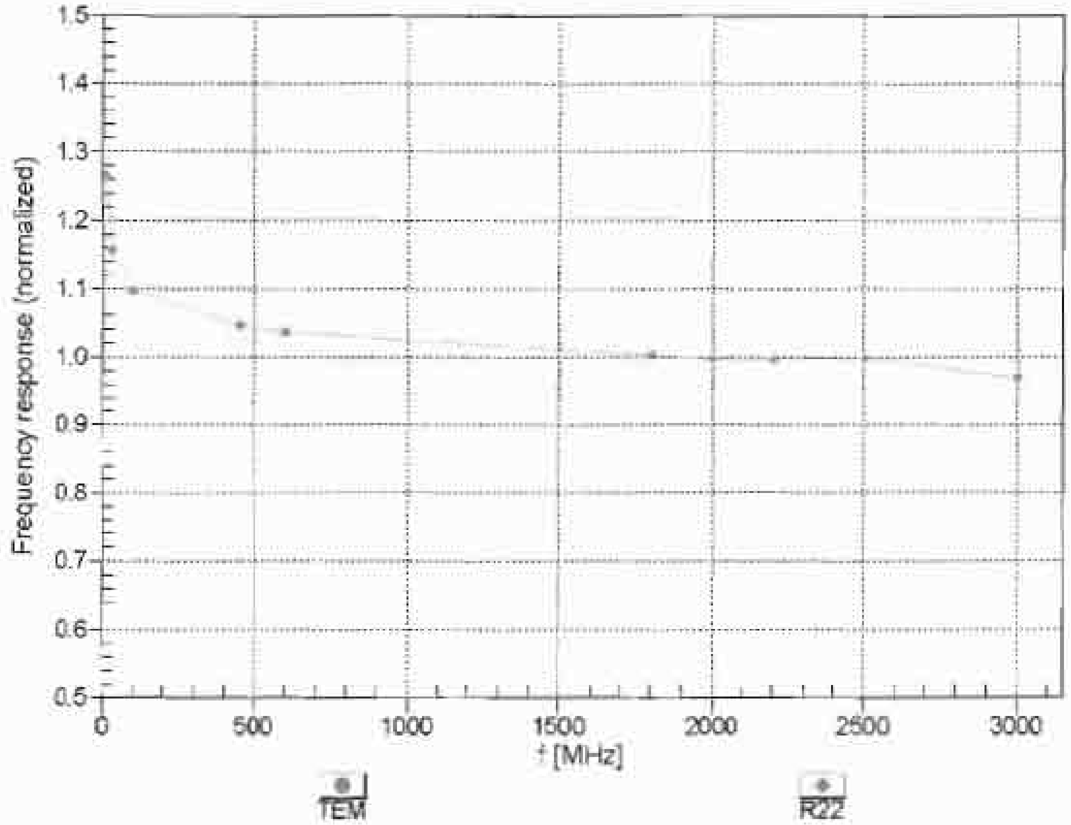
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	9.66	9.66	9.66	0.32	0.99	± 12.0 %
900	55.0	1.05	9.35	9.35	9.35	0.22	1.40	± 12.0 %
1750	53.4	1.49	7.99	7.99	7.99	0.46	0.78	± 12.0 %
1900	53.3	1.52	7.61	7.61	7.61	0.44	0.84	± 12.0 %
2000	53.3	1.52	7.83	7.83	7.83	0.38	0.87	± 12.0 %
2450	52.7	1.95	7.24	7.24	7.24	0.75	0.57	± 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.

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

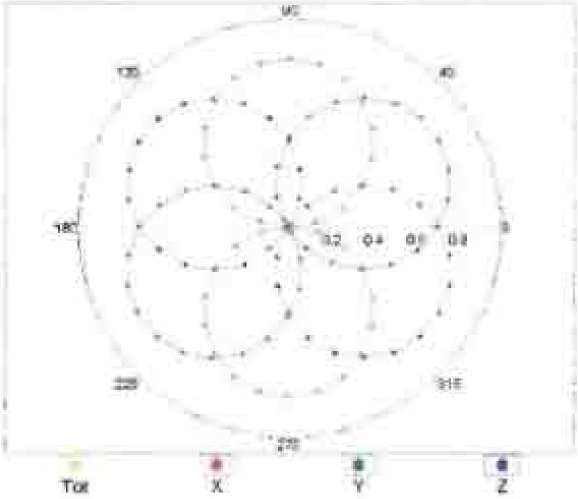


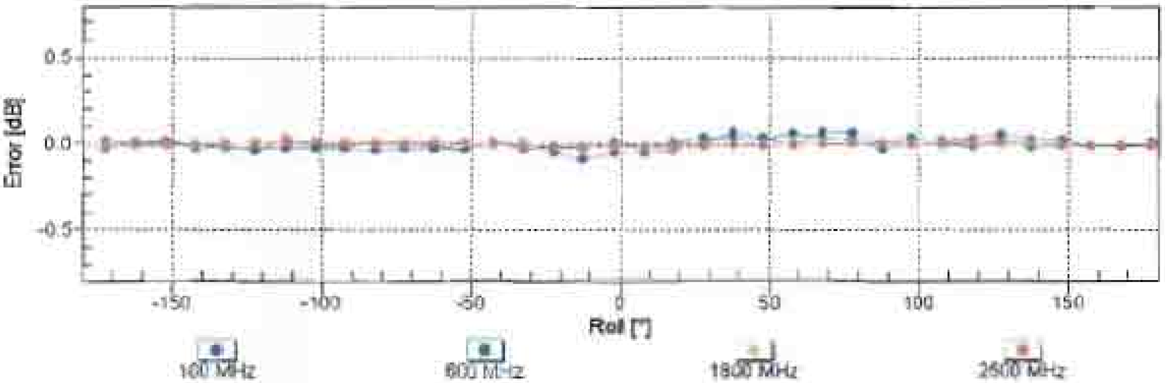
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM

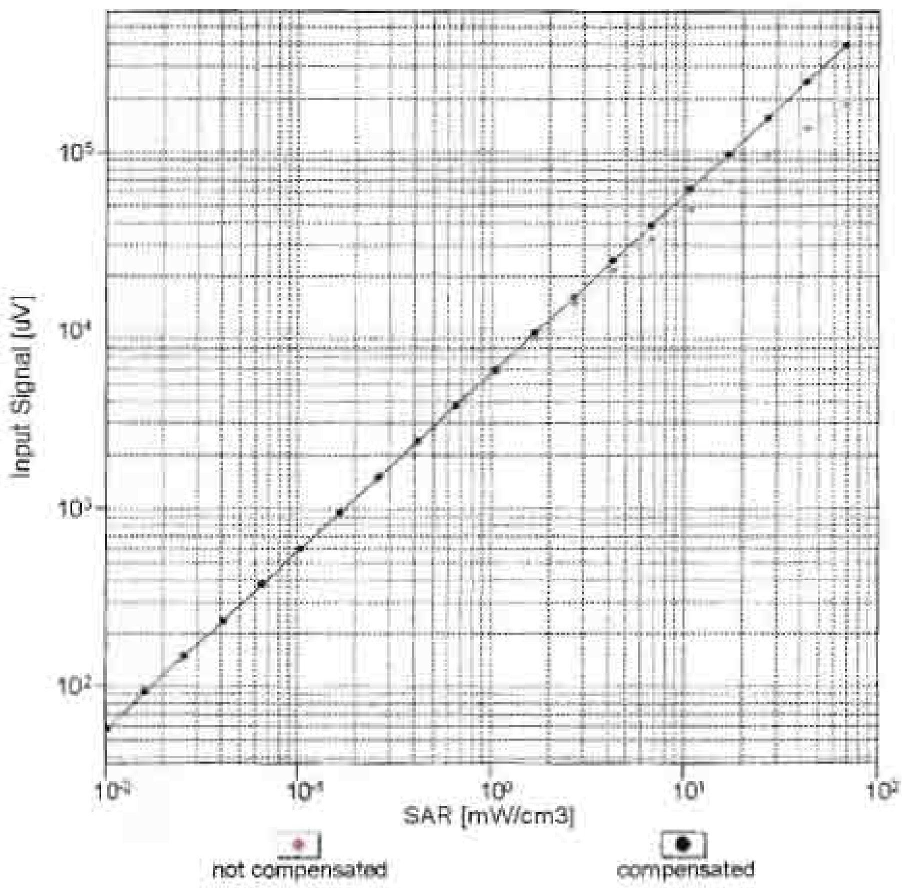
f=1800 MHz,R22

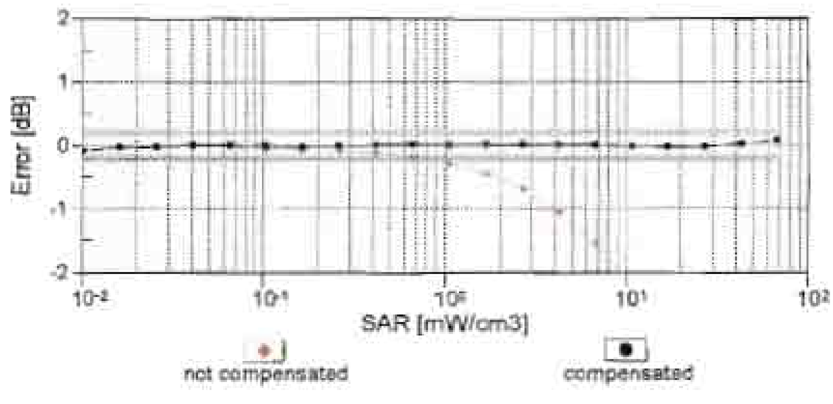




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

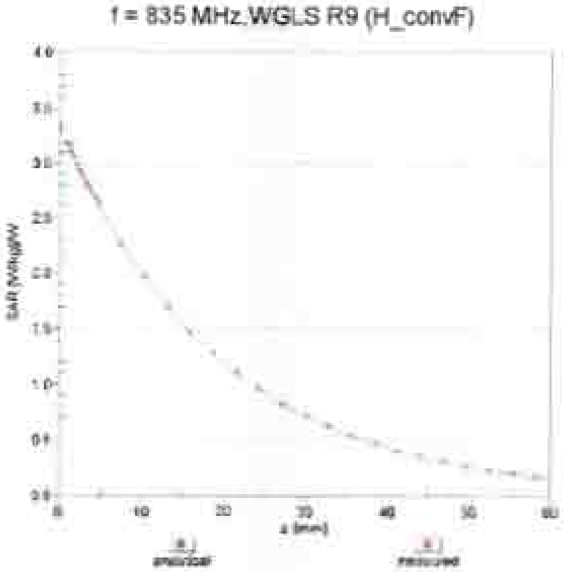
Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)

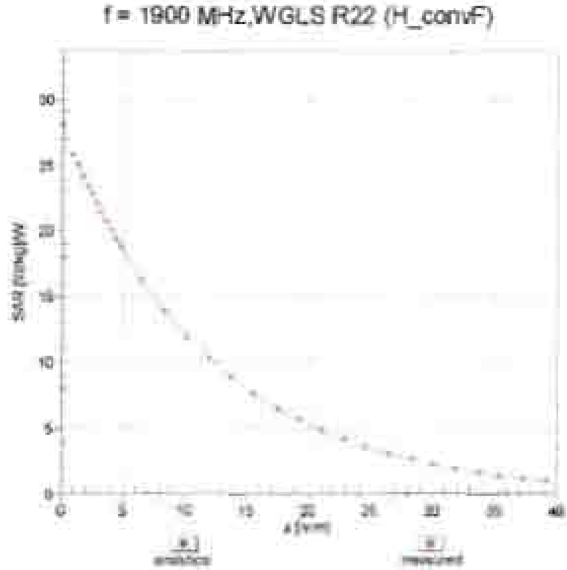




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

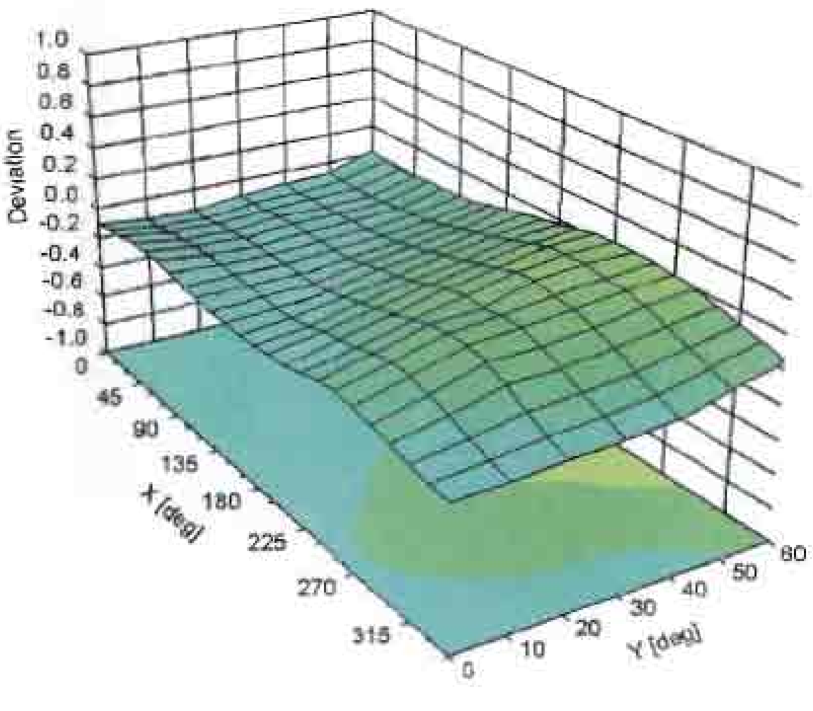
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (φ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3931

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-12.3
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

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

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

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

Accreditation No.: **SCS 108**

Client **Sporton -TW (Auden)**

Certificate No: **EX3-3925_Jun13**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3925
Calibration procedure(s)	QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	June 12, 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
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:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 12, 2013

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,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 ≤ 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 *NORMx,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:3925

Manufactured: March 8, 2013
Calibrated: June 12, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.59	0.52	0.50	± 10.1 %
DCP (mV)[B]	98.2	98.5	98.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.8	±3.5 %
		Y	0.0	0.0	1.0		175.7	
		Z	0.0	0.0	1.0		169.4	

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

[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:3925

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	10.34	10.34	10.34	0.44	0.80	± 12.0 %
835	41.5	0.90	9.87	9.87	9.87	0.29	0.99	± 12.0 %
1750	40.1	1.37	8.36	8.36	8.36	0.56	0.72	± 12.0 %
1900	40.0	1.40	8.13	8.13	8.13	0.37	0.91	± 12.0 %
2150	39.7	1.53	7.89	7.89	7.89	0.54	0.74	± 12.0 %
2450	39.2	1.80	7.25	7.25	7.25	0.59	0.72	± 12.0 %
5200	36.0	4.66	5.25	5.25	5.25	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.01	5.01	5.01	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.89	4.89	4.89	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.73	4.73	4.73	0.30	1.80	± 13.1 %
5800	35.3	5.27	4.48	4.48	4.48	0.40	1.80	± 13.1 %

[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.

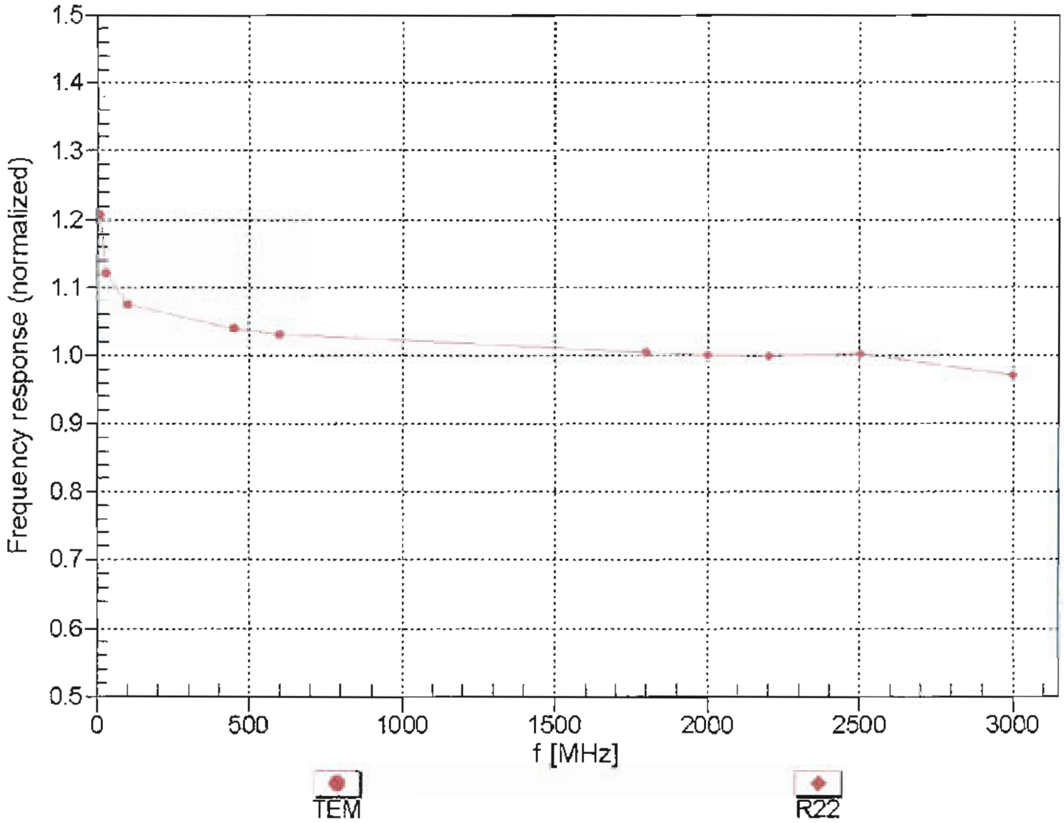
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Calibration Parameter Determined in Body 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	55.5	0.96	10.24	10.24	10.24	0.34	0.99	± 12.0 %
835	55.2	0.97	10.02	10.02	10.02	0.47	0.84	± 12.0 %
1750	53.4	1.49	8.31	8.31	8.31	0.79	0.61	± 12.0 %
1900	53.3	1.52	7.91	7.91	7.91	0.36	0.91	± 12.0 %
2150	53.1	1.66	7.80	7.80	7.80	0.64	0.66	± 12.0 %
2450	52.7	1.95	7.44	7.44	7.44	0.80	0.57	± 12.0 %
5200	49.0	5.30	4.41	4.41	4.41	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.26	4.26	4.26	0.40	1.90	± 13.1 %
5500	48.6	5.65	3.98	3.98	3.98	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.78	3.78	3.78	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.00	4.00	4.00	0.50	1.90	± 13.1 %

[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.

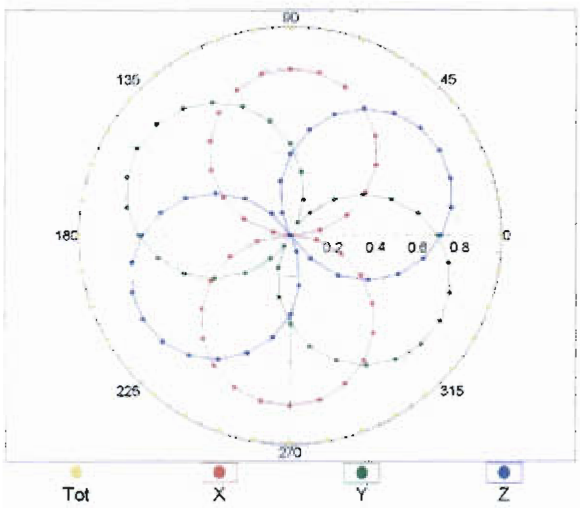
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



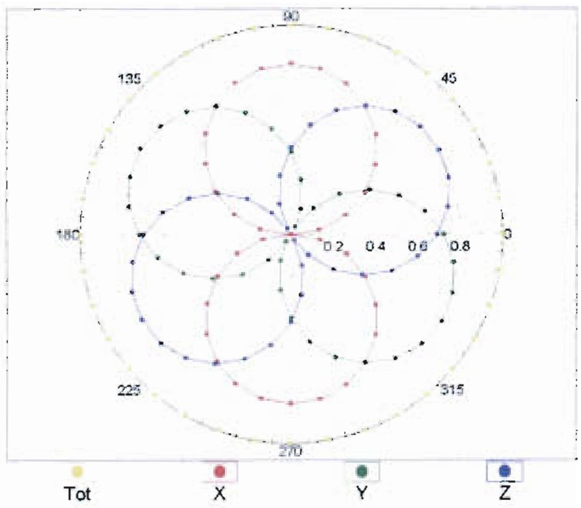
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

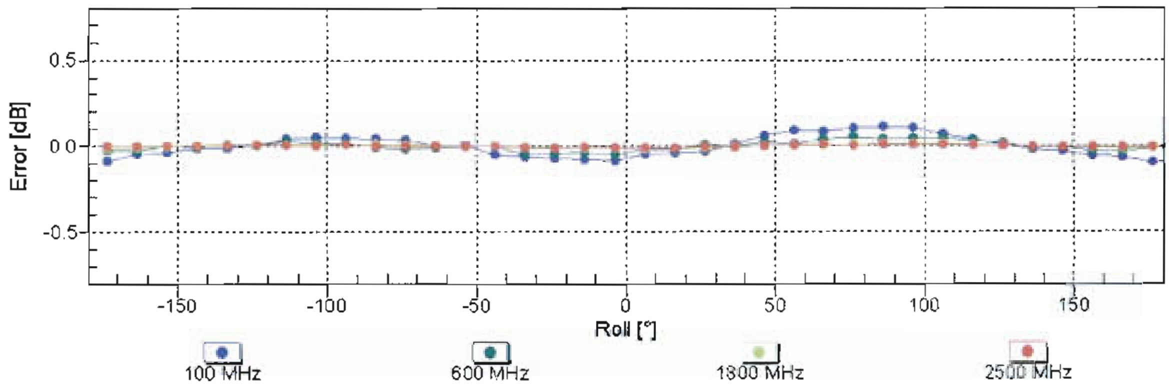
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



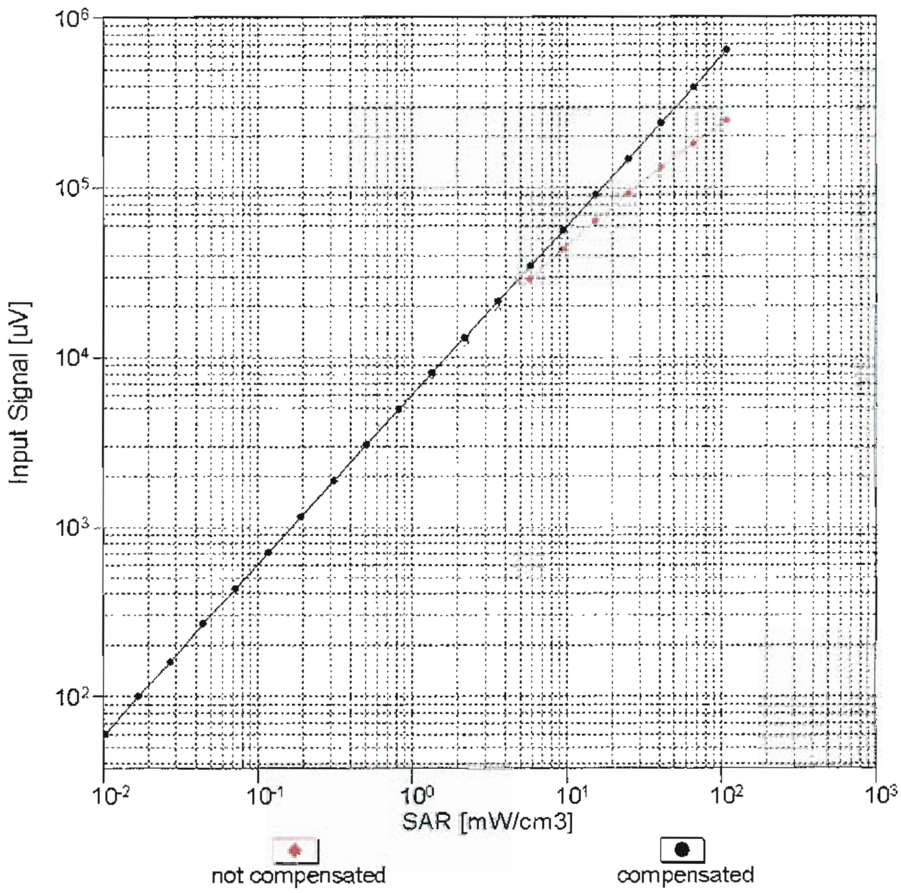
f=1800 MHz,R22

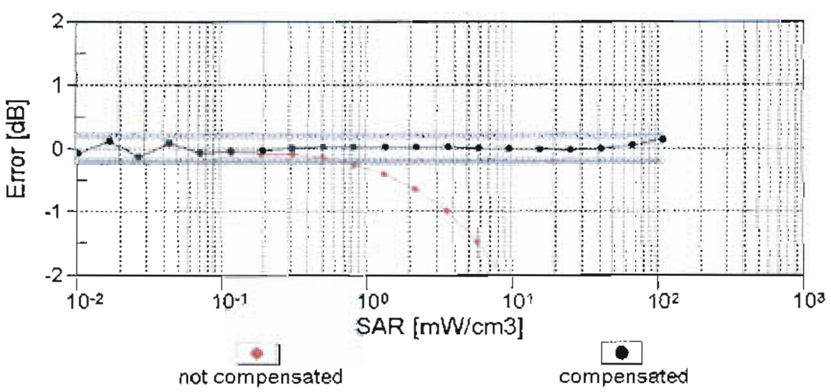




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

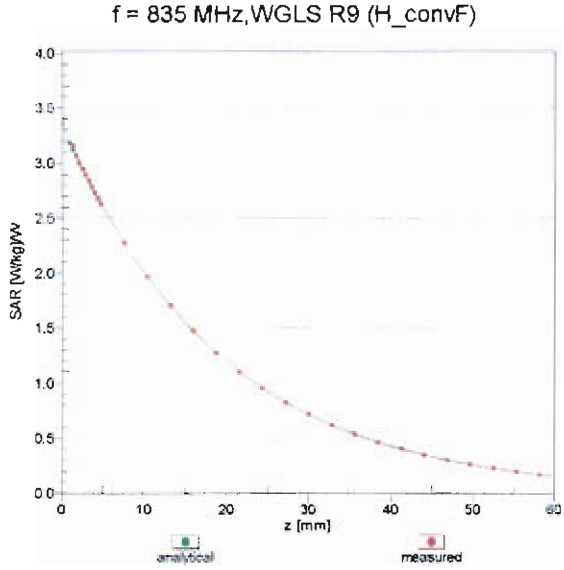
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

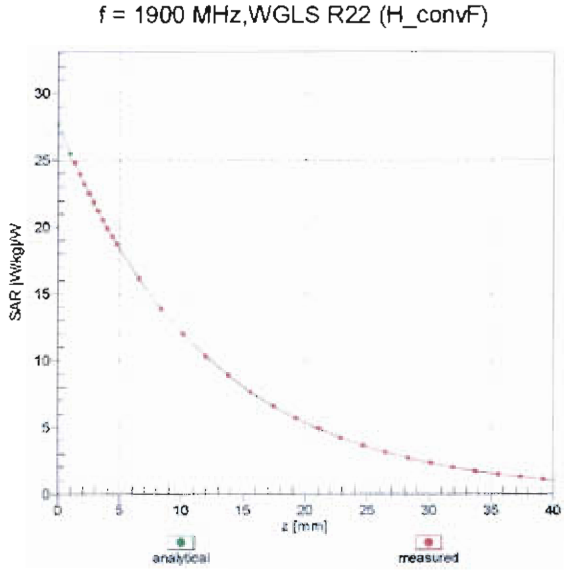




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

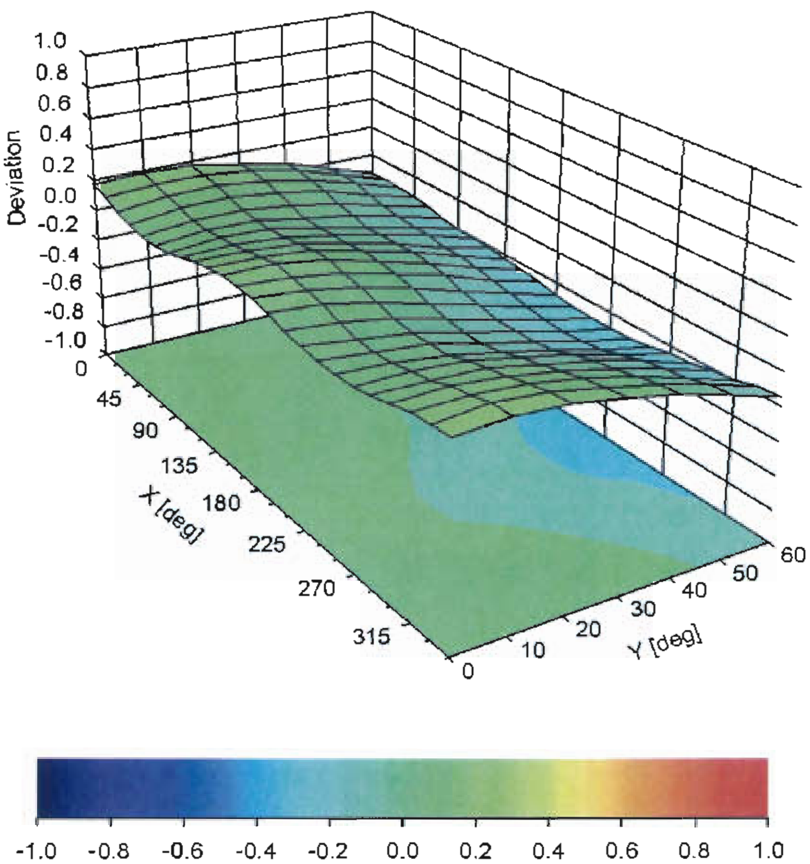
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-93.4
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