FCC SAR Test Report

APPLICANT	**:**	**HTC Corporation**
EQUIPMENT	**:**	**Smartphone**
MODEL NAME	**:**	**0P9O300**
FCC ID	**:**	**NM80P9O300**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2003**

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

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

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA460526	Rev. 01	Initial issue of report	Jul. 25, 2014

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **HTC Corporation, Smartphone, 0P9O300**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			
		Head (Separation 0mm) 1g SAR (W/kg)	Body-worn (Separation 10mm) 1g SAR (W/kg)	Wireless Router (Separation 10mm) 1g SAR (W/kg)	Highest Simultaneous Transmission 1g SAR (W/kg)
PCE	CDMA 2000 BC0	0.19	0.32	0.38	1.50
	CDMA 2000 BC1	0.45	0.74	0.70	
	LTE Band 13	0.34	0.35	0.35	
	LTE Band 4	**1.09**	**0.93**	**0.93**	
DTS	WLAN 2.4GHz Band	0.38	0.42	0.42	1.50
Date of Testing:		07/04/2014 ~ 07/12/2014			

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

2. Administration Data

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

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

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

3. Guidance Standard

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- FCC KDB 941225 D01 SAR test for 3G devices v02
- FCC KDB 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB 941225 D05 SAR for LTE Devices v02r03
- FCC KDB 941225 D06 Hotspot Mode SAR v01r01

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	Smartphone
Model Name	0P9O300
FCC ID	NM80P9O300
IMEI Code	sample for conducted measurement: 990004291004863 sample for SAR testing: 990004291005233
S/N	HT45YSK00003
Wireless Technology and Frequency Range	CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz CDMA 2000 BC1: 1851.25 MHz ~ 1908.75 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	• CDMA2000 : 1xRTT/1xEv-Do(Rev.0)/1xEv-Do(Rev.A) • LTE: QPSK, 16QAM • 802.11b/g/n HT20 • Bluetooth v3.0+HS，Bluetooth v4.0-LE • NFC:ASK
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype

Remark:
1. This device supported VoIP in CDMA, LTE (e.g. 3rd party VoIP).
2. This product has two kinds of earphone and battery options only different is manufacturer, therefore RF exposure evaluation was selected battery1 and earphone 1 performed SAR testing.

Accessories		
Battery 1	Brand Name	HTC
	Manufacturer	WTE
	Model Name	B0P9O100
Battery 2	Brand Name	HTC
	Manufacturer	ATL
	Model Name	B0P9O100
Earphone 1	Brand Name	HTC
	Manufacturer	Merry
	Model Name	HS S250
Earphone 2	Brand Name	HTC
	Manufacturer	Cotron
	Model Name	HS S250
LCM	Brand Name	HTC
	Manufacturer	AUO
	Model Name	H466AAN
Camera Front	Brand Name	HTC
	Manufacturer	LiteOn
	Model Name	12P1BF123
Camera Back	Brand Name	HTC
	Manufacturer	LiteOn
	Model Name	3BA804P1

4.2 Maximum Tune-up Limit

Mode	Average power(dBm)	
	CDMA BC0	CDMA BC1
1xRTT RC1 SO55	24.30	24.30
1xRTT RC3 SO55	24.30	24.30
1xRTT RC3 SO32(+ F-SCH)	24.30	24.30
1xRTT RC3 SO32(+SCH)	24.30	24.30
1xEVDO RTAP 153.6Kbps	24.30	24.30
1xEVDO RETAP 4096Bits	24.30	24.30

LTE Band 13				
Average power(dBm)				
Modulation	BW (MHz)	RB size	MPR	Power
QPSK	10	≤ 12	0	23.00
QPSK	10	> 12	1	22.00
16QAM	10	≤ 12	1	22.00
16QAM	10	> 12	2	21.00

LTE Band 4				
Average power(dBm)				
Modulation	BW (MHz)	RB size	MPR	Power
QPSK	20	≤ 18	0	23.00
QPSK	20	> 18	1	22.00
16QAM	20	≤ 18	1	22.00
16QAM	20	> 18	2	21.00
QPSK	15	≤ 16	0	23.00
QPSK	15	> 16	1	22.00
16QAM	15	≤ 16	1	22.00
16QAM	15	> 16	2	21.00
QPSK	10	≤ 12	0	23.00
QPSK	10	> 12	1	22.00
16QAM	10	≤ 12	1	22.00
16QAM	10	> 12	2	21.00
QPSK	5	≤ 8	0	23.00
QPSK	5	> 8	1	22.00
16QAM	5	≤ 8	1	22.00
16QAM	5	> 8	2	21.00

Mode		Average Power (dBm)
2.4GHz	802.11b	18.00
	802.11g	13.00
	802.11n-HT20	13.00
Bluetooth v3.0+HS		9.00
Bluetooth v4.0+LE		5.00

4.3 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r03	
FCC ID	NM80P9O300
Equipment Name	SMARTPHONE
Operating Frequency Range of each LTE transmission band	LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 04: 1710.7 MHz ~ 1754.3 MHz
Channel Bandwidth	LTE Band 13: 10MHz LTE Band 04: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK, and 16QAM
LTE Voice / Data requirements	Data only
LTE MPR permanently built-in by design	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)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.
Power reduction	Yes, Power is reduced when simultaneously transmitting with 1x-RTT CDMA Voice in certain SVLTE conditions, more detail please refer to section12.1. And the SVLTE power reduction feature is not implemented for satisfying SAR compliance requirements. The simultaneous transmission SAR test exclusion is applied according to the reported standalone SAR tested at the maximum output power level without any power reduction.

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

LTE Band 13

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq.(MHz)
L	23205	779.5		
M	23230	782	23230	782
H	23255	784.5		

LTE Band 4

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20375	1752.5	20350	1750	20325	1747.5	20300	1745

5. RF Exposure Limits

5.1 Uncontrolled Environment

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

5.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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

6. Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

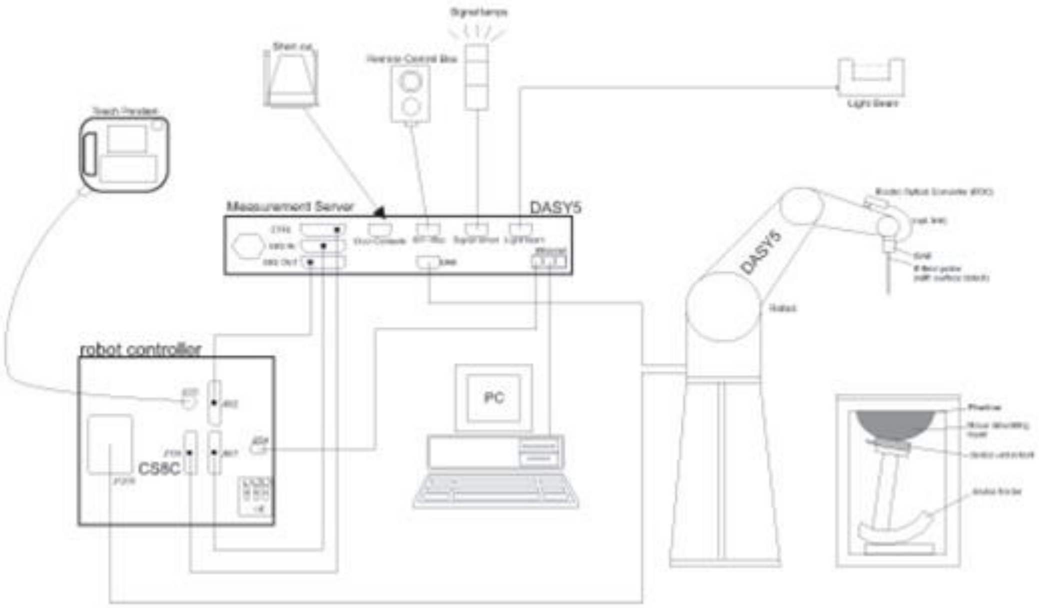
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

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



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

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

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

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

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

8.1 Spatial Peak SAR Evaluation

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

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

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

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values 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

8.2 Power Reference Measurement

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

8.3 Area Scan

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

Area scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2}\cdot\delta\cdot\ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 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>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 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>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 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 $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

8.5 Volume Scan Procedures

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

8.6 Power Drift Monitoring

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

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1012	May. 16, 2014	May. 15, 2015
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 24, 2014	Mar. 23, 2015
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Nov. 27, 2013	Nov. 26, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 21, 2014	Mar. 20, 2015
SPEAG	2450MHz System Validation Kit	D2450V2	924	Nov. 13, 2013	Nov. 12, 2014
SPEAG	Data Acquisition Electronics	DAE4	1338	Nov. 05, 2013	Nov. 04, 2014
SPEAG	Data Acquisition Electronics	DAE3	577	May. 15, 2014	May. 14, 2015
SPEAG	Data Acquisition Electronics	DAE3	495	May. 19, 2014	May. 18, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3935	Nov. 04, 2013	Nov. 03, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 10, 2013	Sep. 09, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	May. 22, 2014	May. 21, 2015
Wisewind	Thermometer	HTC-1	TM281	Oct. 22, 2013	Oct. 21, 2014
H.M.IRIS	Thermometer	TH-08	TM658	Oct. 22, 2013	Oct. 21, 2014
WonDer	Thermometer	WD-5015	TM225	Dec. 02, 2013	Dec. 01, 2014
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Feb. 11, 2014	Feb. 10, 2015
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 10, 2014	Jan. 09, 2015
SPEAG	Device Holder	N/A	N/A	NCR	NCR
Agilent	Signal Generator	E4438C	MY49070755	Oct. 08, 2013	Oct. 07, 2014
SPEAG	Dielectric Probe Kit	DAK-3.5	1138	Nov. 03, 2013	Nov. 02, 2014
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 07, 2014	Feb. 06, 2015
Anritsu	Power Meter	ML2495A	1349001	Dec. 04, 2013	Dec. 03, 2014
Anritsu	Power Sensor	MA2411B	1306099	Dec. 03, 2013	Dec. 02, 2014
R&S	Spectrum Analyzer	FSP30	101067	Nov. 20, 2013	Nov. 19, 2014
Agilent	Dual Directional Coupler	778D	50422	Note 1	
Woken	Attenuator	WK0602-XX	N/A	Note 1	
PE	Attenuator	PE7005-10	N/A	Note 1	
PE	Attenuator	PE7005- 3	N/A	Note 1	
AR	Power Amplifier	5S1G4M2	0328767	Note 1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note 1	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	Note 1	

General Note:

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

10. System Verification

10.1 Tissue Verification

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

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

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
750	Head	22.5	0.879	40.957	0.89	41.90	-1.24	-2.25	±5	2014/7/9
750	Body	22.3	0.961	53.917	0.96	55.50	0.10	-2.85	±5	2014/7/5
835	Head	22.5	0.900	40.826	0.90	41.50	0.00	-1.62	±5	2014/7/11
835	Body	22.3	0.976	53.012	0.97	55.20	0.62	-3.96	±5	2014/7/11
1750	Head	22.5	1.405	39.044	1.37	40.10	2.55	-2.63	±5	2014/7/6
1750	Body	22.5	1.538	52.117	1.49	53.40	3.22	-2.40	±5	2014/7/4
1900	Head	22.3	1.432	39.344	1.40	40.00	2.29	-1.64	±5	2014/7/11
1900	Body	22.2	1.565	52.909	1.52	53.30	2.96	-0.73	±5	2014/7/10
2450	Head	22.2	1.851	39.252	1.80	39.20	2.83	0.13	±5	2014/7/10
2450	Body	22.5	2.015	53.957	1.95	52.70	3.33	2.39	±5	2014/7/5
2450	Body	22.3	2.020	53.936	1.95	52.70	3.59	2.35	±5	2014/7/12

10.2 System Performance Check Results

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

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
2014/7/9	750	Head	250	D750V3-1012	3925	495	2.05	8.12	8.20	0.99
2014/7/5	750	Body	250	D750V3-1012	3925	495	2.20	8.65	8.80	1.73
2014/7/11	835	Head	250	D835V2-499	3931	577	2.22	9.13	8.88	-2.74
2014/7/11	835	Body	250	D835V2-499	3931	577	2.47	9.46	9.88	4.44
2014/7/6	1750	Head	250	D1750V2-1068	3925	495	9.76	37.30	39.04	4.66
2014/7/4	1750	Body	250	D1750V2-1068	3935	1338	9.40	37.50	37.60	0.27
2014/7/11	1900	Head	250	D1900V2-5d041	3931	577	9.89	41.00	39.56	-3.51
2014/7/10	1900	Body	250	D1900V2-5d041	3931	577	10.20	41.00	40.80	-0.49
2014/7/10	2450	Head	250	D2450V2-924	3925	495	13.10	52.40	52.40	0.00
2014/7/5	2450	Body	250	D2450V2-924	3935	1338	12.30	50.20	49.20	-1.99
2014/7/12	2450	Body	250	D2450V2-924	3931	577	12.10	50.20	48.40	-3.59

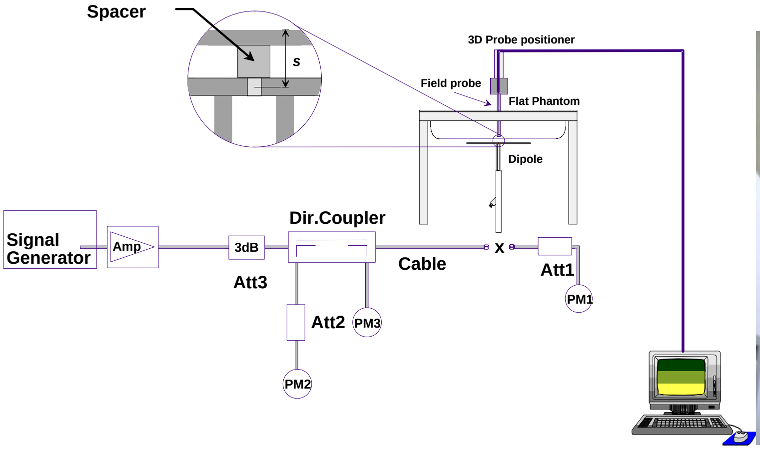


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

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

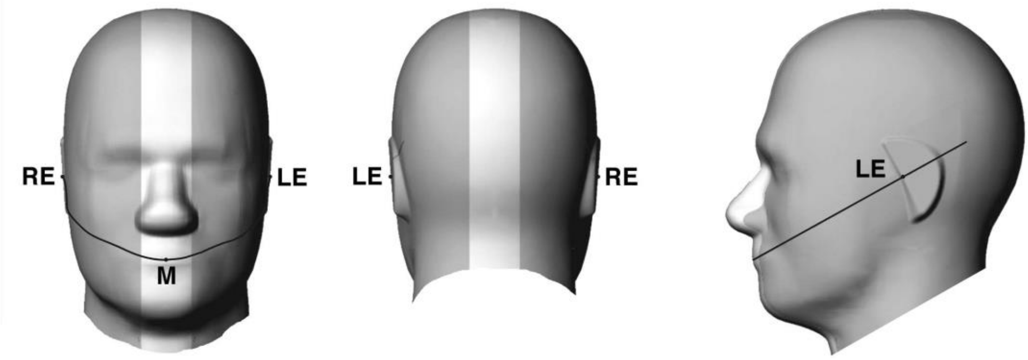


Fig 9.1.1 Front, back, and side views of SAM twin phantom

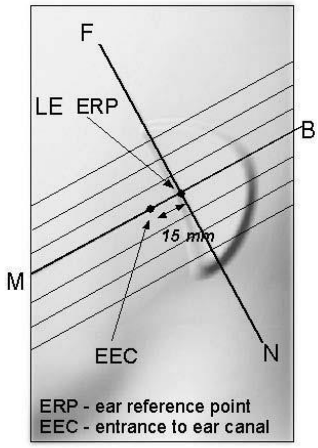


Fig 9.1.2 Close-up side view of phantom showing the ear region.

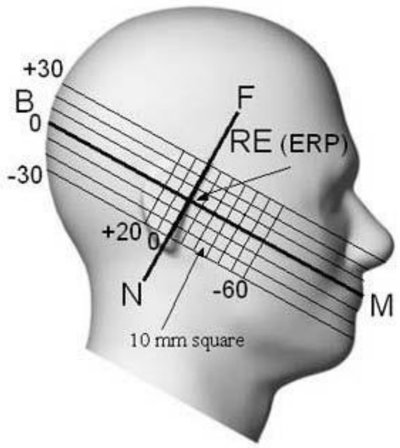


Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 Definition of the cheek position

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

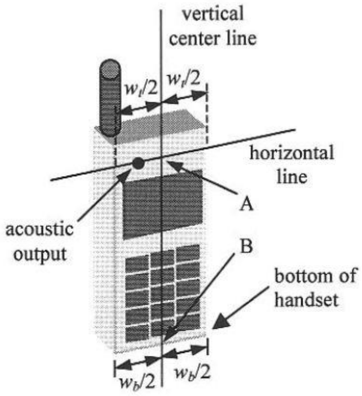


Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case

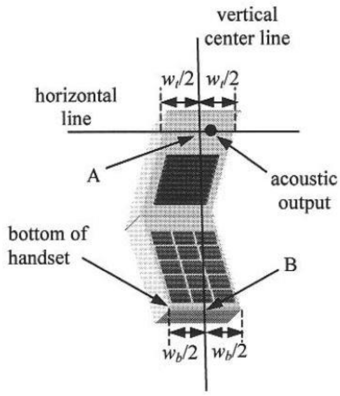


Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

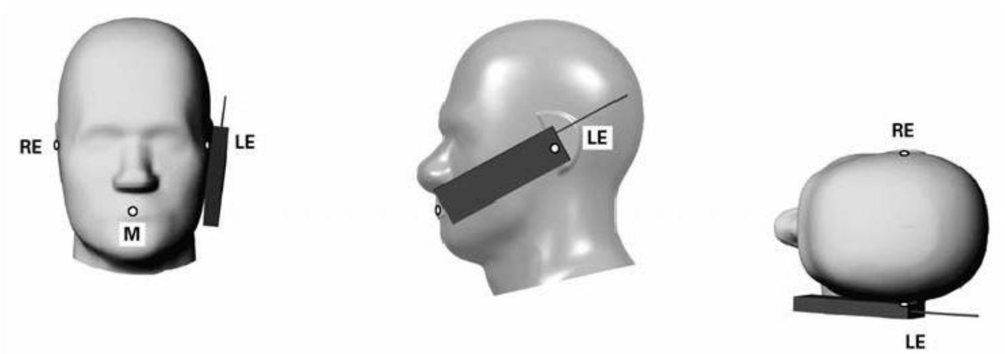


Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 Definition of the tilt position

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

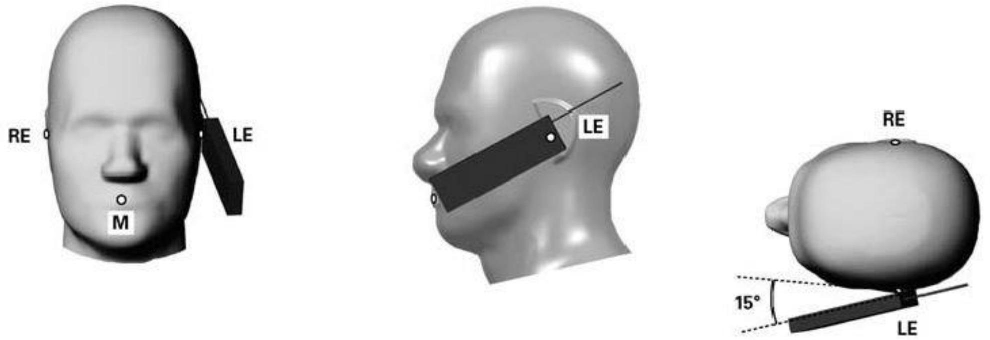


Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 Body Worn Accessory

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

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

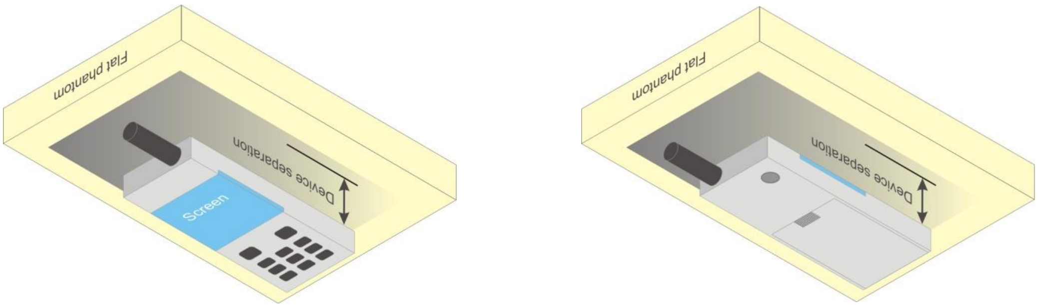


Fig 9.4 Body Worn Position

11.5 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC HDB Publication 941225 D06v01r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05r02 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

12. Conducted RF Output Power (Unit: dBm)

<CDMA2000 Conducted Power>

General Note:

1. Per KDB 941225 D01v02, Head SAR for RC1+SO55 is not required because the maximum average output power of RC1 is less than 1/4 dB higher than RC3+SO55.
2. Per KDB 941225 D01v02, in Hotspot mode EUT is treated as data device and SAR is tested with Ev-Do Rev 0 (RTAP 153.6kbps). If 1xRTT and Ev-Do Rev A (RETAP 4096 bits) power is high than 1/4dB higher than Re v0, SAR tests with those settings are necessary.
3. Per KDB 941225 D01v02, SAR for body-worn exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only.

Band	CDMA2000 BC0			CDMA2000 BC1		
TX Channel	1013	384	777	25	600	1175
Frequency (MHz)	824.7	836.52	848.31	1851.25	1880	1908.75
1xRTT RC1 SO55	23.85	23.95	23.88	23.96	23.81	23.98
1xRTT RC3 SO55	23.79	23.89	23.81	23.90	23.85	23.95
1xRTT RC3 SO32(+ F-SCH)	23.79	23.91	23.80	23.89	23.73	23.92
1xRTT RC3 SO32(+SCH)	23.76	23.87	23.78	23.87	23.74	23.96
1xEVDO RTAP 153.6Kbps	23.90	23.98	23.91	23.98	23.92	23.99
1xEVDO RETAP 4096Bits	23.89	23.97	23.90	23.97	23.90	23.98

<LTE Conducted Power>

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not 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.
7. Per KDB 941225 D05v02r03, 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 13>

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					23230			
Frequency (MHz)					782			
10	QPSK	1	0		22.95		23	0
10	QPSK	1	24		22.91			
10	QPSK	1	49		22.92			
10	QPSK	25	0		21.94		22	0-1
10	QPSK	25	12		21.87			
10	QPSK	25	24		21.88			
10	QPSK	50	0		21.88			
10	16QAM	1	0		21.76		22	0-1
10	16QAM	1	24		21.72			
10	16QAM	1	49		21.75			
10	16QAM	25	0		20.85		21	0-2
10	16QAM	25	12		20.85			
10	16QAM	25	24		20.81			
10	16QAM	50	0		20.81			
Channel				23205	23230	23255	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				779.5	782	784.5		
5	QPSK	1	0	22.74	22.93	22.94	23	0
5	QPSK	1	12	22.82	22.90	22.93		
5	QPSK	1	24	22.84	22.91	22.92		
5	QPSK	12	0	21.88	21.88	21.85	22	0-1
5	QPSK	12	6	21.83	21.81	21.87		
5	QPSK	12	11	21.83	21.86	21.79		
5	QPSK	25	0	21.87	21.85	21.82		
5	16QAM	1	0	21.70	21.77	21.72	22	0-1
5	16QAM	1	12	21.77	21.73	21.71		
5	16QAM	1	24	21.76	21.71	21.70		
5	16QAM	12	0	20.83	20.83	20.82	21	0-2
5	16QAM	12	6	20.81	20.81	20.81		
5	16QAM	12	11	20.83	20.83	20.81		
5	16QAM	25	0	20.83	20.82	20.81		

<u><LTE Band 4></u>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	22.97	22.96	22.90	23	0
20	QPSK	1	49	22.95	22.69	22.86		
20	QPSK	1	99	22.64	22.67	22.89		
20	QPSK	50	0	21.95	21.84	21.76	22	0-1
20	QPSK	50	24	21.88	21.58	21.73		
20	QPSK	50	49	21.76	21.61	21.70		
20	QPSK	100	0	21.87	21.71	21.78		
20	16QAM	1	0	21.91	21.81	21.70	22	0-1
20	16QAM	1	49	21.83	21.53	21.67		
20	16QAM	1	99	21.48	21.45	21.69		
20	16QAM	50	0	20.90	20.71	20.60	21	0-2
20	16QAM	50	24	20.82	20.53	20.63		
20	16QAM	50	49	20.72	20.54	20.67		
20	16QAM	100	0	20.87	20.64	20.61		
Channel				20025	20175	20325	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	22.95	22.97	22.89	23	0
15	QPSK	1	37	22.94	22.62	22.84		
15	QPSK	1	74	22.58	22.65	22.88		
15	QPSK	36	0	21.88	21.82	21.68	22	0-1
15	QPSK	36	18	21.86	21.48	21.64		
15	QPSK	36	37	21.70	21.60	21.75		
15	QPSK	75	0	21.78	21.64	21.70		
15	16QAM	1	0	21.82	21.80	21.66	22	0-1
15	16QAM	1	37	21.73	21.49	21.64		
15	16QAM	1	74	21.41	21.40	21.59		
15	16QAM	36	0	20.90	20.70	20.53	21	0-2
15	16QAM	36	18	20.78	20.50	20.53		
15	16QAM	36	37	20.67	20.47	20.62		
15	16QAM	75	0	20.80	20.59	20.52		
Channel				20000	20175	20350	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	22.96	22.90	22.80	23	0
10	QPSK	1	24	22.93	22.64	22.85		
10	QPSK	1	49	22.63	22.57	22.83		
10	QPSK	25	0	21.90	21.77	21.63	22	0-1
10	QPSK	25	12	21.85	21.57	21.72		
10	QPSK	25	24	21.74	21.59	21.67		
10	QPSK	50	0	21.86	21.64	21.71		
10	16QAM	1	0	21.88	21.78	21.60	22	0-1
10	16QAM	1	24	21.81	21.50	21.61		
10	16QAM	1	49	21.47	21.35	21.59		
10	16QAM	25	0	20.80	20.67	20.54	21	0-2
10	16QAM	25	12	20.80	20.46	20.60		
10	16QAM	25	24	20.71	20.45	20.59		
10	16QAM	50	0	20.86	20.58	20.56		

Channel				19975	20175	20375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	22.96	22.95	22.86	23	0
5	QPSK	1	12	22.93	22.59	22.82		
5	QPSK	1	24	22.62	22.58	22.81		
5	QPSK	12	0	21.90	21.74	21.64	22	0-1
5	QPSK	12	6	21.78	21.51	21.68		
5	QPSK	12	11	21.66	21.54	21.70		
5	QPSK	25	0	21.83	21.65	21.70		
5	16QAM	1	0	21.88	21.74	21.61	22	0-1
5	16QAM	1	12	21.77	21.43	21.59		
5	16QAM	1	24	21.45	21.37	21.59		
5	16QAM	12	0	20.85	20.62	20.54	21	0-2
5	16QAM	12	6	20.76	20.51	20.59		
5	16QAM	12	11	20.62	20.52	20.66		
5	16QAM	25	0	20.77	20.58	20.60		

<2.4GHz WLAN Conducted Power>

General Note:

1. For 2.4GHz WLAN SAR testing, highest average RF output power channel for the lowest data rate for 802.11b were selected for SAR evaluation. 802.11g/n HT20 were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of 802.11b mode.

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	17.86	17.51	17.60	17.63
CH 6	2437	17.57			
CH 11	2462	17.78			

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	12.75	12.93	12.98	12.97	12.74	12.75	12.69	12.80
CH 6	2437	12.84							
CH 11	2462	12.99							

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	12.84	12.81	12.83	12.81	12.83	12.82	12.83	12.81
CH 6	2437	12.52							
CH 11	2462	12.74							

<2.4GHz Bluetooth>

General Note:

1. Base on the maximum conducted power is 9.5dBm of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, Per KDB 447498 D01v05r02, [(9 / 5) * √2.48] = 2.83 < 3. Therefore, Bluetooth SAR was not required.
2. Additional front and back Bluetooth SAR testing was used performed SPLSR analysis.
3. For 2.4GHz Bluetooth SAR testing was selected 3Mbps, due to its highest average power.
4. The duty factor was used theoretical 83.3% perform Bluetooth SAR testing.

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
v3.0+HS	CH 00	2402	4.51	7.38	7.42
	CH 39	2441	4.84	7.64	7.62
	CH 78	2480	5.21	8.10	8.11

Mode	Channel	Frequency (MHz)	Average power (dBm)
			GFSK
v4.0-LE	CH 00	2402	4.29
	CH 19	2440	4.67
	CH 39	2480	4.98

12.1 LTE Power verification

12.1.1 SVLTE operation

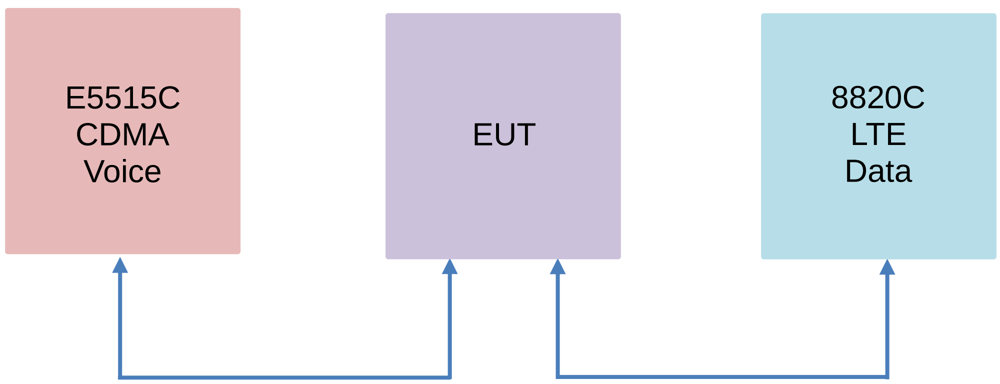
This device is capable of simultaneous voice and LTE (SVLTE) calls, whit he voice call supported by a CDMA 1x-RTT transmitter and the data connection supported by a separate LTE transmitter. A LTE power reduction scheme is applied during a LTE connection operating simultaneously with 1x-RTT voice calls. The maximum transmit power of LTE is limited depending on the CDMA 1x voice transmit power level. When CDMA 1x voice is operating at a certain range of high power levels, the maximum LTE transmit power is limited. When CDMA 1x voice transmit power is below a certain threshold transmit power level, LTE can transmit at the maximum power. Target levels of power reduction and CDMA vioice threshold levels are provided in below table

SVLTE Power Reduction Scheme		
Mode	CDMA 1x-RTT (dBm)	LTE Max. output power (dBm)
SVLTE	P ≥ 18.0	19.0
	P < 18.0	23.0

12.1.2 Output Power Verification

Per KDB 941225 D05v02r03 section4.4, output powers were measured in SVLTE mode the determine that the power reduction mechanism was operating reliably and consistently. The power reduction was investigated by simultaneously connecting the device to both LTE and CDMA base station simulators. LTE output powers were measured through conducted RF connections by first connecting the device in a LTE data call and subsequently a CDMA 1x-RTT call. CDMA powers were controlled by configuring the CDMA base station simulator to active bits. The LTE output power was monitored while changing the cell output power level. The power reduction targets and threshold level described in above table were confirmed. Please see results in below table.

SVLTE verification setup

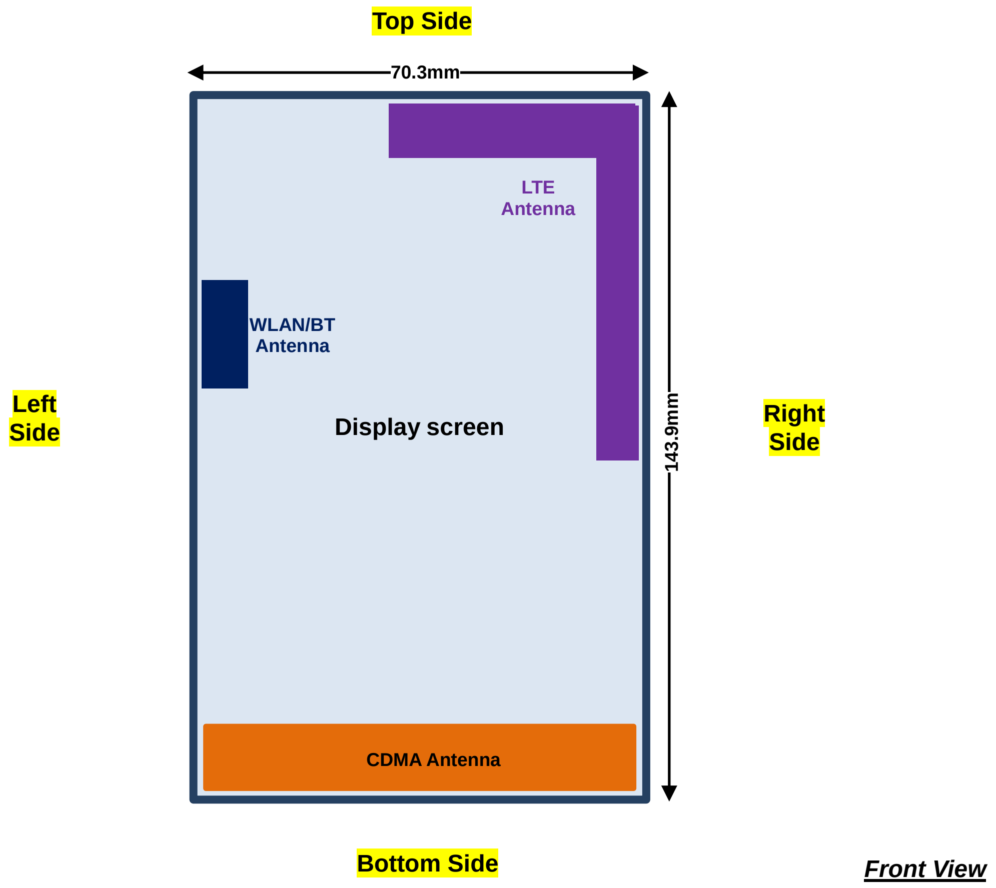


CDMA BC0		LTE Conducted Power (dBm)	
	1x-RTT Level	LTE Band 13 1RB, 0RB offset Channel 23230	LTE Band 4 1RB,0RB offset Channel 20175
Channel 384	24.3	18.91	18.97
	23.0	18.96	18.92
	22.0	18.88	18.95
	21.0	18.87	18.91
	20.0	18.95	18.93
	19.0	18.94	18.92
	18.0	18.94	18.95
	17.0	22.93	22.95
	16.0	22.94	22.92

CDMA BC1		LTE Conducted Power (dBm)	
	1x-RTT Level	LTE Band 13 1RB, 0RB offset Channel 23230	LTE Band 4 1RB,0RB offset Channel 20175
Channel 600	24.3	18.92	18.91
	23.0	18.93	18.88
	22.0	18.94	18.91
	21.0	18.90	18.95
	20.0	18.95	18.89
	19.0	18.96	18.88
	18.0	18.88	18.95
	17.0	22.93	22.91
	16.0	22.90	22.88

13. Antenna Location

<Mobile Phone>



Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
CDMA	≤ 25mm	≤ 25mm	> 25mm	≤ 25mm	≤ 25mm	≤ 25mm
LTE	≤ 25mm	≤ 25mm	≤ 25mm	> 25mm	≤ 25mm	> 25mm
BT&WLAN	≤ 25mm	≤ 25mm	> 25mm	> 25mm	> 25mm	≤ 25mm
Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
CDMA	Yes	Yes	No	Yes	Yes	Yes
LTE	Yes	Yes	Yes	No	Yes	No
BT&WLAN	Yes	Yes	No	No	No	Yes

General 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

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 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 941225 D01v02, Head SAR for RC3+SO55 is not required because the maximum average output power of RC1 is less than 1/4 dB higher than RC3+SO55 and considering the possibility of e.g. 3rd party VoIP was additional Ev-Do Rev A (RETAP 4096 bits) SAR testing performed on RC3+SO55 worse case.
4. Per KDB 941225 D01v02, in Hotspot mode EUT is treated as data device and SAR is tested with Ev-Do Rev 0 (RTAP 153.6kbps). If 1xRTT and Ev-Do Rev A (RETAP 4096 bits) power is high than 1/4dB higher than Re v0, SAR tests with those settings are necessary.
5. Per KDB 941225 D01v02, SAR for body-worn exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. To account for VOIP operation, Ev-Do Rev. A (RETAP 4096 bits) SAR testing was performed at the worst position identified by 1xRTT SAR test results, for both head and body-worn accessory exposure conditions.
6. 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.
7. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
8. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
9. Per KDB 941225 D05v02r03, 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.
10. Per KDB 941225 D05v02r03, 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.
11. 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

14.1 Head SAR

<CDMA 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)
01	CDMA2000 BC0	1xRTT RC3 SO55	Right Cheek	384	836.52	23.89	24.30	1.099	-0.1	0.175	0.192
	CDMA2000 BC0	RETAP 4096 bits	Right Cheek	384	836.52	23.97	24.30	1.079	-0.09	0.161	0.174
	CDMA2000 BC0	1xRTT RC3 SO55	Right Tilted	384	836.52	23.89	24.30	1.099	-0.11	0.092	0.101
	CDMA2000 BC0	1xRTT RC3 SO55	Left Cheek	384	836.52	23.89	24.30	1.099	0.03	0.120	0.132
	CDMA2000 BC0	1xRTT RC3 SO55	Left Tilted	384	836.52	23.89	24.30	1.099	0	0.081	0.089
	CDMA2000 BC1	1xRTT RC3 SO55	Right Cheek	1175	1908.75	23.95	24.30	1.084	-0.12	0.217	0.235
	CDMA2000 BC1	1xRTT RC3 SO55	Right Tilted	1175	1908.75	23.95	24.30	1.084	0	0.126	0.137
02	CDMA2000 BC1	1xRTT RC3 SO55	Left Cheek	1175	1908.75	23.95	24.30	1.084	-0.1	0.418	0.453
	CDMA2000 BC1	RETAP 4096Bits	Left Cheek	1175	1908.75	23.98	24.30	1.076	-0.07	0.412	0.444
	CDMA2000 BC1	1xRTT RC3 SO55	Left Tilted	1175	1908.75	23.95	24.30	1.084	-0.04	0.115	0.125

<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 13	10M	QPSK	1	0	Right Cheek	23230	782	22.95	23.00	1.012	-0.02	0.239	0.242
	LTE Band 13	10M	QPSK	25	0	Right Cheek	23230	782	21.94	22.00	1.014	0.02	0.172	0.174
	LTE Band 13	10M	QPSK	1	0	Right Tilted	23230	782	22.95	23.00	1.012	0.08	0.143	0.145
	LTE Band 13	10M	QPSK	25	0	Right Tilted	23230	782	21.94	22.00	1.014	0.03	0.103	0.104
03	LTE Band 13	10M	QPSK	1	0	Left Cheek	23230	782	22.95	23.00	1.012	0.05	0.337	0.341
	LTE Band 13	10M	QPSK	25	0	Left Cheek	23230	782	21.94	22.00	1.014	0.03	0.242	0.245
	LTE Band 13	10M	QPSK	1	0	Left Tilted	23230	782	22.95	23.00	1.012	0.01	0.171	0.173
	LTE Band 13	10M	QPSK	25	0	Left Tilted	23230	782	21.94	22.00	1.014	0.04	0.122	0.124
	LTE Band 4	20M	QPSK	1	0	Right Cheek	20050	1720	22.97	23.00	1.007	0.05	0.786	0.791
	LTE Band 4	20M	QPSK	50	0	Right Cheek	20050	1720	21.95	22.00	1.012	-0.02	0.612	0.619
	LTE Band 4	20M	QPSK	1	0	Right Tilted	20050	1720	22.97	23.00	1.007	-0.01	0.795	0.801
	LTE Band 4	20M	QPSK	1	0	Right Tilted	20175	1732.5	22.96	23.00	1.009	-0.03	0.776	0.783
	LTE Band 4	20M	QPSK	1	0	Right Tilted	20300	1745	22.90	23.00	1.023	0.03	0.755	0.773
	LTE Band 4	20M	QPSK	50	0	Right Tilted	20050	1720	21.95	22.00	1.012	0.01	0.617	0.624
	LTE Band 4	20M	QPSK	100	0	Right Tilted	20050	1720	21.87	22.00	1.030	-0.03	0.607	0.625
	LTE Band 4	20M	QPSK	1	0	Left Cheek	20050	1720	22.97	23.00	1.007	0.05	1.070	1.077
04	LTE Band 4	20M	QPSK	1	0	Left Cheek	20175	1732.5	22.96	23.00	1.009	0.02	1.080	1.090
	LTE Band 4	20M	QPSK	1	0	Left Cheek	20300	1745	22.90	23.00	1.023	0.01	1.060	1.085
	LTE Band 4	20M	QPSK	50	0	Left Cheek	20050	1720	21.95	22.00	1.012	-0.02	0.871	0.881
	LTE Band 4	20M	QPSK	50	0	Left Cheek	20175	1732.5	21.84	22.00	1.038	0.01	0.866	0.898
	LTE Band 4	20M	QPSK	50	0	Left Cheek	20300	1745	21.76	22.00	1.057	-0.04	0.844	0.892
	LTE Band 4	20M	QPSK	100	0	Left Cheek	20050	1720	21.87	22.00	1.030	0.03	0.876	0.903
	LTE Band 4	20M	QPSK	1	0	Left Tilted	20050	1720	22.97	23.00	1.007	-0.02	0.868	0.874
	LTE Band 4	20M	QPSK	1	0	Left Tilted	20175	1732.5	22.96	23.00	1.009	-0.02	0.875	0.883
	LTE Band 4	20M	QPSK	1	0	Left Tilted	20300	1745	22.90	23.00	1.023	0.02	0.874	0.894
	LTE Band 4	20M	QPSK	50	0	Left Tilted	20050	1720	21.95	22.00	1.012	0.01	0.679	0.687
	LTE Band 4	20M	QPSK	100	0	Left Tilted	20050	1720	21.87	22.00	1.030	0.02	0.679	0.700

< WLAN 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)
05	WLAN 2.4GHz	802.11b 1Mbps	Right Cheek	1	2412	17.86	18.00	1.033	0	0.369	0.381
	WLAN 2.4GHz	802.11b 1Mbps	Right Tilted	1	2412	17.86	18.00	1.033	0.02	0.127	0.131
	WLAN 2.4GHz	802.11b 1Mbps	Left Cheek	1	2412	17.86	18.00	1.033	0	0.206	0.213
	WLAN 2.4GHz	802.11b 1Mbps	Left Tilted	1	2412	17.86	18.00	1.033	0.06	0.068	0.070

14.2 Hotspot SAR

<CDMA 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)
	CDMA2000 BC0	RTAP 153.6Kbps	Front	1cm	384	836.52	23.98	24.30	1.076	-0.05	0.286	0.308
06	CDMA2000 BC0	RTAP 153.6Kbps	Back	1cm	384	836.52	23.98	24.30	1.076	-0.07	0.352	0.379
	CDMA2000 BC0	RTAP 153.6Kbps	Left Side	1cm	384	836.52	23.98	24.30	1.076	-0.07	0.176	0.189
	CDMA2000 BC0	RTAP 153.6Kbps	Right Side	1cm	384	836.52	23.98	24.30	1.076	-0.02	0.177	0.191
	CDMA2000 BC0	RTAP 153.6Kbps	Bottom Side	1cm	384	836.52	23.98	24.30	1.076	-0.09	0.073	0.079
	CDMA2000 BC1	RTAP 153.6Kbps	Front	1cm	1175	1908.75	23.99	24.30	1.074	-0.09	0.399	0.429
07	CDMA2000 BC1	RTAP 153.6Kbps	Back	1cm	1175	1908.75	23.99	24.30	1.074	-0.17	0.651	0.699
	CDMA2000 BC1	RTAP 153.6Kbps	Left Side	1cm	1175	1908.75	23.99	24.30	1.074	-0.1	0.258	0.277
	CDMA2000 BC1	RTAP 153.6Kbps	Right Side	1cm	1175	1908.75	23.99	24.30	1.074	-0.15	0.031	0.033
	CDMA2000 BC1	RTAP 153.6Kbps	Bottom Side	1cm	1175	1908.75	23.99	24.30	1.074	-0.13	0.556	0.597

<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 13	10M	QPSK	1	0	Front	1cm	23230	782	22.95	23.00	1.012	-0.01	0.203	0.205
	LTE Band 13	10M	QPSK	25	0	Front	1cm	23230	782	21.94	22.00	1.014	0.01	0.151	0.153
08	LTE Band 13	10M	QPSK	1	0	Back	1cm	23230	782	22.95	23.00	1.012	0	0.343	0.347
	LTE Band 13	10M	QPSK	25	0	Back	1cm	23230	782	21.94	22.00	1.014	0.01	0.261	0.265
	LTE Band 13	10M	QPSK	1	0	Right Side	1cm	23230	782	22.95	23.00	1.012	0.02	0.268	0.271
	LTE Band 13	10M	QPSK	25	0	Right Side	1cm	23230	782	21.94	22.00	1.014	-0.01	0.204	0.207
	LTE Band 13	10M	QPSK	1	0	Top Side	1cm	23230	782	22.95	23.00	1.012	0.04	0.033	0.033
	LTE Band 13	10M	QPSK	25	0	Top Side	1cm	23230	782	21.94	22.00	1.014	0.02	0.024	0.024
	LTE Band 4	20M	QPSK	1	0	Front	1cm	20050	1720	22.97	23.00	1.007	-0.03	0.444	0.447
	LTE Band 4	20M	QPSK	50	0	Front	1cm	20050	1720	21.95	22.00	1.012	-0.06	0.311	0.315
09	LTE Band 4	20M	QPSK	1	0	Back	1cm	20050	1720	22.97	23.00	1.007	-0.16	0.926	0.932
	LTE Band 4	20M	QPSK	1	0	Back	1cm	20175	1732.5	22.96	23.00	1.009	-0.16	0.906	0.914
	LTE Band 4	20M	QPSK	1	0	Back	1cm	20300	1745	22.90	23.00	1.023	-0.13	0.900	0.921
	LTE Band 4	20M	QPSK	50	0	Back	1cm	20050	1720	21.95	22.00	1.012	-0.14	0.717	0.725
	LTE Band 4	20M	QPSK	100	0	Back	1cm	20050	1720	21.87	22.00	1.030	-0.19	0.718	0.740
	LTE Band 4	20M	QPSK	1	0	Right Side	1cm	20050	1720	22.97	23.00	1.007	-0.14	0.621	0.625
	LTE Band 4	20M	QPSK	50	0	Right Side	1cm	20050	1720	21.95	22.00	1.012	-0.18	0.485	0.491
	LTE Band 4	20M	QPSK	1	0	Top Side	1cm	20050	1720	22.97	23.00	1.007	-0.15	0.129	0.130
	LTE Band 4	20M	QPSK	50	0	Top Side	1cm	20050	1720	21.95	22.00	1.012	-0.14	0.102	0.103

< WLAN 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)
	WLAN2.4GHz	802.11b 1Mbps	Front	1cm	1	2412	17.86	18.00	1.033	-0.07	0.087	0.090
10	WLAN2.4GHz	802.11b 1Mbps	Back	1cm	1	2412	17.86	18.00	1.033	-0.1	0.406	0.419
	WLAN2.4GHz	802.11b 1Mbps	Left Side	1cm	1	2412	17.86	18.00	1.033	-0.16	0.190	0.196

14.3 Body Worn Accessory SAR

<CDMA 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)
	CDMA2000 BC0	1xRTT RC3 SO32	Front	1cm	384	836.52	23.91	24.30	1.094	-0.11	0.271	0.296
11	CDMA2000 BC0	1xRTT RC3 SO32	Back	1cm	384	836.52	23.91	24.30	1.094	-0.16	0.296	0.324
	CDMA2000 BC0	RETAP 4096Bits	Back	1cm	384	836.52	23.97	24.30	1.079	-0.09	0.282	0.304
	CDMA2000 BC1	1xRTT RC3 SO32	Front	1cm	1175	1908.75	23.92	24.30	1.091	-0.11	0.415	0.453
12	CDMA2000 BC1	1xRTT RC3 SO32	Back	1cm	1175	1908.75	23.92	24.30	1.091	-0.16	0.674	0.736
	CDMA2000 BC1	RETAP 4096Bits	Back	1cm	1175	1908.75	23.98	24.30	1.076	-0.12	0.662	0.713

<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 13	10M	QPSK	1	0	Front	1cm	23230	782	22.95	23.00	1.012	-0.01	0.203	0.205
	LTE Band 13	10M	QPSK	25	0	Front	1cm	23230	782	21.94	22.00	1.014	0.01	0.151	0.153
13	LTE Band 13	10M	QPSK	1	0	Back	1cm	23230	782	22.95	23.00	1.012	0	0.343	0.347
	LTE Band 13	10M	QPSK	25	0	Back	1cm	23230	782	21.94	22.00	1.014	0.01	0.261	0.265
	LTE Band 4	20M	QPSK	1	0	Front	1cm	20050	1720	22.97	23.00	1.007	-0.03	0.444	0.447
	LTE Band 4	20M	QPSK	50	0	Front	1cm	20050	1720	21.95	22.00	1.012	-0.06	0.311	0.315
14	LTE Band 4	20M	QPSK	1	0	Back	1cm	20050	1720	22.97	23.00	1.007	-0.16	0.926	0.932
	LTE Band 4	20M	QPSK	1	0	Back	1cm	20175	1732.5	22.96	23.00	1.009	-0.16	0.906	0.914
	LTE Band 4	20M	QPSK	1	0	Back	1cm	20300	1745	22.90	23.00	1.023	-0.13	0.900	0.921
	LTE Band 4	20M	QPSK	50	0	Back	1cm	20050	1720	21.95	22.00	1.012	-0.14	0.717	0.725
	LTE Band 4	20M	QPSK	100	0	Back	1cm	20050	1720	21.87	22.00	1.030	-0.19	0.718	0.740

<WLAN 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)
	WLAN2.4GHz	802.11b 1Mbps	Front	1cm	1	2412	17.86	18.00	1.033	-0.07	0.087	0.090
15	WLAN2.4GHz	802.11b 1Mbps	Back	1cm	1	2412	17.86	18.00	1.033	-0.1	0.406	0.419

<Bluetooth 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)
	Bluetooth	1Mbps	Front	1cm	78	2480	8.11	9.00	1.227	0.12	0.004	0.005
16	Bluetooth	1Mbps	Back	1cm	78	2480	8.11	9.00	1.227	0.15	0.023	0.028

14.4 Repeated SAR Measurement

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)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 4	20M	QPSK	1	0	Left Cheek	20175	1732.5	22.96	23.00	1.009	0.02	1.080	-	1.090
2nd	LTE Band 4	20M	QPSK	1	0	Left Cheek	20175	1732.5	22.96	23.00	1.009	0.02	1.010	1.07	1.019

General 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 difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Smart Phone			Note
		Head	Body-worn	Hotspot	
1.	CDMA(Voice) + WLAN2.4GHz(data)	Yes	Yes		
2.	CDMA((Voice) + Bluetooth(data)		Yes		
3.	CDMA(Voice) + LTE(data) + WLAN2.4GHz(data)	Yes	Yes		SVLTE + 2.4GHz Hotspot
4.	CDMA(Voice) + LTE(data) + Bluetooth(data)		Yes		SVLTE + Bluetooth Tethering
5.	CDMA(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
6.	LTE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
7.	CDMA(Data) + Bluetooth(data)		Yes		
8.	LTE(Data) + Bluetooth(data)		Yes		

General Note:

1. This device supported VoIP in CDMA, 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) Per KDB 941225 D05 v02r03, maximum power standalone SAR of 1xRTT/EVDO/LTE is used for simultaneous transmission analysis.
   ii) Start analysis from full power combination
   iii) 1g-SAR scalar summation < 1.6W/kg, simultaneous SAR measurement and SVLTE reduced power mode are not necessary.
   iv) 1g-SAR summation >1.6W/kg, SPLSR calculation is necessary.
   v) SPLSR ≤ 0.04, SVLTE reduced power mode evaluation is not required.
   vi) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   vii) The SPLSR calculated results please refer to section 15.4.

15.1 Head Exposure Conditions

Exposure Position	1		2		3	1+2+3 Summed SAR (W/kg)	SPLSR	Case No
	CDMA		LTE		2.4GHz WLAN			
	Band	SAR (W/kg)	Band	SAR (W/kg)	SAR (W/kg)			
Right Cheek	BC0	0.192	Band 13	0.242	0.381	**0.82**		
Right Tilted		0.101		0.145	0.131	**0.38**		
Left Cheek		0.132		0.341	0.213	**0.69**		
Left Tilted		0.089		0.173	0.070	**0.33**		
Right Cheek	BC1	0.235	Band 13	0.242	0.381	**0.86**		
Right Tilted		0.137		0.145	0.131	**0.41**		
Left Cheek		0.453		0.341	0.213	**1.01**		
Left Tilted		0.125		0.173	0.070	**0.37**		
Right Cheek	BC0	0.192	Band 4	0.791	0.381	**1.36**		
Right Tilted		0.101		0.801	0.131	**1.03**		
Left Cheek		0.132		1.090	0.213	**1.44**		
Left Tilted		0.089		0.894	0.070	**1.05**		
Right Cheek	BC1	0.235	Band 4	0.791	0.381	**1.41**		
Right Tilted		0.137		0.801	0.131	**1.07**		
Left Cheek		0.453		1.090	0.213	**1.76**	0.03	Case 1
Left Tilted		0.125		0.894	0.070	**1.09**		

15.2 Hotspot Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2 Summed SAR (W/kg)	SPLSR	Case No
			WWAN	2.4GHz WLAN			
			SAR (W/kg)	SAR (W/kg)			
CDMA	BC0	Front	0.308	0.090	**0.40**		
		Back	0.379	0.419	**0.80**		
		Left side	0.189	0.196	**0.39**		
		Right side	0.191		**0.19**		
		Top side			**0.00**		
		Bottom side	0.079		**0.08**		
	BC1	Front	0.429	0.090	**0.52**		
		Back	0.699	0.419	**1.12**		
		Left side	0.277	0.196	**0.47**		
		Right side	0.033		**0.03**		
		Top side			**0.00**		
		Bottom side	0.597		**0.60**		
LTE	Band 13	Front	0.205	0.090	**0.30**		
		Back	0.347	0.419	**0.77**		
		Left side		0.196	**0.20**		
		Right side	0.271		**0.27**		
		Top side	0.033		**0.03**		
		Bottom side			**0.00**		
	Band 4	Front	0.447	0.090	**0.54**		
		Back	0.932	0.419	**1.35**		
		Left side		0.196	**0.20**		
		Right side	0.625		**0.63**		
		Top side	0.130		**0.13**		
		Bottom side			**0.00**		

15.3 Body-Worn Accessory Exposure Conditions

Exposure Position	1 CDMA Band	1 CDMA SAR (W/kg)	2 LTE Band	2 LTE SAR (W/kg)	3 2.4GHz WLAN SAR (W/kg)	1+2+3 Summed SAR (W/kg)	SPLSR	Case No
Front	BC0	0.296	Band 13	0.205	0.090	**0.59**		
Back		0.324		0.347	0.419	**1.09**		
Front	BC1	0.453	Band 13	0.205	0.090	**0.75**		
Back		0.736		0.347	0.419	**1.50**		
Front	BC0	0.296	Band 4	0.447	0.090	**0.83**		
Back		0.324		0.932	0.419	**1.68**	0.02	Case 2
Front	BC1	0.453	Band 4	0.447	0.090	**0.99**		
Back		0.736		0.932	0.419	**2.09**	0.02	Case 3

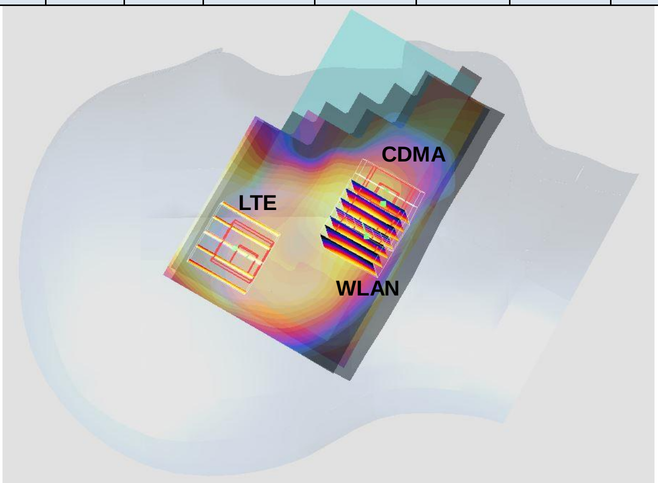
Exposure Position	1 CDMA Band	1 CDMA SAR (W/kg)	2 LTE Band	2 LTE SAR (W/kg)	4 2.4GHz Bluetooth SAR (W/kg)	1+2+4 Summed SAR (W/kg)	SPLSR	Case No
Front	BC0	0.296	Band 13	0.205	0.005	**0.51**		
Back		0.324		0.347	0.028	**0.70**		
Front	BC1	0.453	Band 13	0.205	0.005	**0.66**		
Back		0.736		0.347	0.028	**1.11**		
Front	BC0	0.296	Band 4	0.447	0.005	**0.75**		
Back		0.324		0.932	0.028	**1.28**		
Front	BC1	0.453	Band 4	0.447	0.005	**0.91**		
Back		0.736		0.932	0.028	**1.70**	0.02	Case 4

15.4 SPLSR Evaluation and Analysis

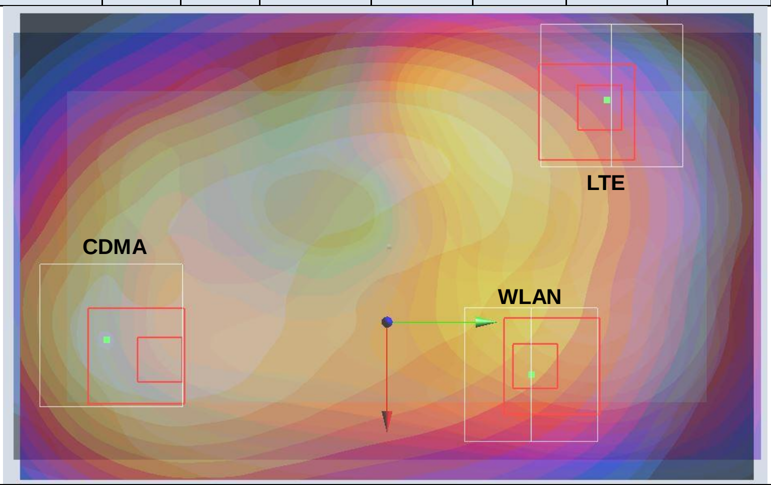
General Note:

1. SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*). If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary

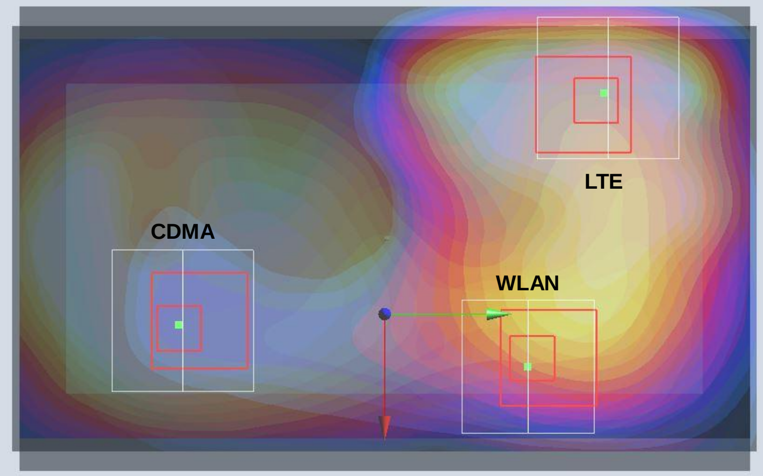
	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m) X	Y	Z	3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
Case 1	CDMA BC1	Left Cheek	0.453	0	0.0627	0.253	-0.172	75.0	1.54	0.03	Not required
	LTE Band 4		1.090	0	0.0311	0.321	-0.171				
	CDMA BC1		0.453	0	0.0627	0.253	-0.172	24.4	0.67	0.02	Not required
	WLAN 2.4GHz		0.213	0	0.0409	0.264	-0.173				
	LTE Band 4		1.090	0	0.0311	0.321	-0.171	57.9	1.30	0.03	Not required
	WLAN 2.4GHz		0.213	0	0.0409	0.264	-0.173				



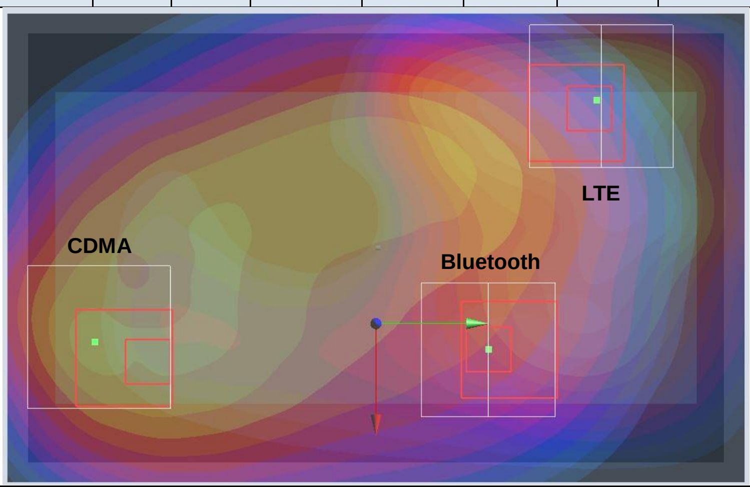
	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m) X	Y	Z	3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
Case 2	CDMA BC0	Back	0.324	1	0.003	-0.046	-0.205	110.6	1.26	0.01	Not required
	LTE Band 4		0.932	1	-0.051	0.0505	-0.203				
	CDMA BC0		0.324	1	0.003	-0.046	-0.205	78.9	0.74	0.01	Not required
	WLAN2.4GHz		0.419	1	0.0118	0.0324	-0.205				
	LTE Band 4		0.932	1	-0.051	0.0505	-0.203	65.4	1.35	0.02	Not required
	WLAN2.4GHz		0.419	1	0.0118	0.0324	-0.205				



Case	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m) X	Y	Z	3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
Case 3	CDMA BC1	Back	0.736	1	0.0015	-0.0455	-0.205	109.4	1.67	0.02	Not required
	LTE Band 4		0.932	1	-0.051	0.0505	-0.203				
	CDMA BC1		0.736	1	0.0015	-0.0455	-0.205	78.6	1.16	0.02	Not required
	WLAN2.4GHz		0.419	1	0.0118	0.0324	-0.205				
	LTE Band 4		0.932	1	-0.051	0.0505	-0.203	65.4	1.35	0.02	Not required
	WLAN2.4GHz		0.419	1	0.0118	0.0324	-0.205				



Case	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m) X	Y	Z	3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
Case 4	CDMA BC1	Back	0.736	1	0.0015	-0.0455	-0.205	109.4	1.67	0.02	Not required
	LTE Band 4		0.932	1	-0.051	0.0505	-0.203				
	CDMA BC1		0.736	1	0.0015	-0.0455	-0.205	70.8	0.76	0.01	Not required
	Bluetooth		0.028	1	0.0058	0.0252	-0.205				
	LTE Band 4		0.932	1	-0.051	0.0505	-0.203	62.2	0.96	0.02	Not required
	Bluetooth		0.028	1	0.0058	0.0252	-0.205				



Test Engineer : Ken Lee, Kurt Liu, Jerry Hu, Tommy Chen, Galen Zhang, Angelo Chang, Jack Wu, and Bevis Chang

16. 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 below.

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

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

(b) κ is the coverage factor

Table 16.1. Standard Uncertainty for Assumed Distribution

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

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

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
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 16.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

17. References

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

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

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

[4] SPEAG DASY System Handbook

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

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

[7] FCC KDB 648474 D04 v01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013.

[8] FCC KDB 941225 D01 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 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013

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

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

[13] 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_140709

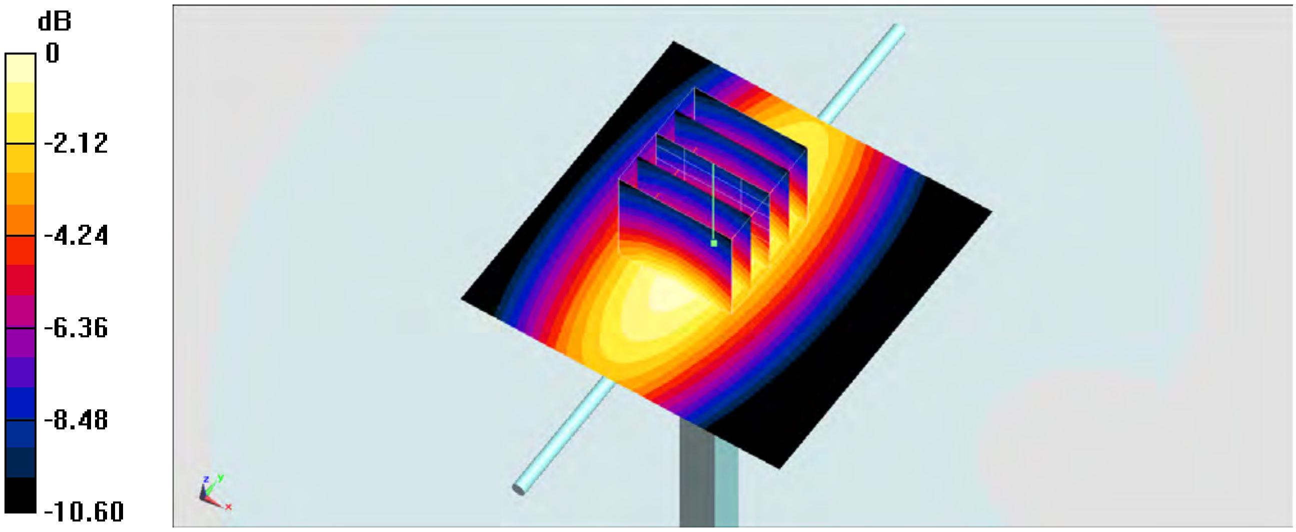
DUT: D750V3-1012

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: HSL_750_140709 Medium parameters used: f = 750 MHz; σ = 0.879 S/m; ε_r = 40.957; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(10.26, 10.26, 10.26); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.59 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 54.143 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.05 W/kg
SAR(1 g) = 2.05 W/kg; SAR(10 g) = 1.35 W/kg
Maximum value of SAR (measured) = 2.59 W/kg



0 dB = 2.59 W/kg = 4.13 dBW/kg

System Check_Body_750MHz_140705

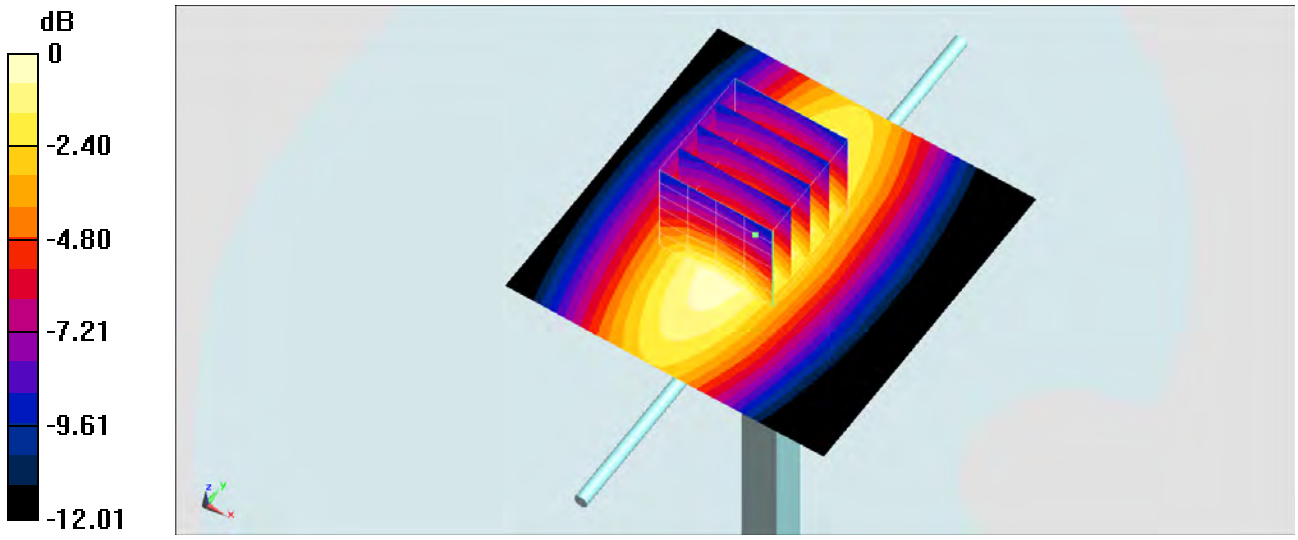
DUT: D750V3-1012

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: MSL_750_140705 Medium parameters used: f = 750 MHz; σ = 0.961 S/m; ε_r = 53.917; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.70 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.52 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.21 W/kg
SAR(1 g) = 2.2 W/kg; SAR(10 g) = 1.47 W/kg
Maximum value of SAR (measured) = 2.76 W/kg



0 dB = 2.76 W/kg = 4.41 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/7/11

System Check_Head_835MHz_140711

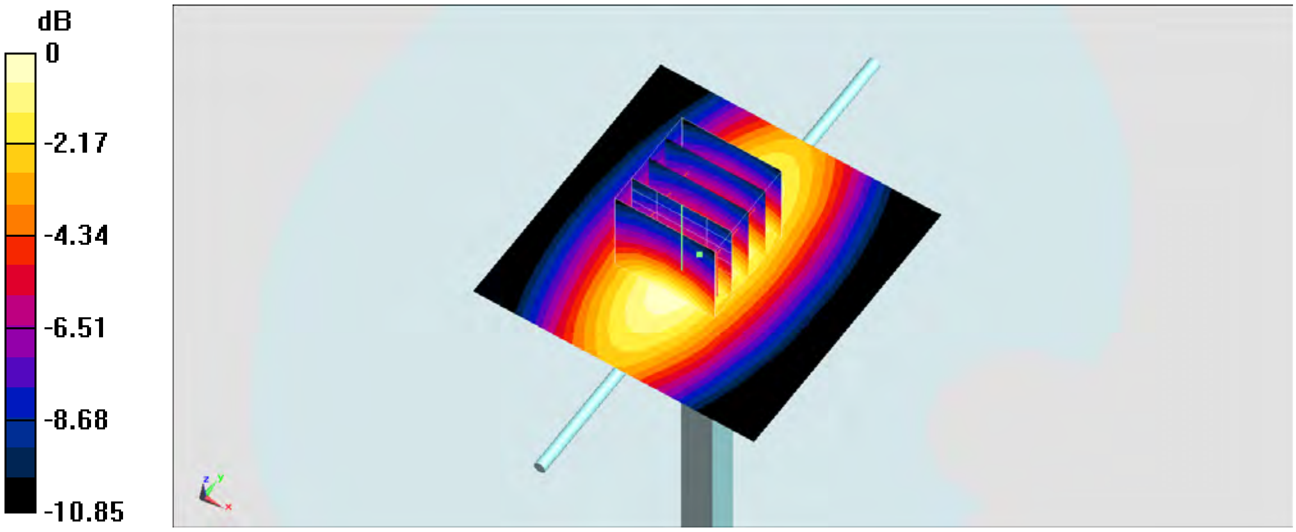
DUT: D835V2-499

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_850_140711 Medium parameters used: f = 835 MHz; σ = 0.9 S/m; ε_r = 40.826; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 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: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.79 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.981 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 3.21 W/kg
SAR(1 g) = 2.22 W/kg; SAR(10 g) = 1.46 W/kg
Maximum value of SAR (measured) = 2.74 W/kg



0 dB = 2.74 W/kg = 4.38 dBW/kg

System Check_Body_835MHz_140711

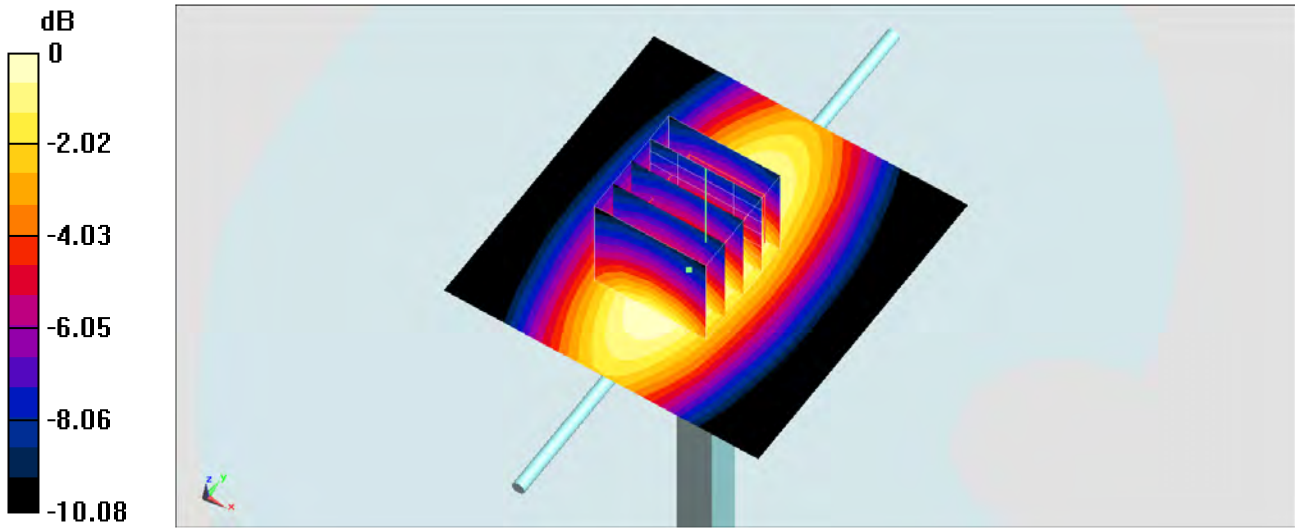
DUT: D835V2-499

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_850_140711 Medium parameters used: f = 835 MHz; σ = 0.976 S/m; ε_r = 53.012; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 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: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.56 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 61.452 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 3.49 W/kg
SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.66 W/kg
Maximum value of SAR (measured) = 3.06 W/kg



0 dB = 3.06 W/kg = 4.86 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/7/6

System Check_Head_1750MHz_140706

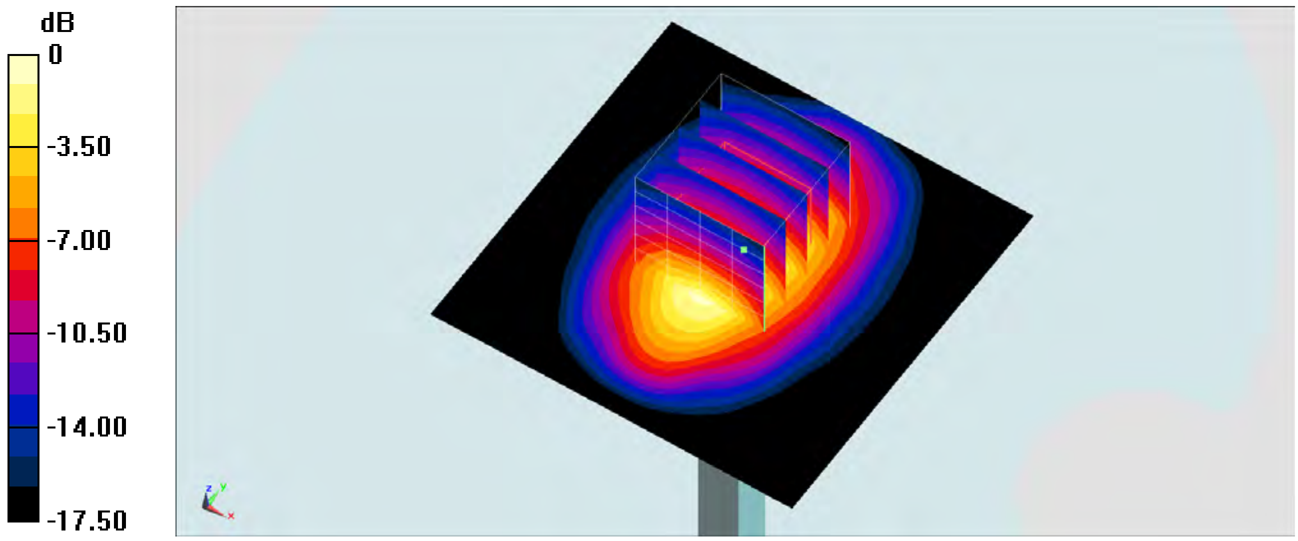
DUT: D1750V2-1068

Communication System:CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: HSL_1750_140706 Medium parameters used: f = 1750 MHz; σ = 1.405 S/m; ε_r = 39.044; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8.54, 8.54, 8.54); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.1 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 100.3 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 9.76 W/kg; SAR(10 g) = 5.2 W/kg
Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg

System Check_Body_1750MHz_140704

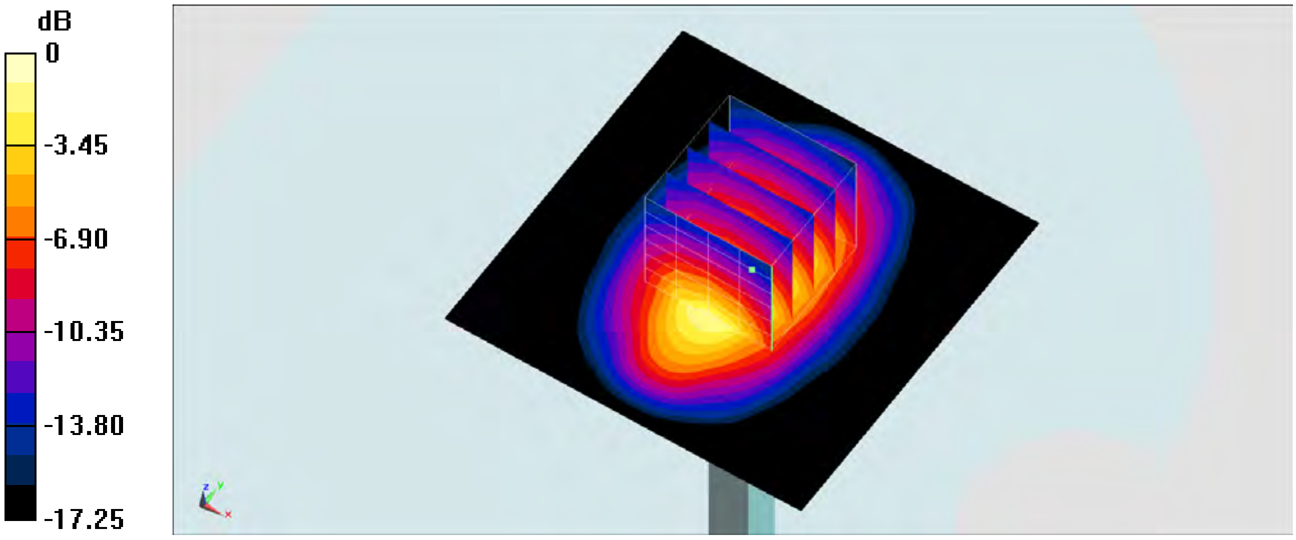
DUT: D1750V2-1068

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140704 Medium parameters used: f = 1750 MHz; σ = 1.538 S/m; ε_r = 52.117; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2013/11/4;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2013/11/5
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.1 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 93.10 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 16.0 W/kg
SAR(1 g) = 9.4 W/kg; SAR(10 g) = 5.12 W/kg
Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.14 dBW/kg

System Check_Head_1900MHz_140711

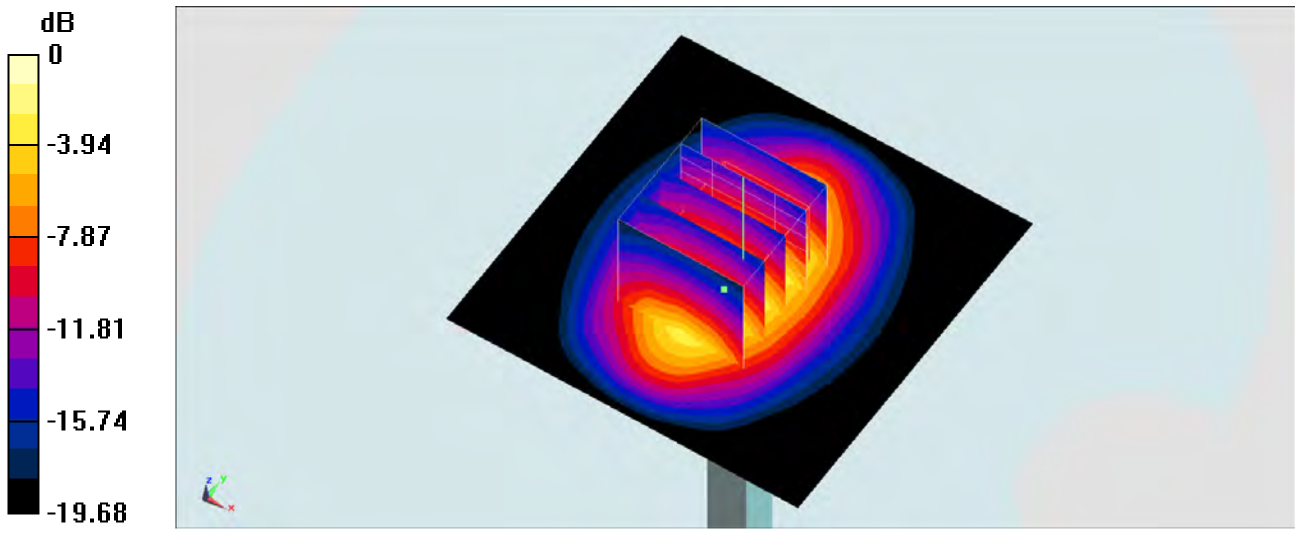
DUT: D1900V2-5d041

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_140711 Medium parameters used: f = 1900 MHz; σ = 1.432 S/m; ε_r = 39.344; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 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: 2014/5/15
- Phantom: SAM_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 12.8 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 94.080 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.22 W/kg
Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg = 11.40 dBW/kg

System Check_Body_1900MHz_140710

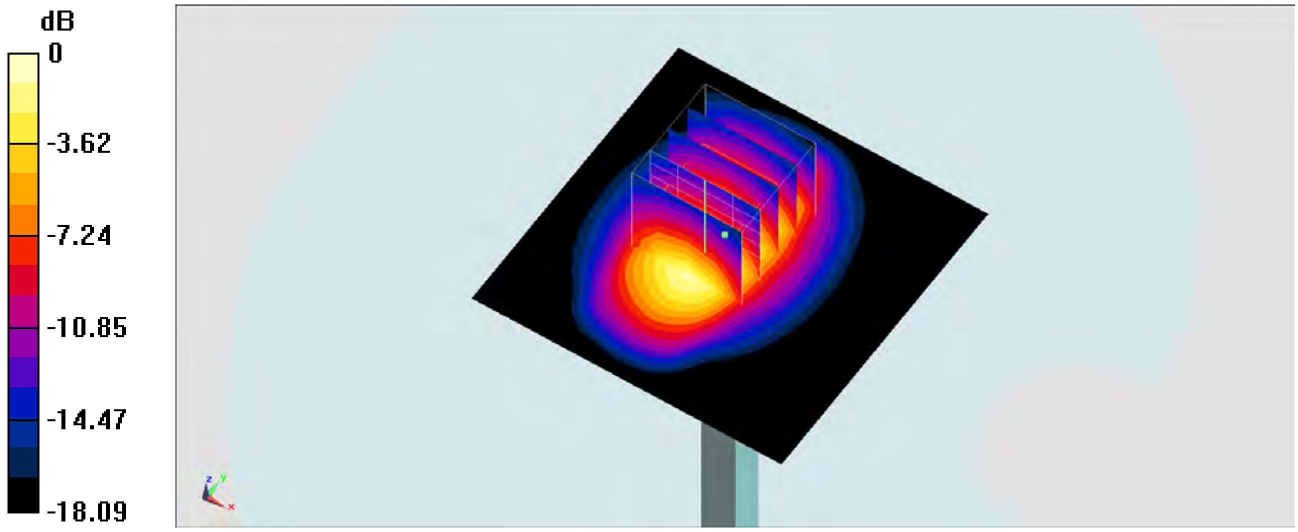
DUT: D1900V2-5d041

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140710 Medium parameters used: f = 1900 MHz; σ = 1.565 S/m; ε_r = 52.909; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY5 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: 2014/5/15
- Phantom: SAM_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.3 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 87.636 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.39 W/kg
Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

System Check_Head_2450MHz_140710

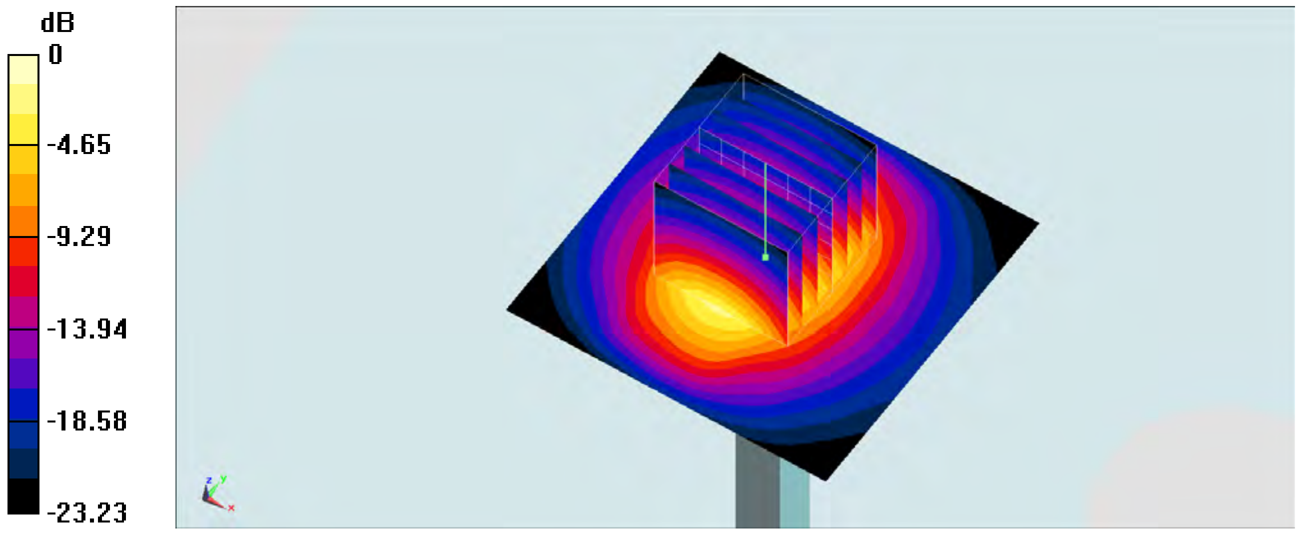
DUT: D2450V2-924

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450_140710 Medium parameters used: f = 2450 MHz; σ = 1.851 S/m; ε_r = 39.252; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(7.26, 7.26, 7.26); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 20.2 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.7 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 5.97 W/kg
Maximum value of SAR (measured) = 20.4 W/kg



0 dB = 20.4 W/kg = 13.10 dBW/kg

System Check_Body_2450MHz_140705

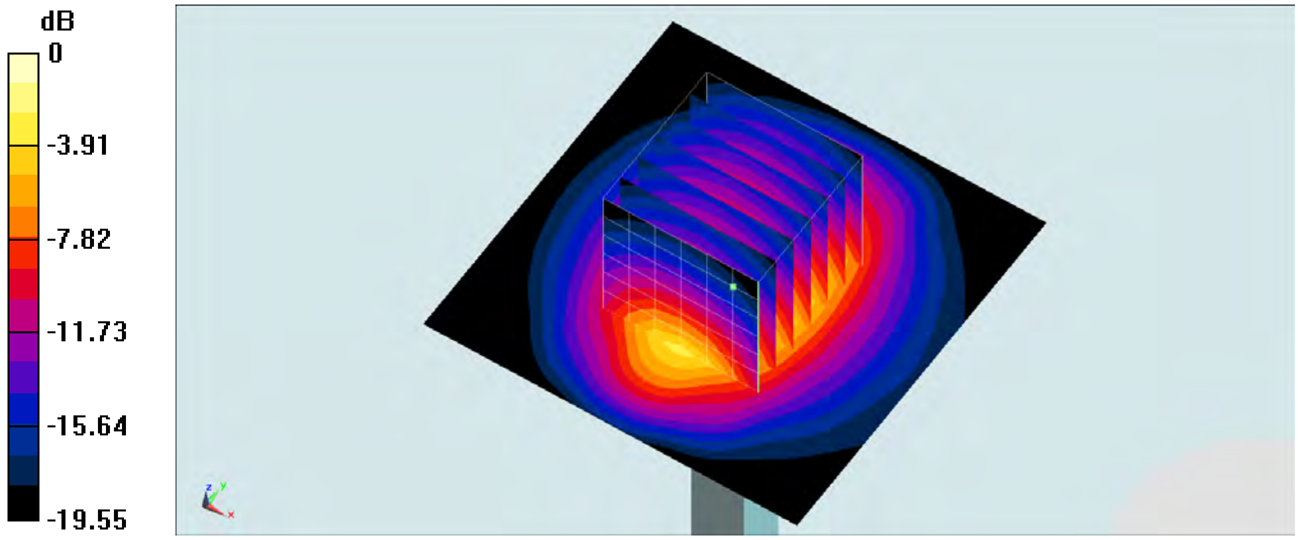
DUT: D2450V2-924

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_140705 Medium parameters used: f = 2450 MHz; σ = 2.015 S/m; ε_r = 53.957; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.32, 7.32, 7.32); Calibrated: 2013/11/4;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2013/11/5
- Phantom: SAM_Left; Type: QD000P40CD; Serial: S/N:1796
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 18.7 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.08 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 23.6 W/kg
SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.89 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

System Check_Body_2450MHz_140712

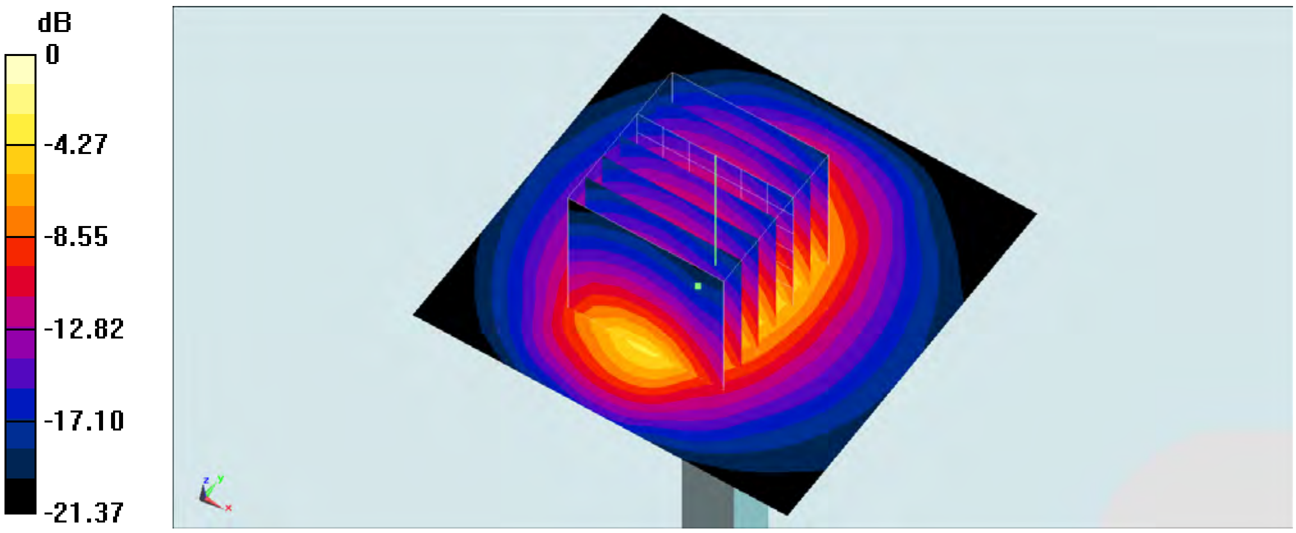
DUT: D2450V2-924

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_140712 Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 53.936; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3931; ConvF(7.24, 7.24, 7.24); Calibrated: 2013/9/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 20.7 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.454 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 23.8 W/kg
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.72 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

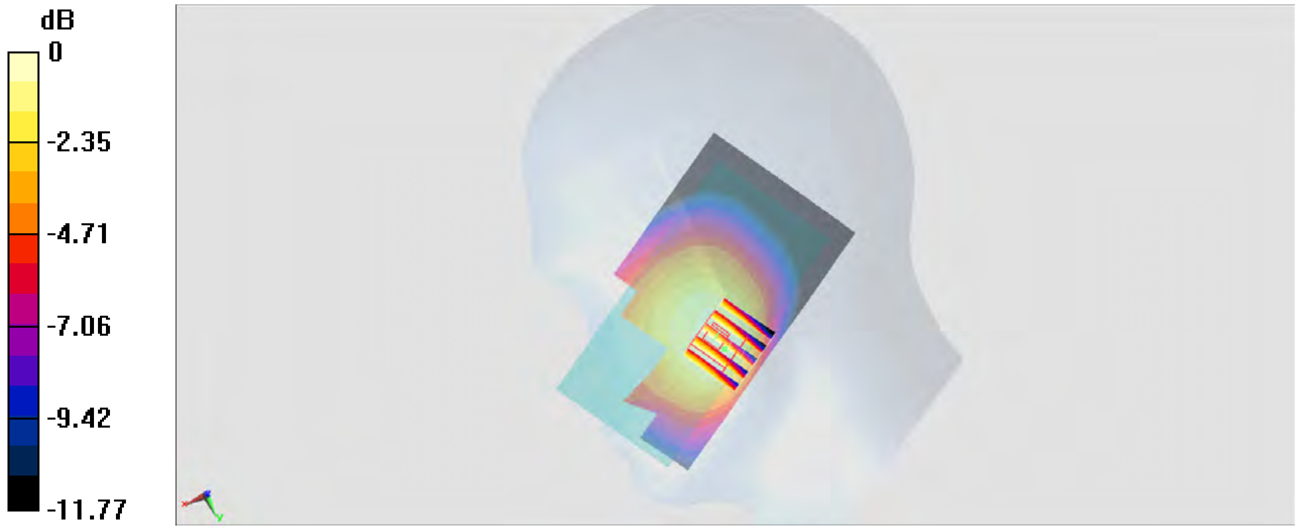
#01_CDMA2000 BC0_1xRTT RC3 SO55_Right Cheek_Ch384

Communication System: CDMA ; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: HSL_850_140711 Medium parameters used: f = 837 MHz; σ = 0.902 S/m; ε_r = 40.813; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 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: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch384/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.200 W/kg

Configuration/Ch384/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.672 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.209 W/kg
SAR(1 g) = 0.175 W/kg; SAR(10 g) = 0.130 W/kg
Maximum value of SAR (measured) = 0.199 W/kg



0 dB = 0.199 W/kg = -7.01 dBW/kg

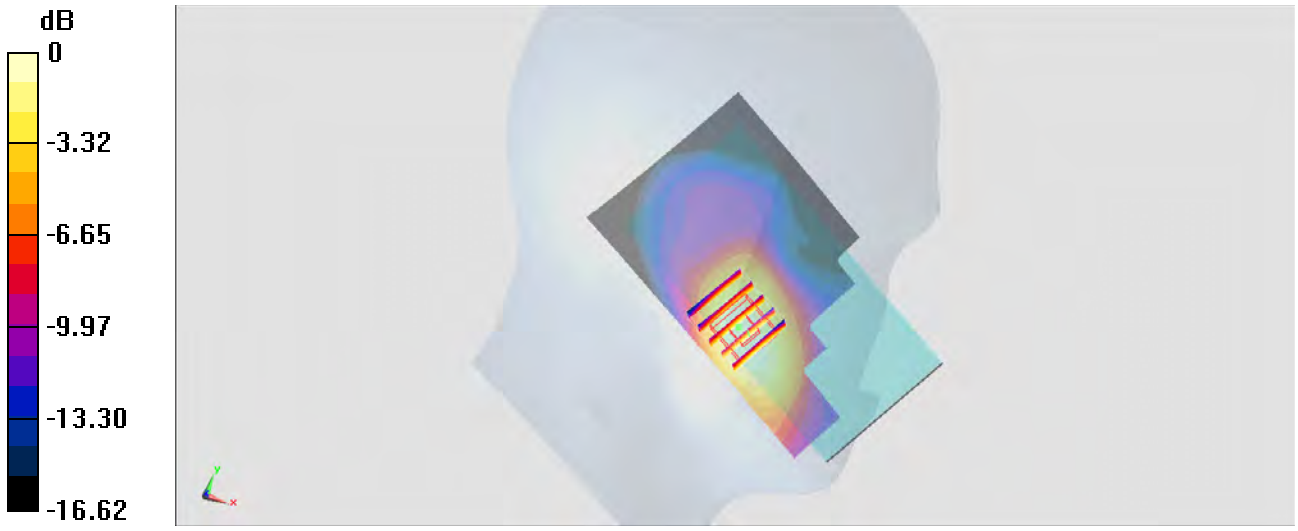
#02_CDMA2000 BC1_1xRTT RC3 SO55_Left Cheek_Ch1175

Communication System: CDMA; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium: HSL_1900_140711 Medium parameters used: f = 1909 MHz; σ = 1.441 S/m; ε_r = 39.288; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 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: 2014/5/15
- Phantom: SAM_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch1175/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.546 W/kg

Configuration/Ch1175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.278 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.609 W/kg
SAR(1 g) = 0.418 W/kg; SAR(10 g) = 0.263 W/kg
Maximum value of SAR (measured) = 0.519 W/kg



0 dB = 0.519 W/kg = -2.85 dBW/kg

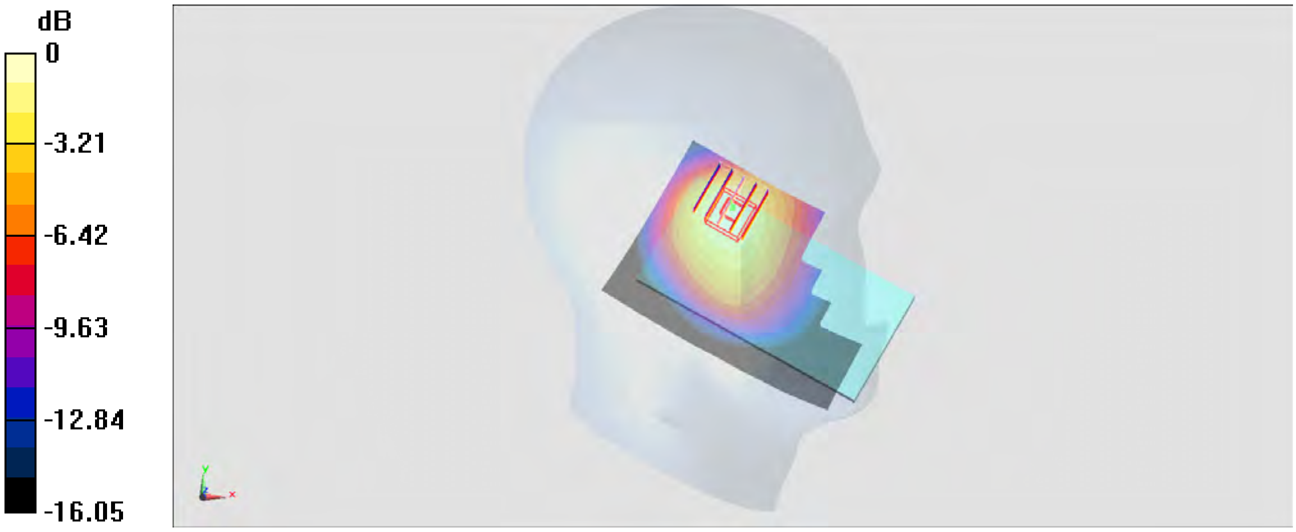
#03_LTE Band 13_10M_QPSK_1RB_0Offset_Left Cheek_Ch23230

Communication System: LTE ; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: HSL_750_140709 Medium parameters used: f = 782 MHz; σ = 0.897 S/m; ε_r = 40.237; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(10.26, 10.26, 10.26); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch23230/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.440 W/kg

Configuration/Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.584 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.541 W/kg
SAR(1 g) = 0.337 W/kg; SAR(10 g) = 0.214 W/kg
Maximum value of SAR (measured) = 0.439 W/kg



0 dB = 0.439 W/kg = -3.58 dBW/kg

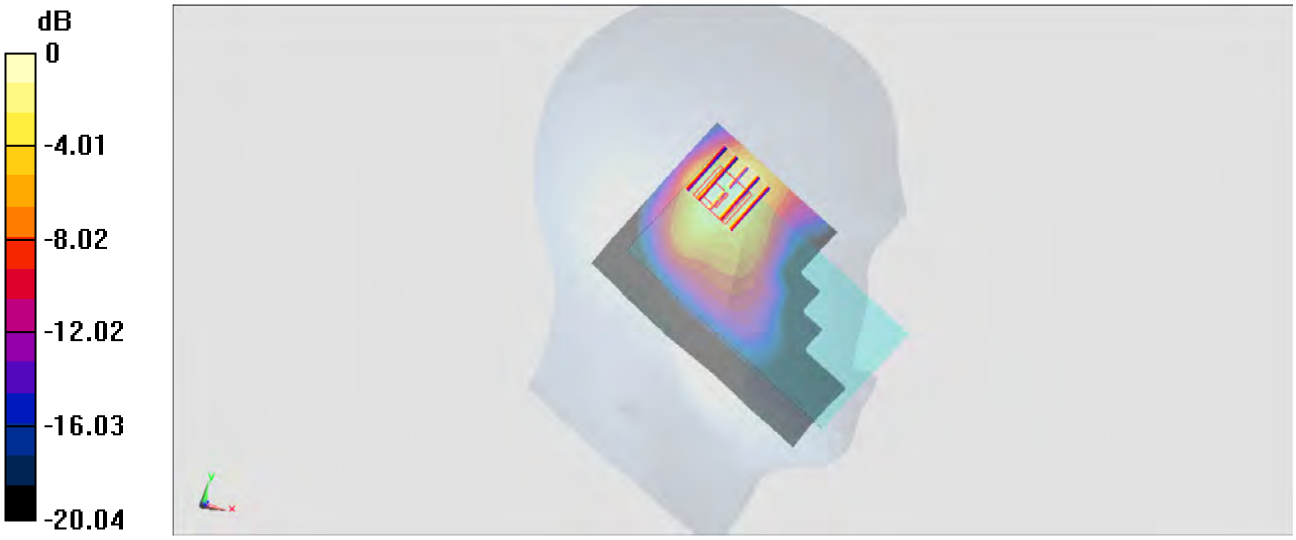
#04_LTE Band 4_20M_QPSK_1RB_0Offset_Left Cheek_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: HSL_1750_140706 Medium parameters used: f = 1732.5 MHz; σ = 1.389 S/m; ε_r = 39.107; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8.54, 8.54, 8.54); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch20175/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.39 W/kg

Configuration/Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.22 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.593 W/kg
Maximum value of SAR (measured) = 1.41 W/kg



0 dB = 1.41 W/kg = 1.49 dBW/kg

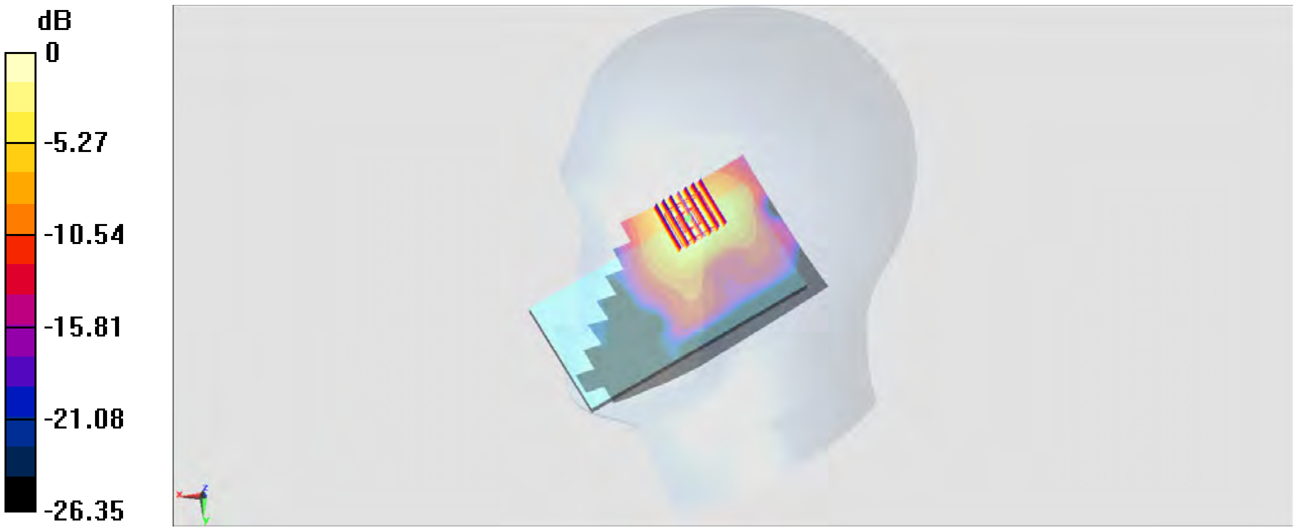
#05_WLAN 2.4GHz_802.11b 1Mbps_Right Cheek_Ch1

Communication System: 802.11b ; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: HSL_2450_140710 Medium parameters used: f = 2412 MHz; σ = 1.809 S/m; ε_r = 39.434; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(7.26, 7.26, 7.26); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch1/Area Scan (81x131x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.585 W/kg

Configuration/Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.662 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.806 W/kg
SAR(1 g) = 0.369 W/kg; SAR(10 g) = 0.181 W/kg
Maximum value of SAR (measured) = 0.572 W/kg



0 dB = 0.572 W/kg = -2.43 dBW/kg

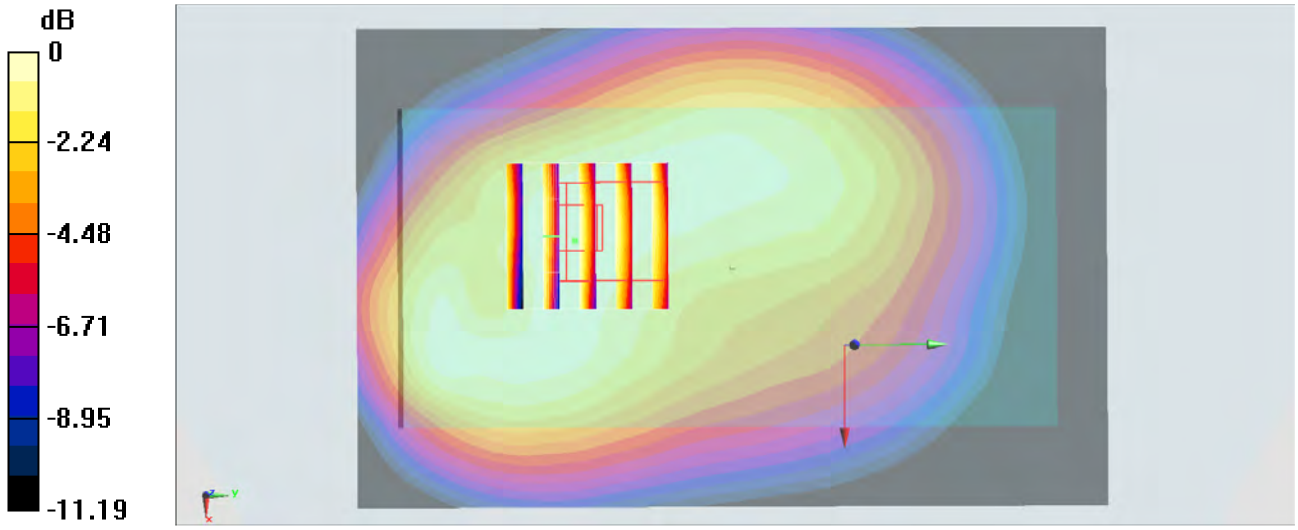
#06_CDMA2000 BC0_RTAP 153.6Kbps_Back_1cm_Ch384

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: MSL_850_140711 Medium parameters used: f = 837 MHz; σ = 0.978 S/m; ε_r = 52.983; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 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: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch384/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.411 W/kg

Configuration/Ch384/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.323 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.439 W/kg
SAR(1 g) = 0.352 W/kg; SAR(10 g) = 0.272 W/kg
Maximum value of SAR (measured) = 0.392 W/kg



0 dB = 0.392 W/kg = -4.07 dBW/kg

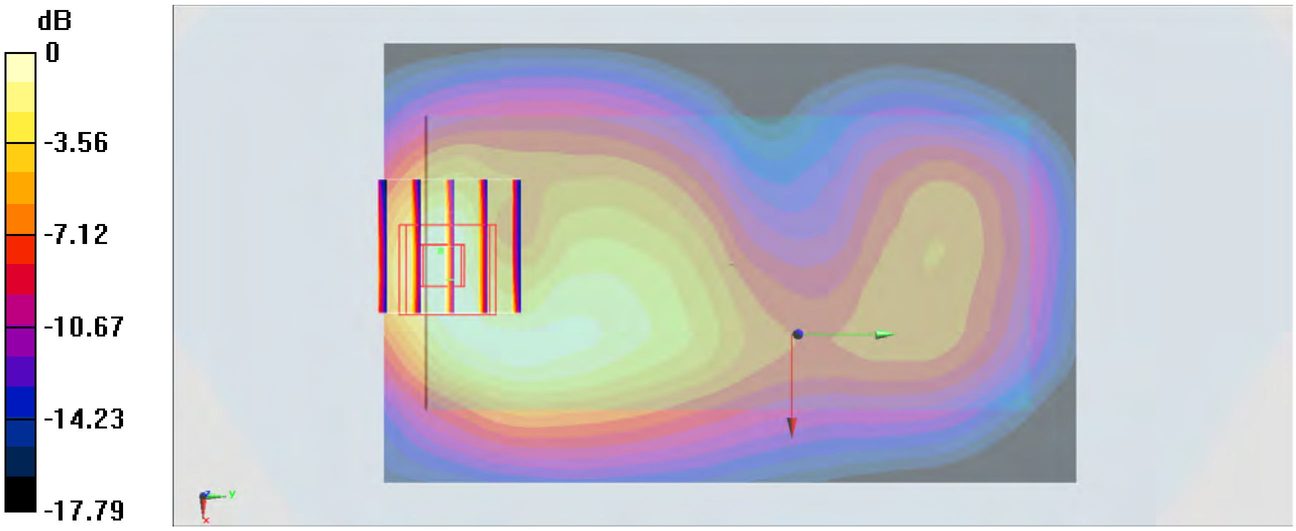
#07_CDMA2000 BC1_RTAP 153.6Kbps_Back_1cm_Ch1175

Communication System: CDMA ; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140710 Medium parameters used: f = 1909 MHz; σ = 1.583 S/m; ε_r = 52.888; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY5 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: 2014/5/15
- Phantom: SAM_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch1175/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.857 W/kg

Configuration/Ch1175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.915 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.651 W/kg; SAR(10 g) = 0.355 W/kg
Maximum value of SAR (measured) = 0.889 W/kg



0 dB = 0.889 W/kg = -0.51 dBW/kg

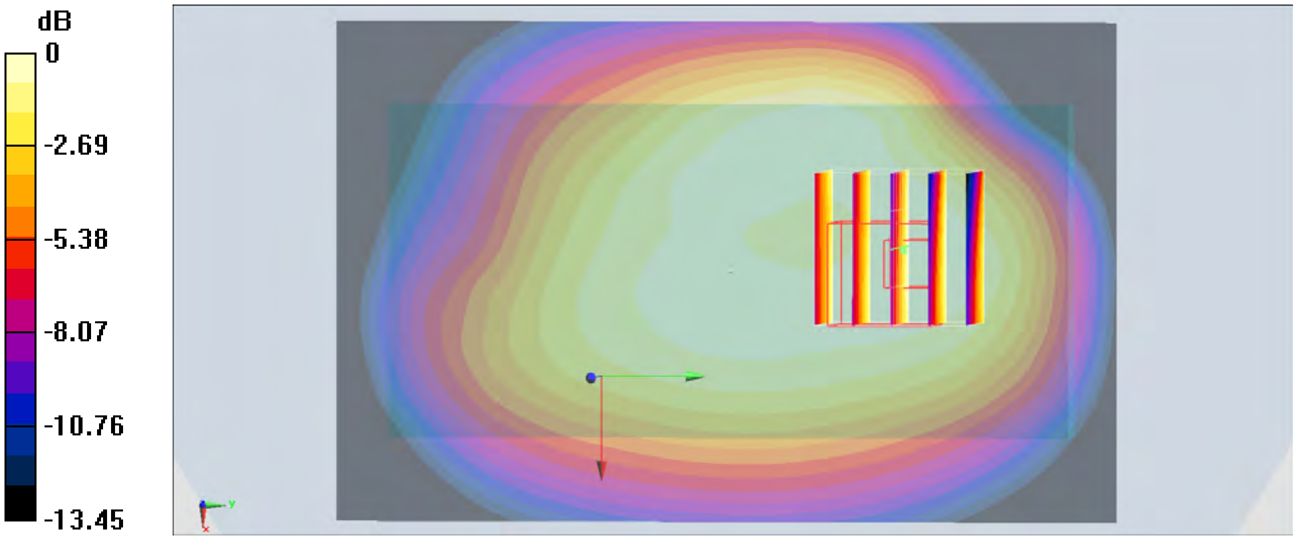
#08_LTE Band 13_10M_QPSK_1RB_0Offset_Back_1cm_Ch23230

Communication System: LTE; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: MSL_750_140705 Medium parameters used: f = 782 MHz; σ = 0.987 S/m; ε_r = 53.229; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch23230/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.419 W/kg

Configuration/Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.09 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.511 W/kg
SAR(1 g) = 0.343 W/kg; SAR(10 g) = 0.241 W/kg
Maximum value of SAR (measured) = 0.421 W/kg



0 dB = 0.421 W/kg = -3.76 dBW/kg

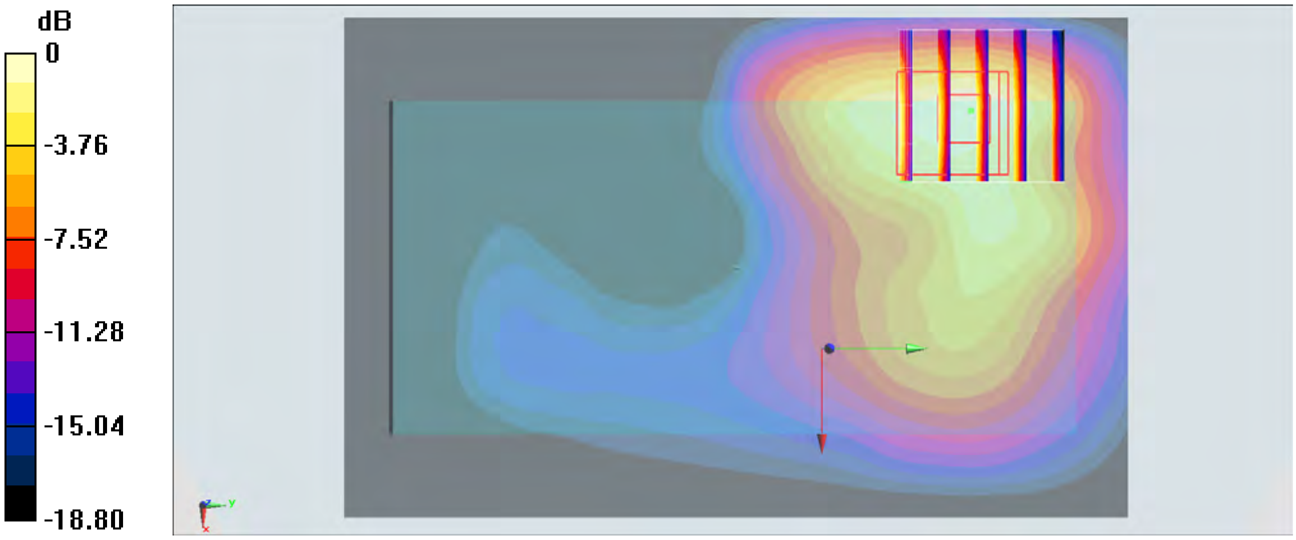
#09_LTE Band 4_20M_QPSK_1RB_0Offset_Back_1cm_Ch20050

Communication System: LTE; Frequency: 1720 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140704 Medium parameters used: f = 1720 MHz; σ = 1.507 S/m; ε_r = 52.288; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2013/11/4;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2013/11/5
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch20050/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.33 W/kg

Configuration/Ch20050/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.97 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.68 W/kg
SAR(1 g) = 0.926 W/kg; SAR(10 g) = 0.498 W/kg
Maximum value of SAR (measured) = 1.25 W/kg



0 dB = 1.25 W/kg = 0.97 dBW/kg

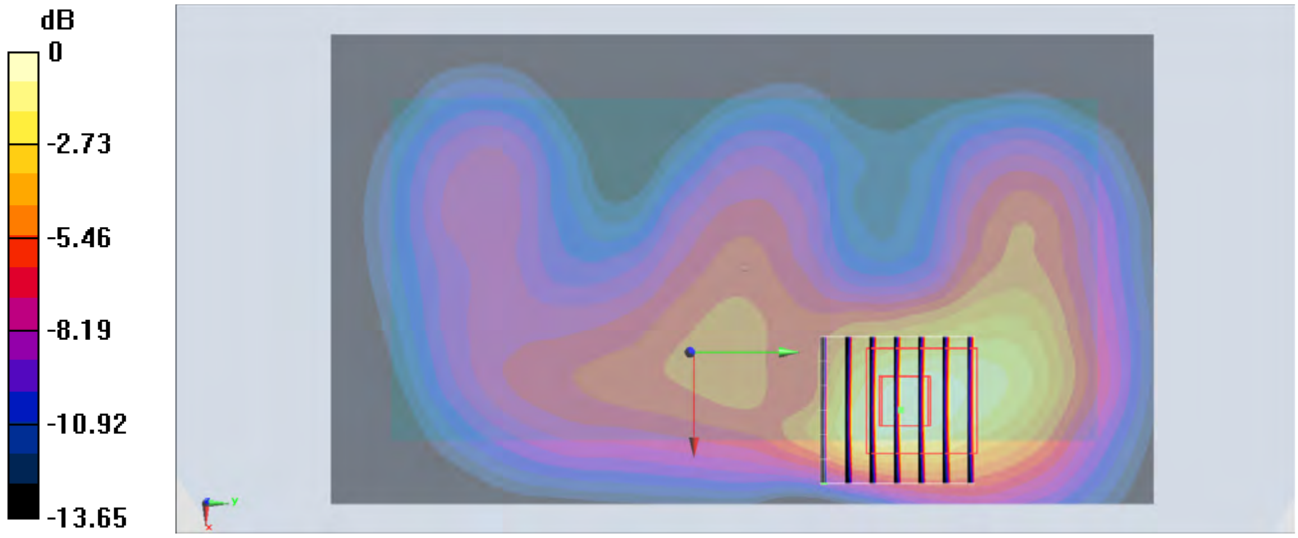
#10_WLAN2.4GHz_802.11b 1Mbps_Back_1cm_Ch1

Communication System: 802.11b ; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: MSL_2450_140705 Medium parameters used: f = 2412 MHz; σ = 1.959 S/m; ε_r = 54.047; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.32, 7.32, 7.32); Calibrated: 2013/11/4;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2013/11/5
- Phantom: SAM_Left; Type: QD000P40CD; Serial: S/N:1796
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch1/Area Scan (81x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.551 W/kg

Configuration/Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.50 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.757 W/kg
SAR(1 g) = 0.406 W/kg; SAR(10 g) = 0.213 W/kg
Maximum value of SAR (measured) = 0.582 W/kg



0 dB = 0.582 W/kg = -2.35 dBW/kg

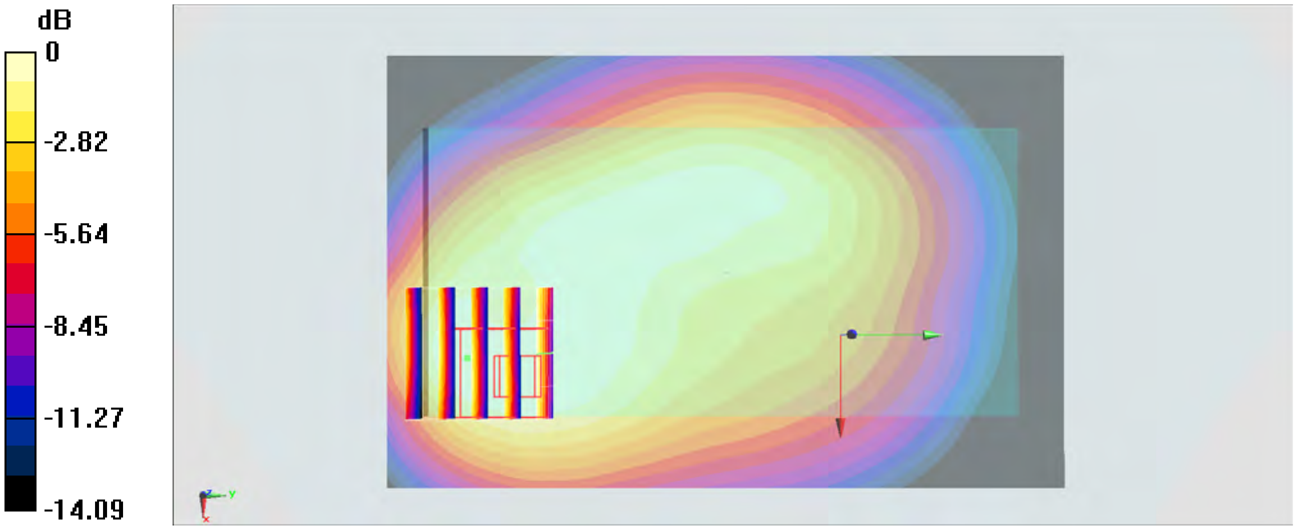
#11_CDMA2000 BC0_1xRTT RC3 SO32_Back_1cm_Ch384

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: MSL_850_140711 Medium parameters used: f = 837 MHz; σ = 0.978 S/m; ε_r = 52.983; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 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: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch384/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.439 W/kg

Configuration/Ch384/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.737 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.486 W/kg
SAR(1 g) = 0.296 W/kg; SAR(10 g) = 0.184 W/kg
Maximum value of SAR (measured) = 0.385 W/kg



0 dB = 0.385 W/kg = -4.15 dBW/kg

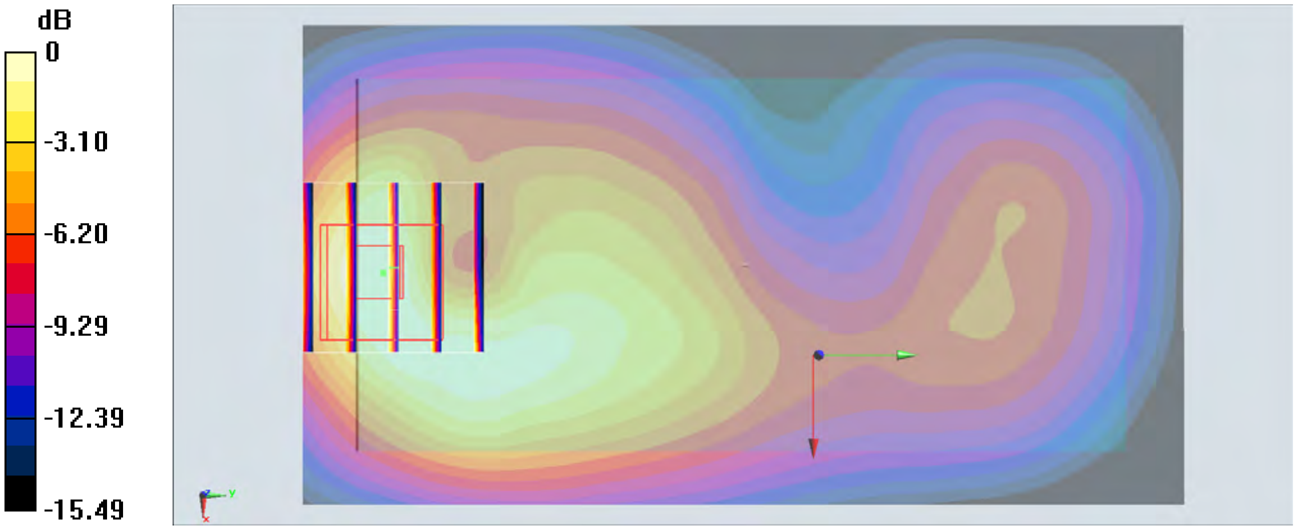
#12_CDMA2000 BC1_1xRTT RC3 SO32_Back_1cm_Ch1175

Communication System: CDMA; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140710 Medium parameters used: f = 1909 MHz; σ = 1.583 S/m; ε_r = 52.888; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY5 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: 2014/5/15
- Phantom: SAM_RIGHT; Type: QD000P40CD; Serial: 1719
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch1175/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.913 W/kg

Configuration/Ch1175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.320 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.674 W/kg; SAR(10 g) = 0.365 W/kg
Maximum value of SAR (measured) = 0.872 W/kg



0 dB = 0.872 W/kg = -0.59 dBW/kg

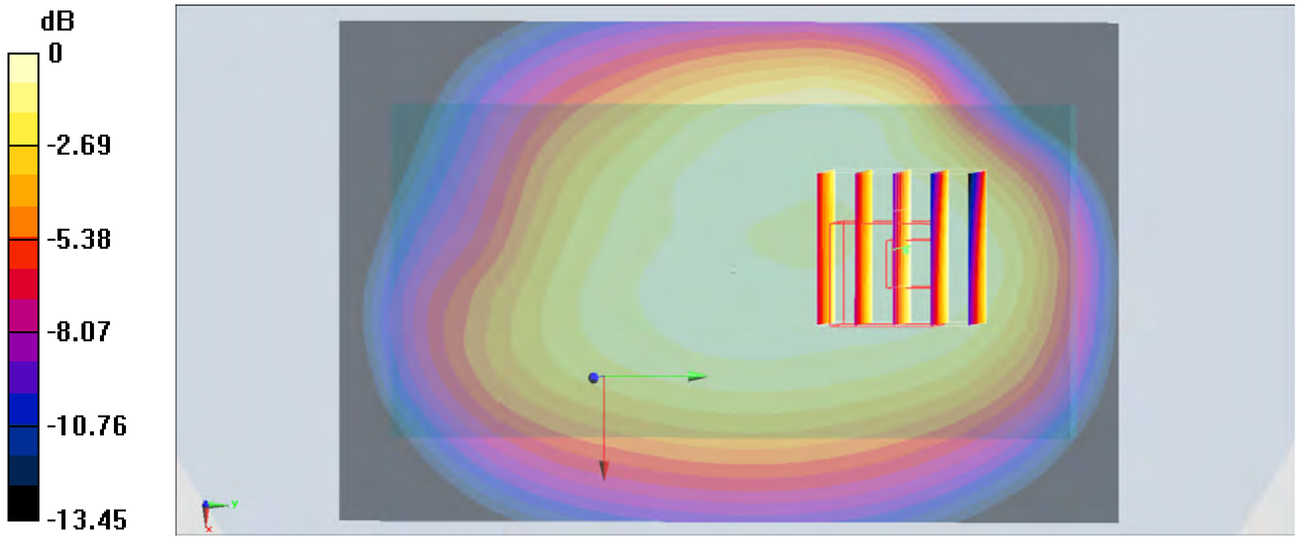
#13_LTE Band 13_10M_QPSK_1RB_0Offset_Back_1cm_Ch23230

Communication System: LTE; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: MSL_750_140705 Medium parameters used: f = 782 MHz; σ = 0.987 S/m; ε_r = 53.229; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch23230/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.419 W/kg

Configuration/Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.09 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.511 W/kg
SAR(1 g) = 0.343 W/kg; SAR(10 g) = 0.241 W/kg
Maximum value of SAR (measured) = 0.421 W/kg



0 dB = 0.421 W/kg = -3.76 dBW/kg

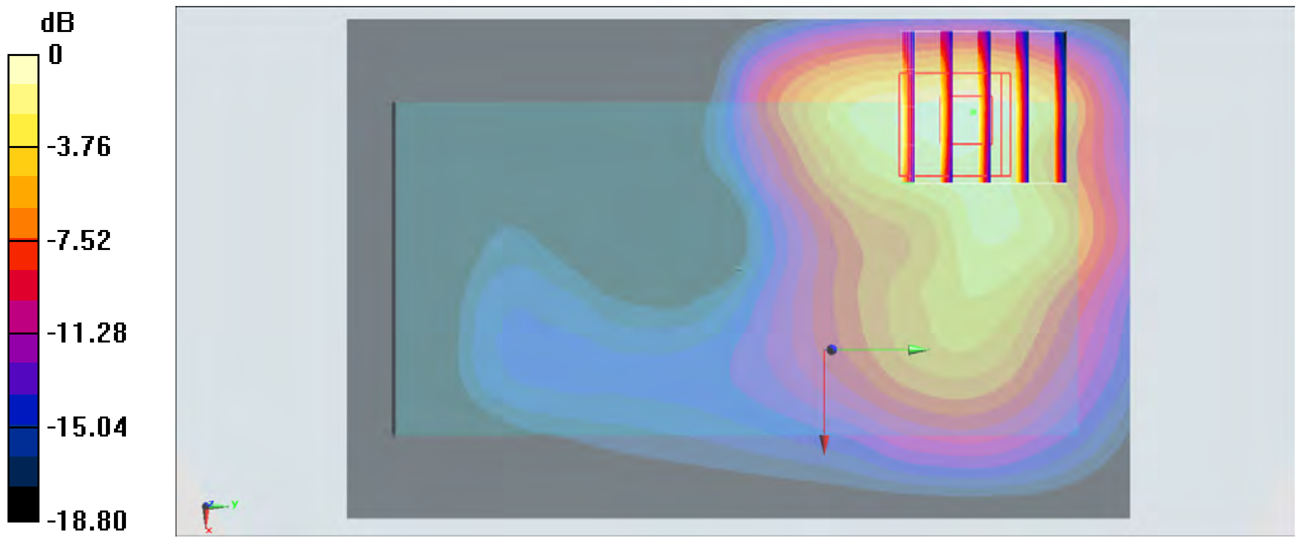
#14_LTE Band 4_20M_QPSK_1RB_0Offset_Back_1cm_Ch20050

Communication System: LTE; Frequency: 1720 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140704 Medium parameters used: f = 1720 MHz; σ = 1.507 S/m; ε_r = 52.288; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2013/11/4;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2013/11/5
- Phantom: SAM_RIGHT; Type: SAM; Serial: 1801
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch20050/Area Scan (71x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.33 W/kg

Configuration/Ch20050/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.97 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.68 W/kg
SAR(1 g) = 0.926 W/kg; SAR(10 g) = 0.498 W/kg
Maximum value of SAR (measured) = 1.25 W/kg



0 dB = 1.25 W/kg = 0.97 dBW/kg

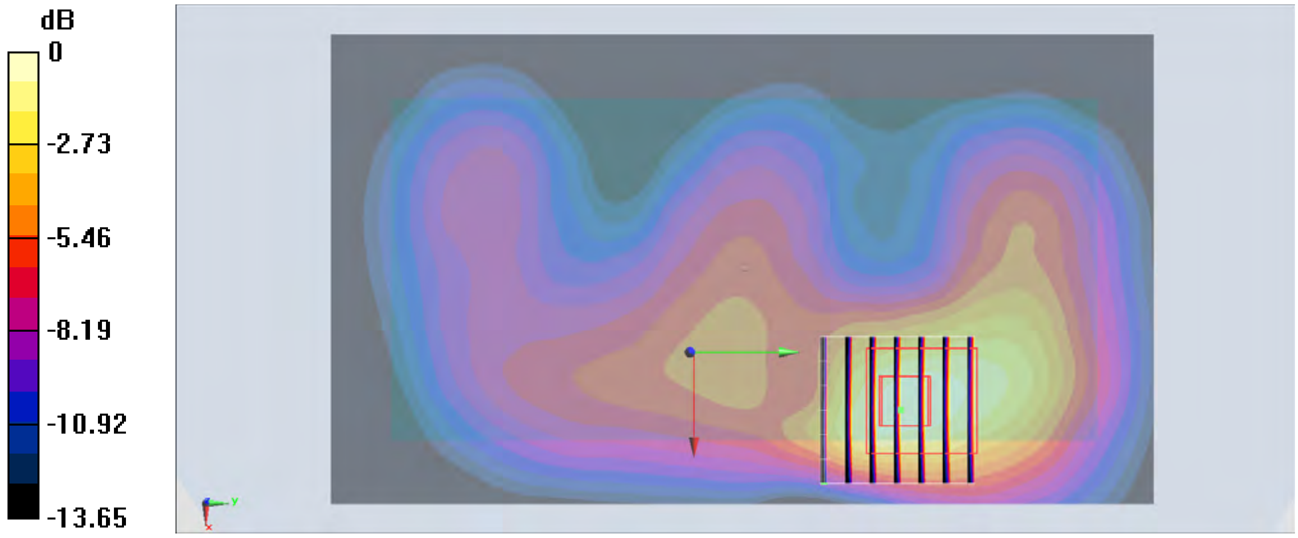
#15_WLAN2.4GHz_802.11b 1Mbps_Back_1cm_Ch1

Communication System: 802.11b ; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: MSL_2450_140705 Medium parameters used: f = 2412 MHz; σ = 1.959 S/m; ε_r = 54.047; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.32, 7.32, 7.32); Calibrated: 2013/11/4;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2013/11/5
- Phantom: SAM_Left; Type: QD000P40CD; Serial: S/N:1796
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Configuration/Ch1/Area Scan (81x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.551 W/kg

Configuration/Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.50 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.757 W/kg
SAR(1 g) = 0.406 W/kg; SAR(10 g) = 0.213 W/kg
Maximum value of SAR (measured) = 0.582 W/kg



0 dB = 0.582 W/kg = -2.35 dBW/kg

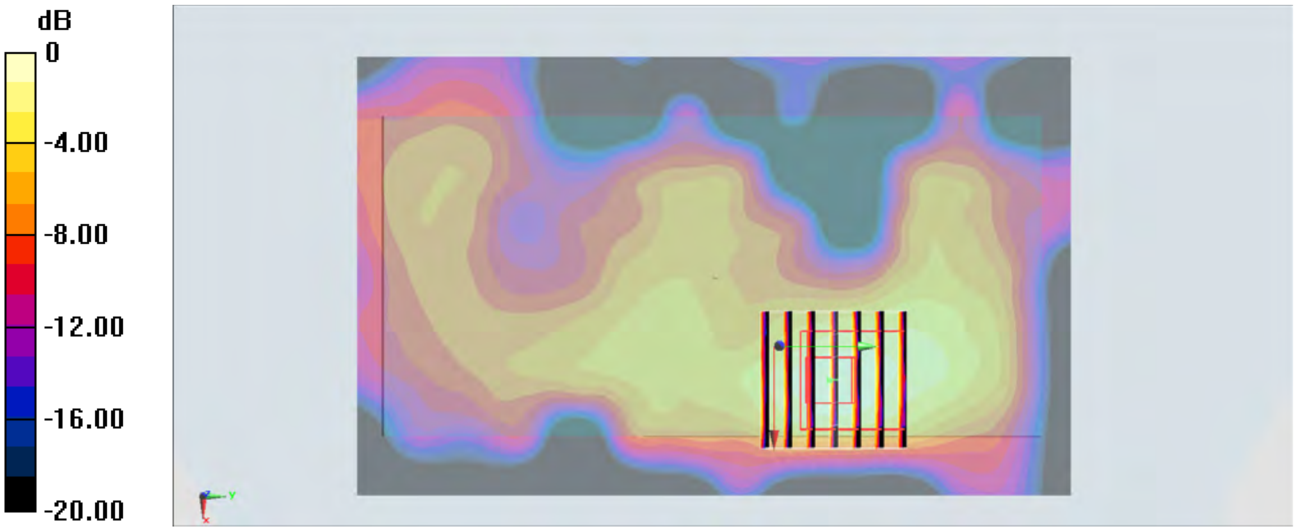
#16_Bluetooth_1Mbps_Back_1cm_Ch78

Communication System: Bluetooth_DH5; Frequency: 2480 MHz;Duty Cycle: 1:1.2
Medium: MSL_2450_140712 Medium parameters used: f = 2480 MHz; σ = 2.061 S/m; ε_r = 53.879; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3931; ConvF(7.24, 7.24, 7.24); Calibrated: 2013/9/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2014/5/15
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Ch78/Area Scan (81x131x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0317 W/kg

Configuration/Ch78/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.031 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.0420 W/kg
SAR(1 g) = 0.023 W/kg; SAR(10 g) = 0.00981 W/kg
Maximum value of SAR (measured) = 0.0334 W/kg



0 dB = 0.0334 W/kg = -14.76 dBW/kg

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
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: D750V3-1012_May14

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1012
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 16, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 20, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	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	40.4 ± 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	2.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.12 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.30 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	56.8 ± 6 %	1.00 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	2.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.65 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.68 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω + 0.8 jΩ
Return Loss	- 28.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.2 Ω - 1.9 jΩ
Return Loss	- 31.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 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 29, 2009

DASY5 Validation Report for Head TSL

Date: 16.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1012

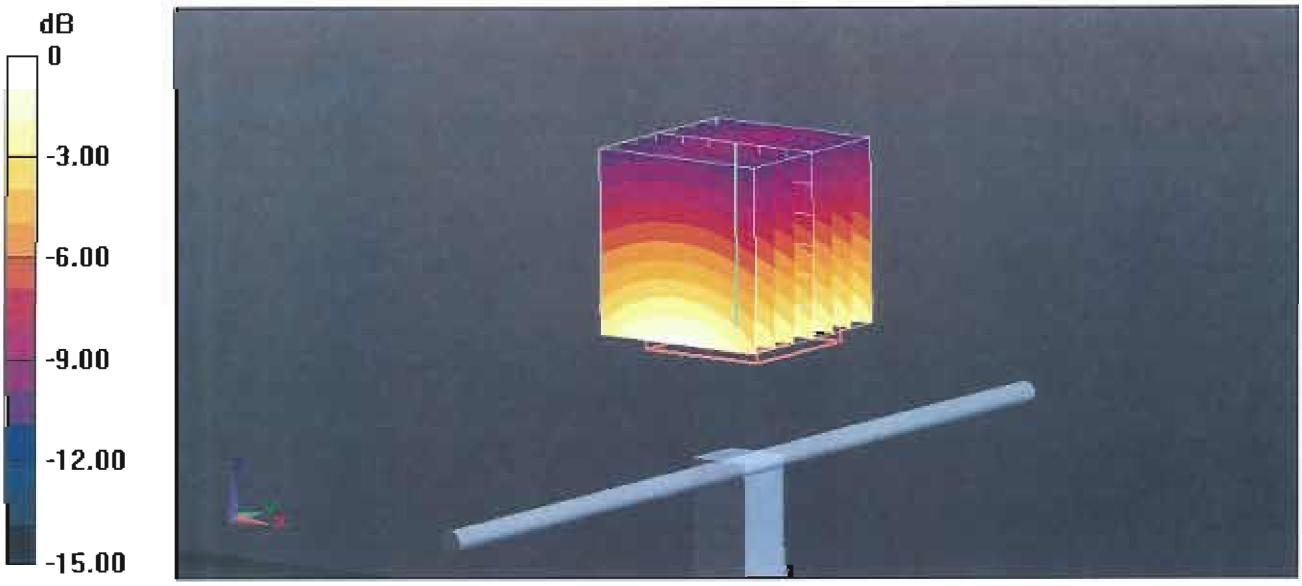
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 S/m; ε_r = 40.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

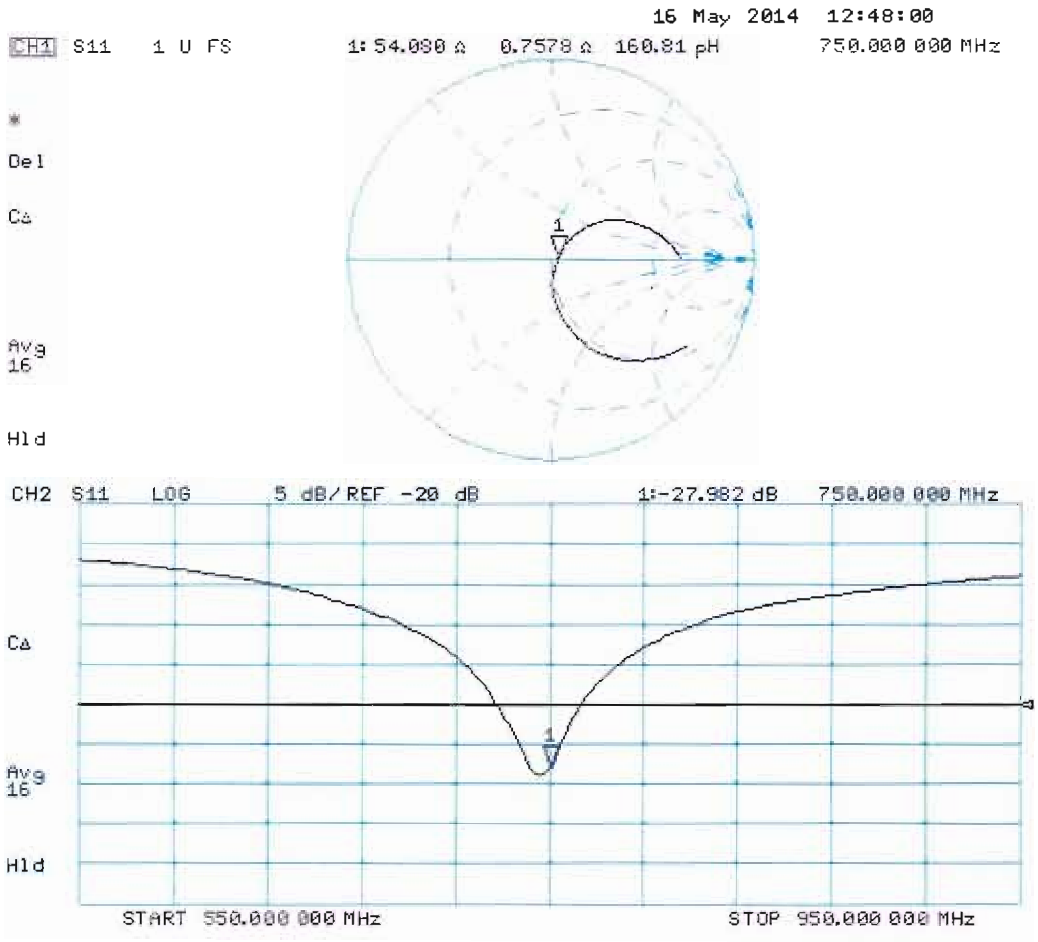
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.52 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.36 W/kg
Maximum value of SAR (measured) = 2.46 W/kg



0 dB = 2.46 W/kg = 3.91 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1012

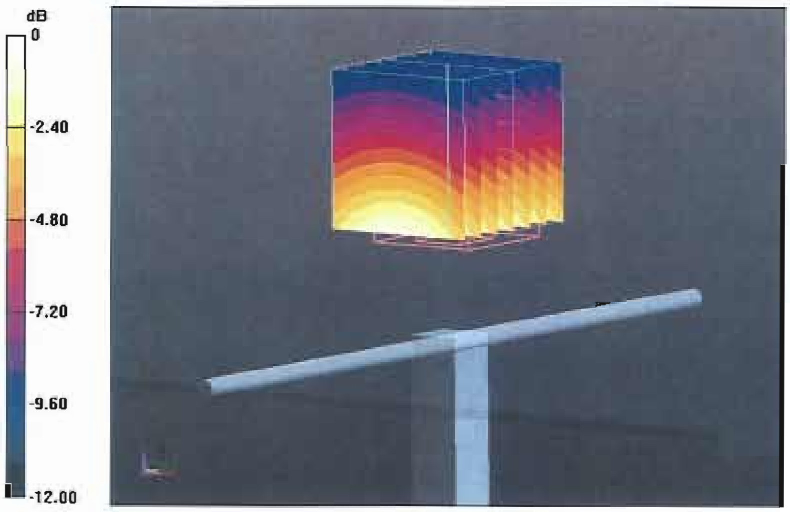
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 1 S/m; ε_r = 56.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.13, 6.13, 6.13); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

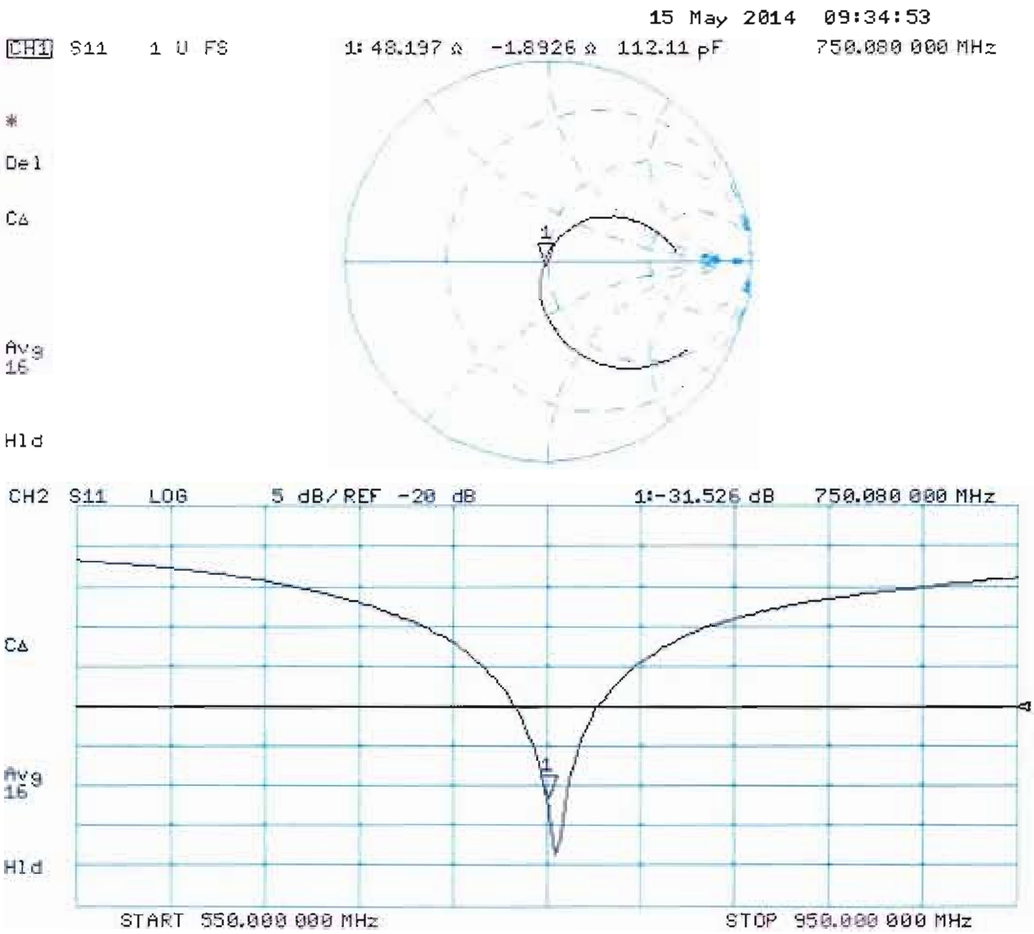
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.79 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.30 W/kg
SAR(1 g) = 2.22 W/kg; SAR(10 g) = 1.45 W/kg
Maximum value of SAR (measured) = 2.60 W/kg



0 dB = 2.60 W/kg = 4.15 dBW/kg

Impedance Measurement Plot for Body TSL



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

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Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **D835V2-499_Mar14**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 499
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 24, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
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	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
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-16
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: March 24, 2014

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	40.5 ± 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	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.13 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.94 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	55.0 ± 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	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.46 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.17 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω - 2.8 jΩ
Return Loss	- 28.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 Ω - 5.6 jΩ
Return Loss	- 23.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 10, 2003

DASY5 Validation Report for Head TSL

Date: 24.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

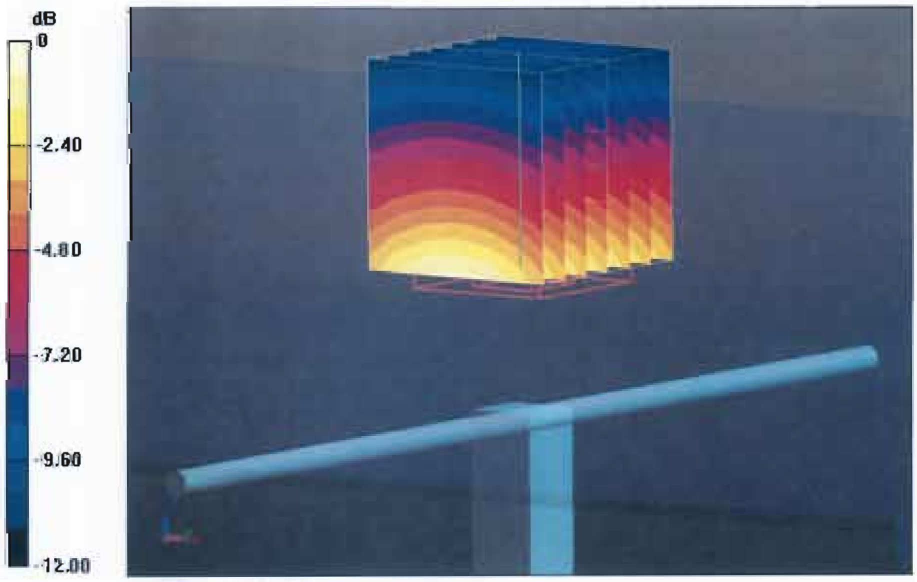
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 40.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- 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)

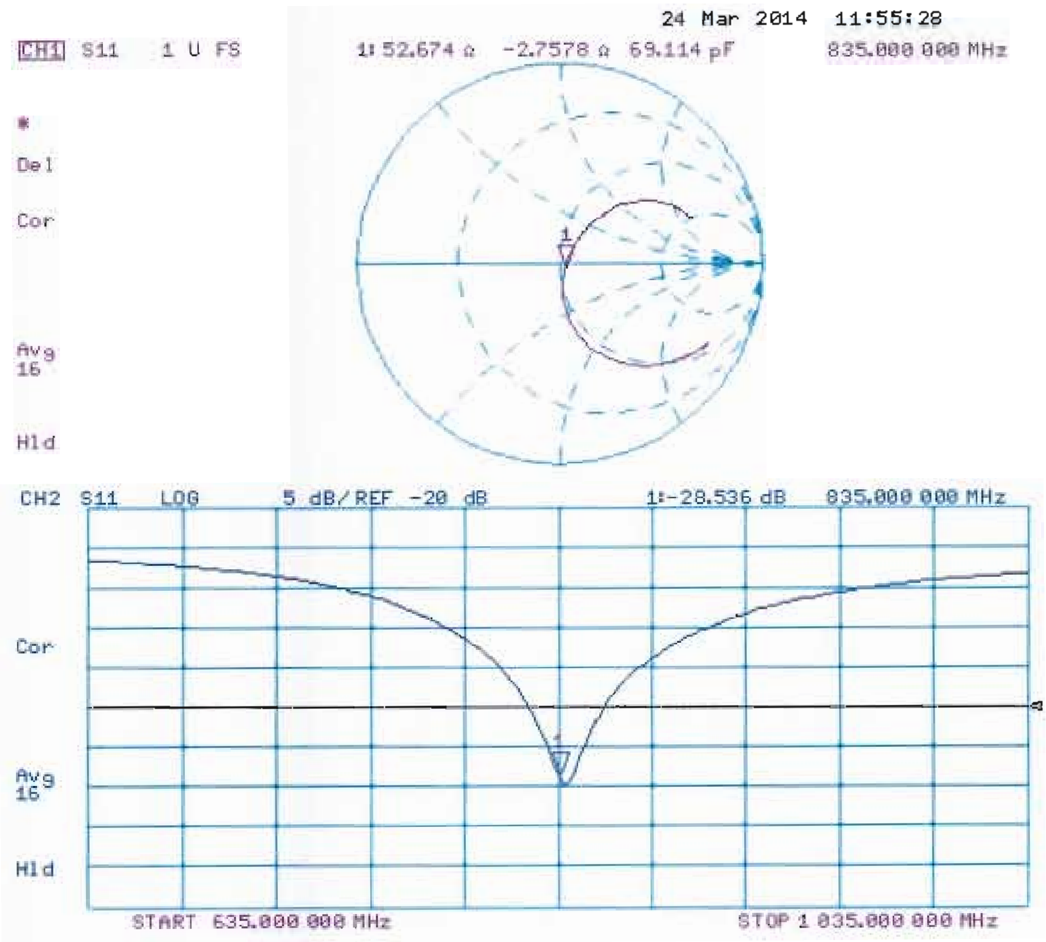
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.333 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.60 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

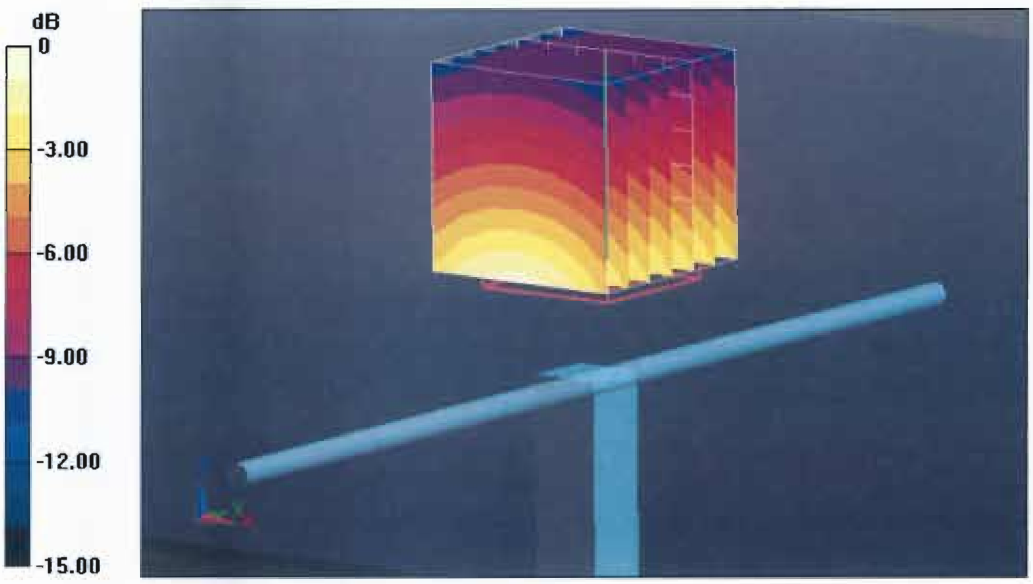
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- 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)

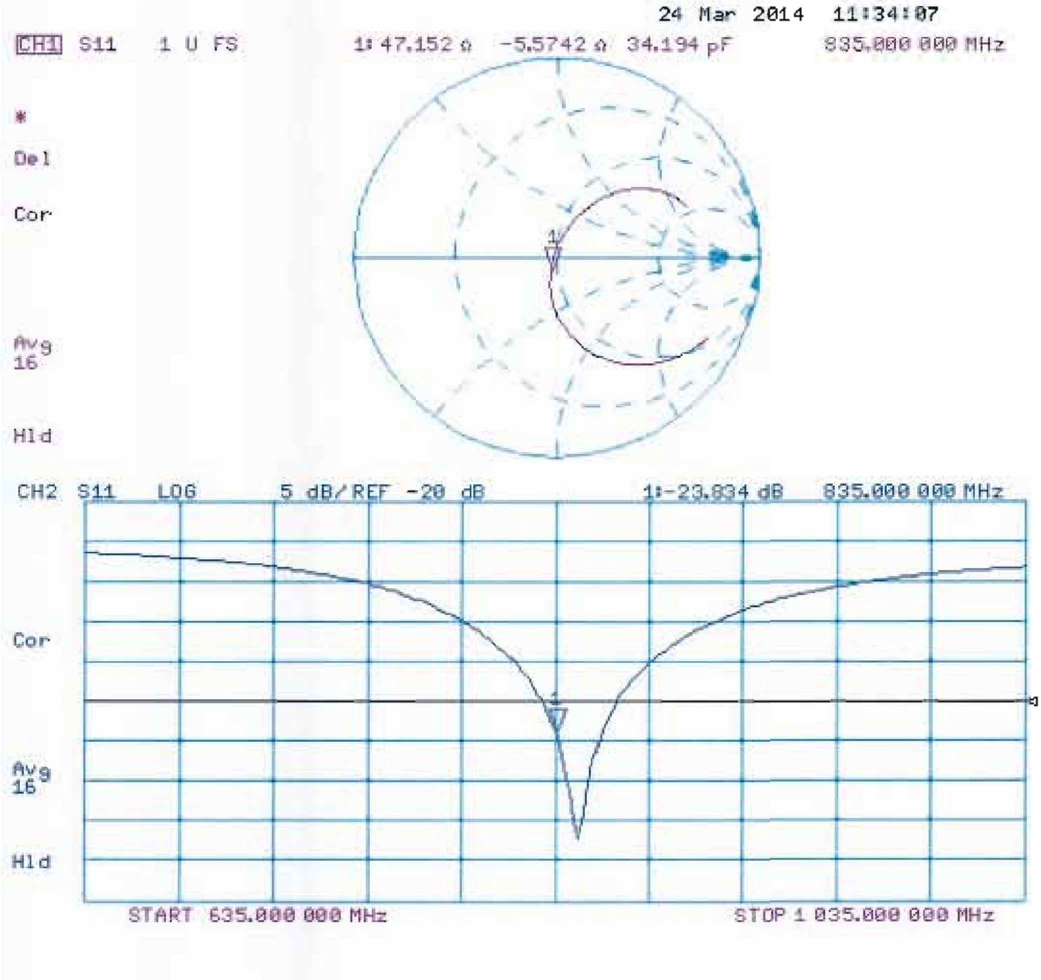
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.909 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.65 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (measured) = 2.86 W/kg



0 dB = 2.86 W/kg = 4.56 dBW/kg

Impedance Measurement Plot for Body TSL



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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

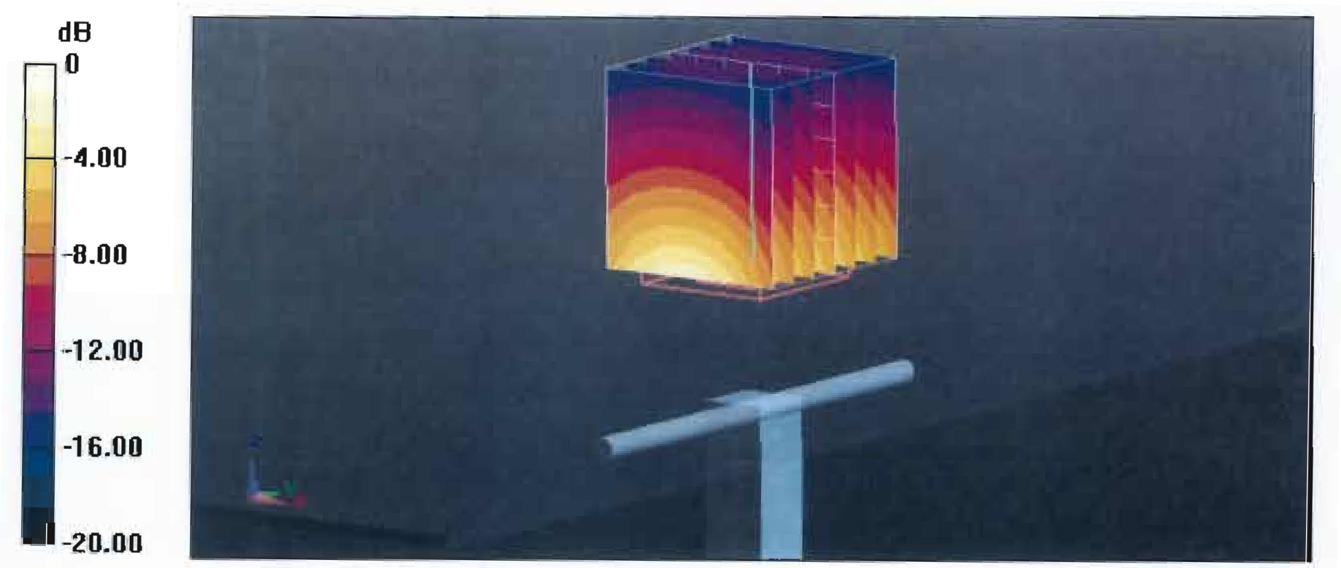
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.37 S/m; ε_r = 40; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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)

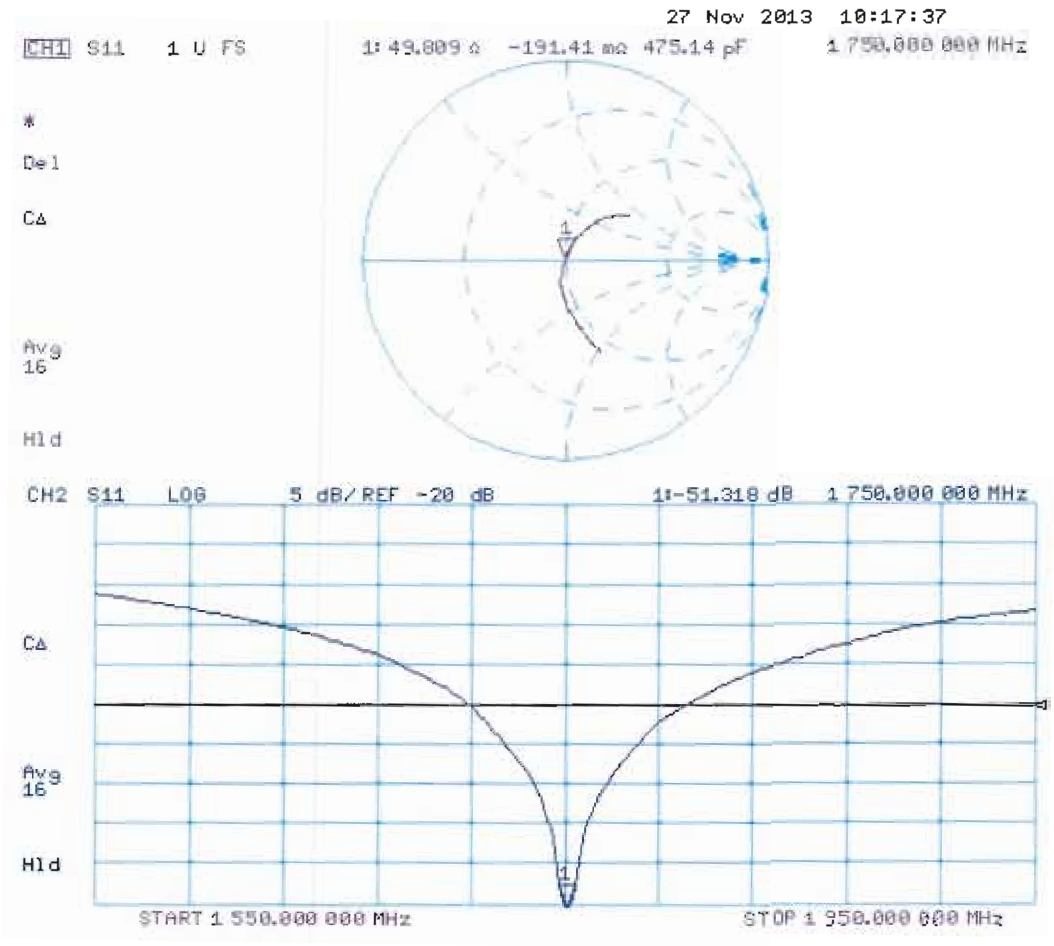
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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:

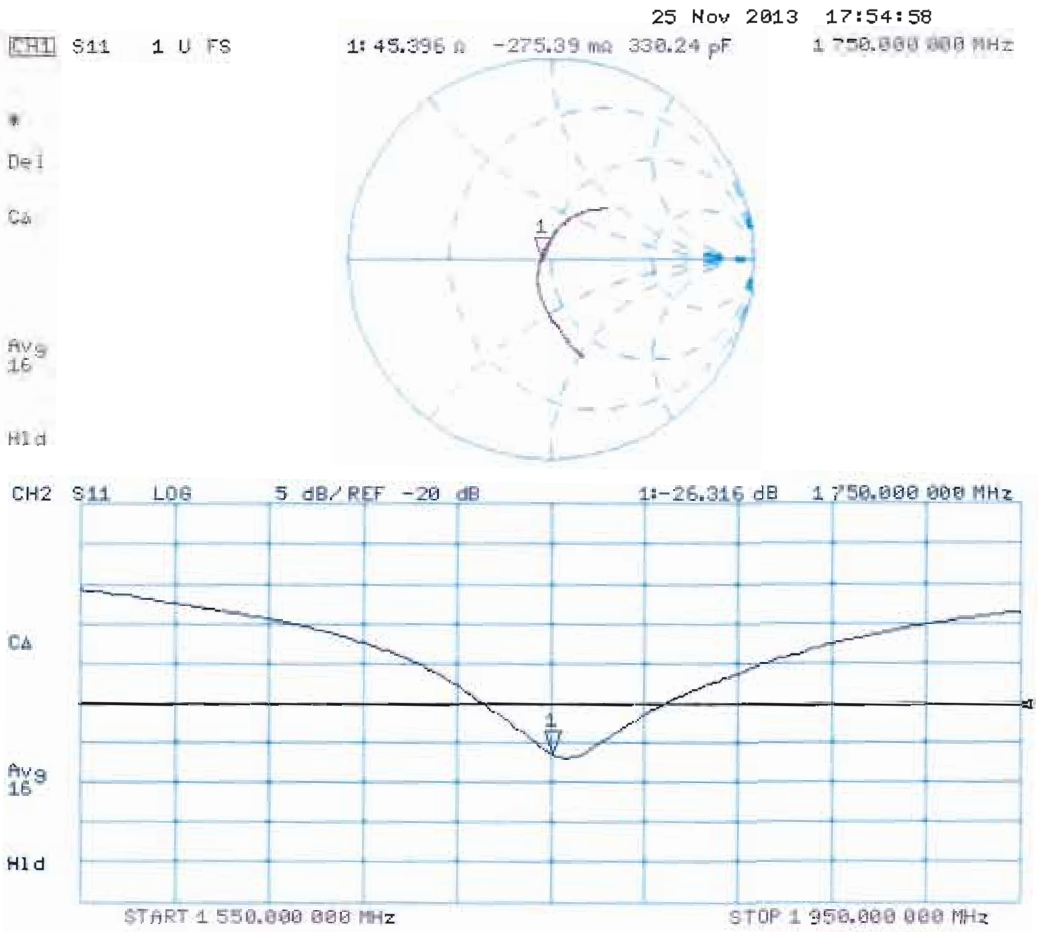
- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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 (Auden)**

Certificate No: D1900V2-5d041_Mar14

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d041
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 21, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	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	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
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-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 21, 2014

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

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	38.8 ± 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	10.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**41.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.4 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	52.5 ± 6 %	1.50 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	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**41.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.7 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 Ω + 6.6 jΩ
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω + 6.4 jΩ
Return Loss	- 23.8 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	July 04, 2003

DASY5 Validation Report for Head TSL

Date: 21.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

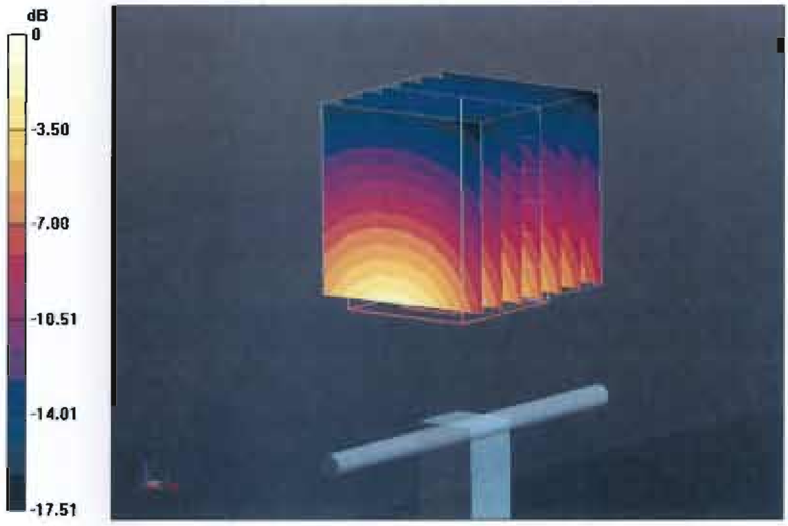
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d041

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.37 S/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

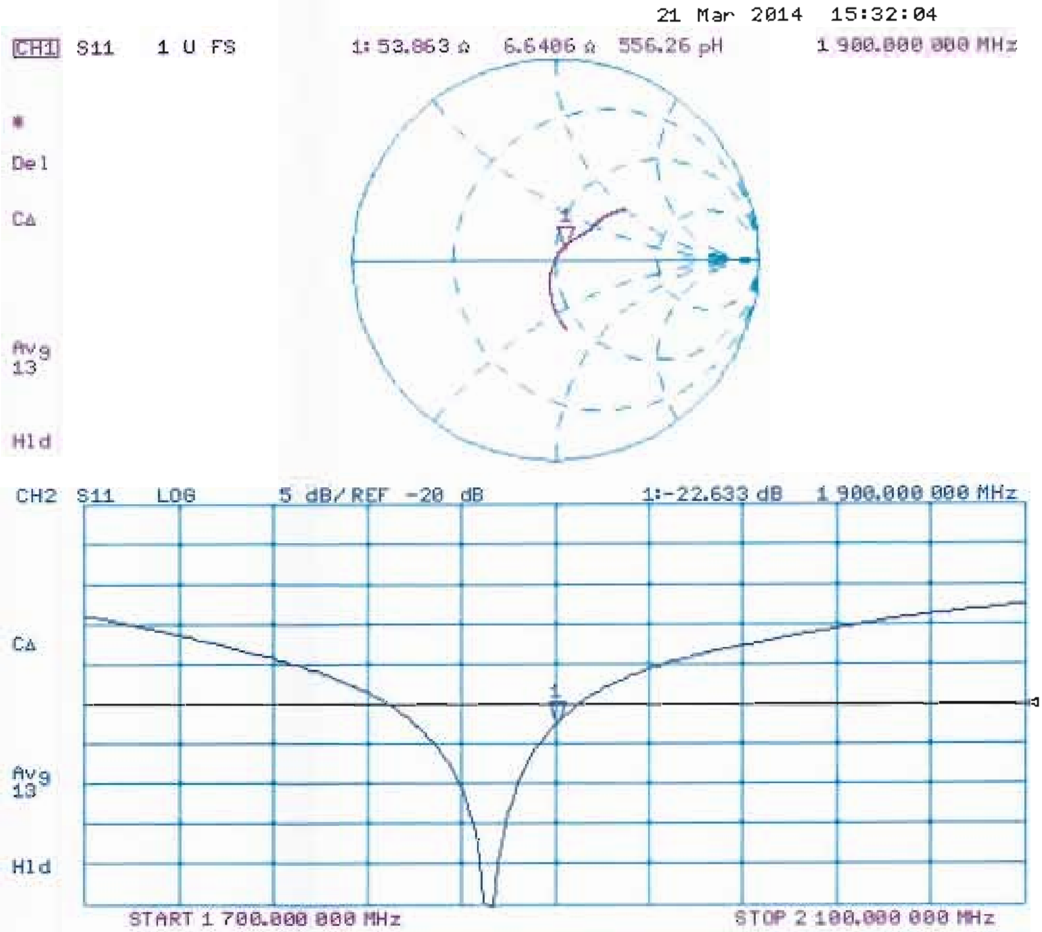
- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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 = 98.04 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 18.6 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.32 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d041

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.5 S/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

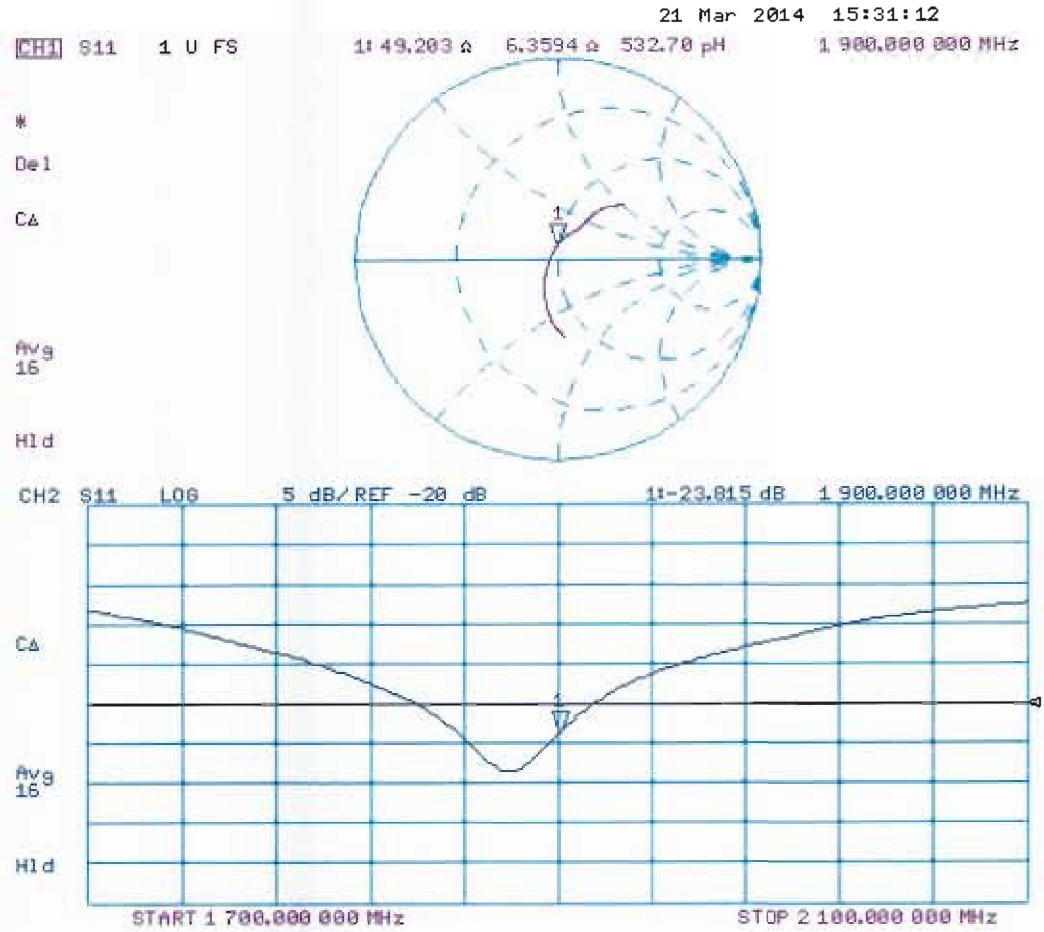
DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- 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 = 96.439 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.4 W/kg
Maximum value of SAR (measured) = 12.9 W/kg

0 dB = 12.9 W/kg = 11.11 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
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: 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

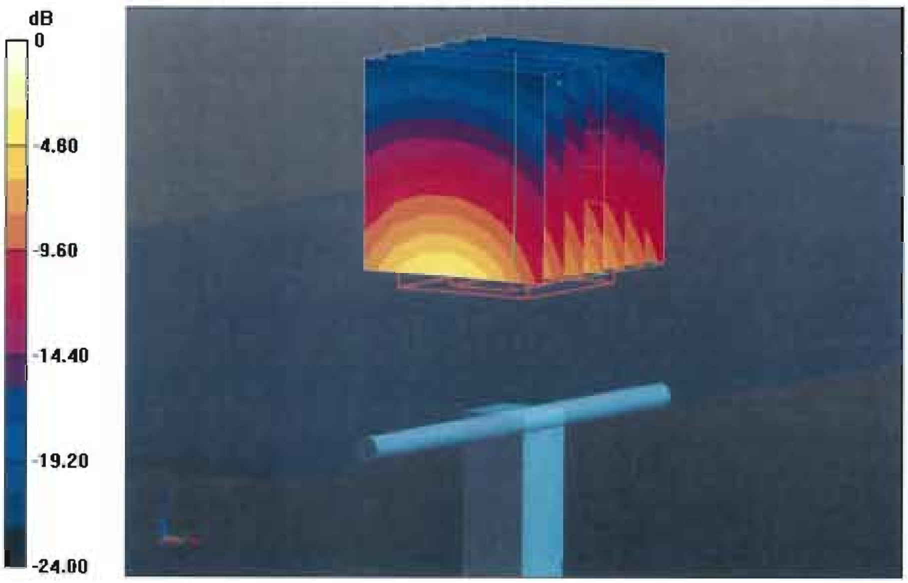
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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)

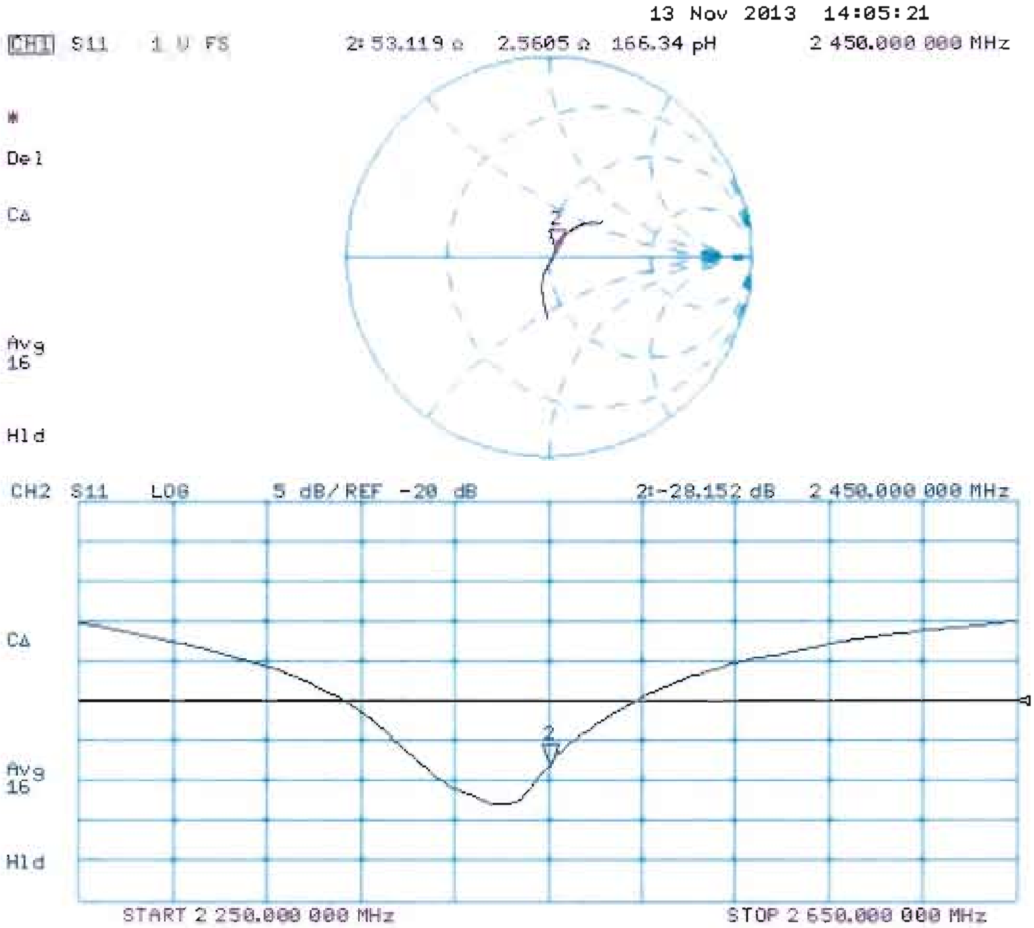
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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:

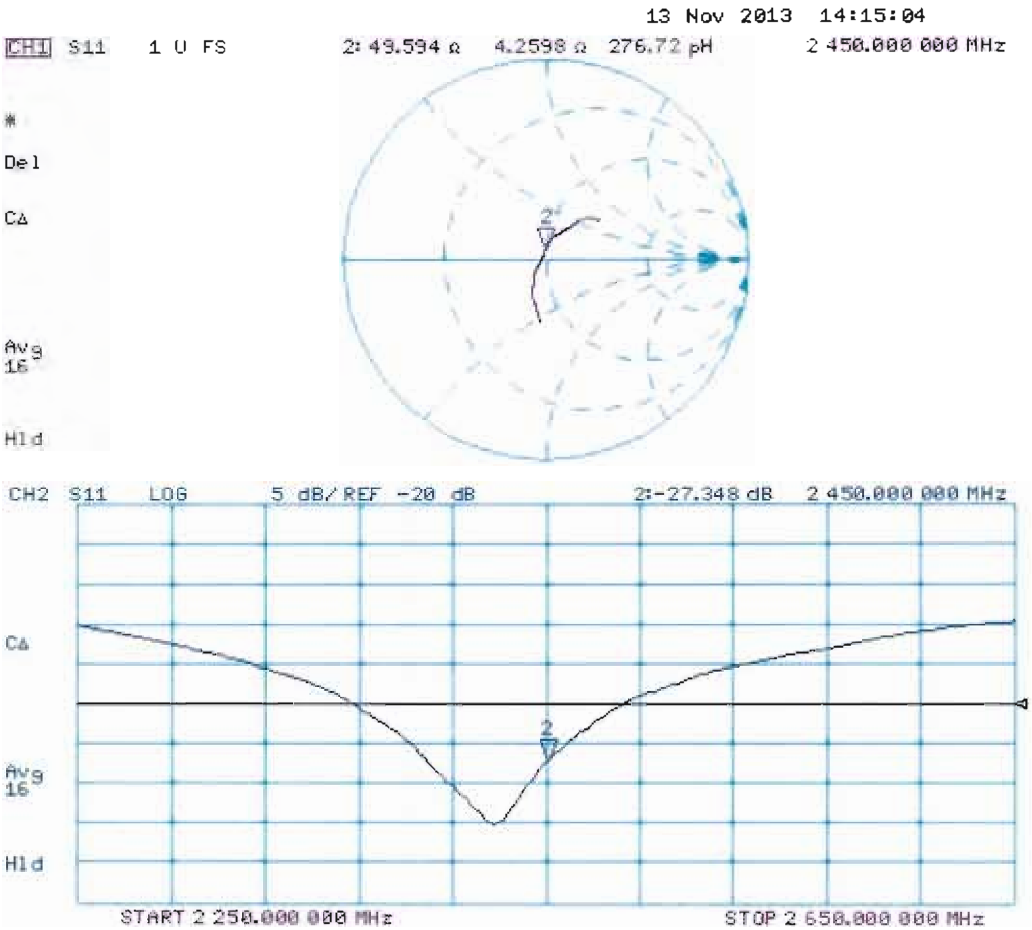
- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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



Schmid & Partner Engineering AG

s p e a g

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info@speag.com, http://www.speag.com

IMPORTANT NOTICE

USAGE OF THE DAE 4

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

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

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

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

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

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

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

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

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

Schmid & Partner Engineering

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

S Schweizerischer Kalibrierdienst
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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: DAE4-1338_Nov13

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1338
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 05, 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	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-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:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: November 5, 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	403.588 ± 0.02% (k=2)	404.163 ± 0.02% (k=2)	404.121 ± 0.02% (k=2)
Low Range	3.97535 ± 1.50% (k=2)	3.97840 ± 1.50% (k=2)	4.00168 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	61.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199991.54	-2.49	-0.00
Channel X	+ Input	19998.72	-0.84	-0.00
Channel X	- Input	-20001.49	-0.25	0.00
Channel Y	+ Input	199992.13	-1.44	-0.00
Channel Y	+ Input	19998.12	-1.38	-0.01
Channel Y	- Input	-20002.84	-1.55	0.01
Channel Z	+ Input	199991.31	-2.03	-0.00
Channel Z	+ Input	19996.91	-2.55	-0.01
Channel Z	- Input	-20003.07	-1.77	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.08	1.13	0.06
Channel X	+ Input	200.79	0.33	0.16
Channel X	- Input	-199.30	0.27	-0.14
Channel Y	+ Input	2000.90	1.18	0.06
Channel Y	+ Input	199.73	-0.49	-0.25
Channel Y	- Input	-200.57	-0.83	0.41
Channel Z	+ Input	2000.53	0.81	0.04
Channel Z	+ Input	199.26	-1.03	-0.52
Channel Z	- Input	-201.38	-1.66	0.83

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	7.85	6.28
	- 200	-4.77	-6.78
Channel Y	200	-21.63	-20.91
	- 200	19.72	19.81
Channel Z	200	-2.76	-2.99
	- 200	0.47	0.46

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.56	-3.27
Channel Y	200	8.51	-	4.88
Channel Z	200	9.57	6.01	-

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	16248	15963
Channel Y	16289	16472
Channel Z	16098	16221

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	-0.93	-2.76	0.02	0.42
Channel Y	-1.27	-2.49	-0.40	0.43
Channel Z	-1.95	-3.07	-0.93	0.35

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: DAE3-577_May14

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 15, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

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

Issued: May 15, 2014

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	403.502 ± 0.02% (k=2)	403.489 ± 0.02% (k=2)	403.794 ± 0.02% (k=2)
Low Range	3.91202 ± 1.50% (k=2)	3.94891 ± 1.50% (k=2)	3.96437 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	153.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200035.63	-1.10	-0.00
Channel X	+ Input	20009.01	4.84	0.02
Channel X	- Input	-20000.99	4.76	-0.02
Channel Y	+ Input	200033.80	-2.27	-0.00
Channel Y	+ Input	20006.18	2.29	0.01
Channel Y	- Input	-20005.70	0.26	-0.00
Channel Z	+ Input	200034.44	-1.76	-0.00
Channel Z	+ Input	20005.23	1.27	0.01
Channel Z	- Input	-20006.26	-0.42	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.47	-0.05	-0.00
Channel X	+ Input	201.41	0.81	0.40
Channel X	- Input	-198.53	0.84	-0.42
Channel Y	+ Input	2000.24	0.05	0.00
Channel Y	+ Input	199.82	-0.43	-0.21
Channel Y	- Input	-200.38	-0.69	0.35
Channel Z	+ Input	2000.38	0.17	0.01
Channel Z	+ Input	199.82	-0.57	-0.28
Channel Z	- Input	-201.02	-1.42	0.71

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	-2.31	-3.84
	- 200	5.81	3.87
Channel Y	200	-13.72	-14.00
	- 200	13.80	13.60
Channel Z	200	2.26	2.69
	- 200	-5.76	-5.45

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	-	0.10	-2.92
Channel Y	200	9.53	-	1.00
Channel Z	200	6.85	6.81	-

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	16132	15549
Channel Y	16099	15687
Channel Z	16128	12672

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	0.10	-0.80	1.33	0.38
Channel Y	0.41	-0.69	1.64	0.51
Channel Z	0.49	-0.71	1.43	0.44

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: **DAE3-495_May14**

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AD - SN: 495
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 19, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: May 19, 2014

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	404.385 ± 0.02% (k=2)	405.359 ± 0.02% (k=2)	405.713 ± 0.02% (k=2)
Low Range	3.95160 ± 1.50% (k=2)	3.99165 ± 1.50% (k=2)	3.96622 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	77.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200034.33	-4.40	-0.00
Channel X	+ Input	20007.03	2.57	0.01
Channel X	- Input	-20001.24	3.51	-0.02
Channel Y	+ Input	200034.04	-0.65	-0.00
Channel Y	+ Input	20005.84	1.63	0.01
Channel Y	- Input	-20002.32	2.64	-0.01
Channel Z	+ Input	200038.21	3.22	0.00
Channel Z	+ Input	20008.03	3.75	0.02
Channel Z	- Input	-20002.39	2.50	-0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.81	-0.32	-0.02
Channel X	+ Input	201.28	0.10	0.05
Channel X	- Input	-198.05	0.61	-0.31
Channel Y	+ Input	2000.54	-0.54	-0.03
Channel Y	+ Input	201.02	-0.05	-0.02
Channel Y	- Input	-199.81	-1.07	0.54
Channel Z	+ Input	2000.48	-0.52	-0.03
Channel Z	+ Input	199.62	-1.35	-0.67
Channel Z	- Input	-199.45	-0.67	0.34

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	4.33	2.52
	- 200	-1.22	-2.61
Channel Y	200	0.12	-0.32
	- 200	-0.79	-1.02
Channel Z	200	2.31	2.30
	- 200	-4.76	-4.84

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	-	-1.27	-2.19
Channel Y	200	8.58	-	-0.77
Channel Z	200	5.25	6.26	-

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	15815	17196
Channel Y	15764	17349
Channel Z	15898	16472

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	-0.27	-1.43	0.67	0.49
Channel Y	-0.09	-1.79	1.08	0.58
Channel Z	-1.01	-2.74	0.55	0.60

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: EX3-3935_Nov13

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3935
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	November 4, 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)	Sep-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-13)	In house check: Oct-14

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

Issued: November 4, 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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *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.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3935

Manufactured: July 24, 2013
Calibrated: November 4, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3935

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.50	0.54	0.49	± 10.1 %
DCP (mV)[B]	103.3	98.8	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	167.0	±2.7 %
		Y	0.0	0.0	1.0		172.1	
		Z	0.0	0.0	1.0		171.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3935

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 [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	10.11	10.11	10.11	0.34	0.96	± 12.0 %
900	41.5	0.97	9.98	9.98	9.98	0.39	0.85	± 12.0 %
1750	40.1	1.37	8.54	8.54	8.54	0.78	0.62	± 12.0 %
1900	40.0	1.40	8.27	8.27	8.27	0.62	0.72	± 12.0 %
2000	40.0	1.40	8.25	8.25	8.25	0.42	0.83	± 12.0 %
2300	39.5	1.67	7.81	7.81	7.81	0.40	0.81	± 12.0 %
2450	39.2	1.80	7.43	7.43	7.43	0.62	0.63	± 12.0 %
2600	39.0	1.96	7.27	7.27	7.27	0.37	0.85	± 12.0 %
3500	37.9	2.91	6.99	6.99	6.99	0.41	1.00	± 13.1 %
5200	36.0	4.66	5.29	5.29	5.29	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.03	5.03	5.03	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.90	4.90	4.90	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.62	4.62	4.62	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.52	4.52	4.52	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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

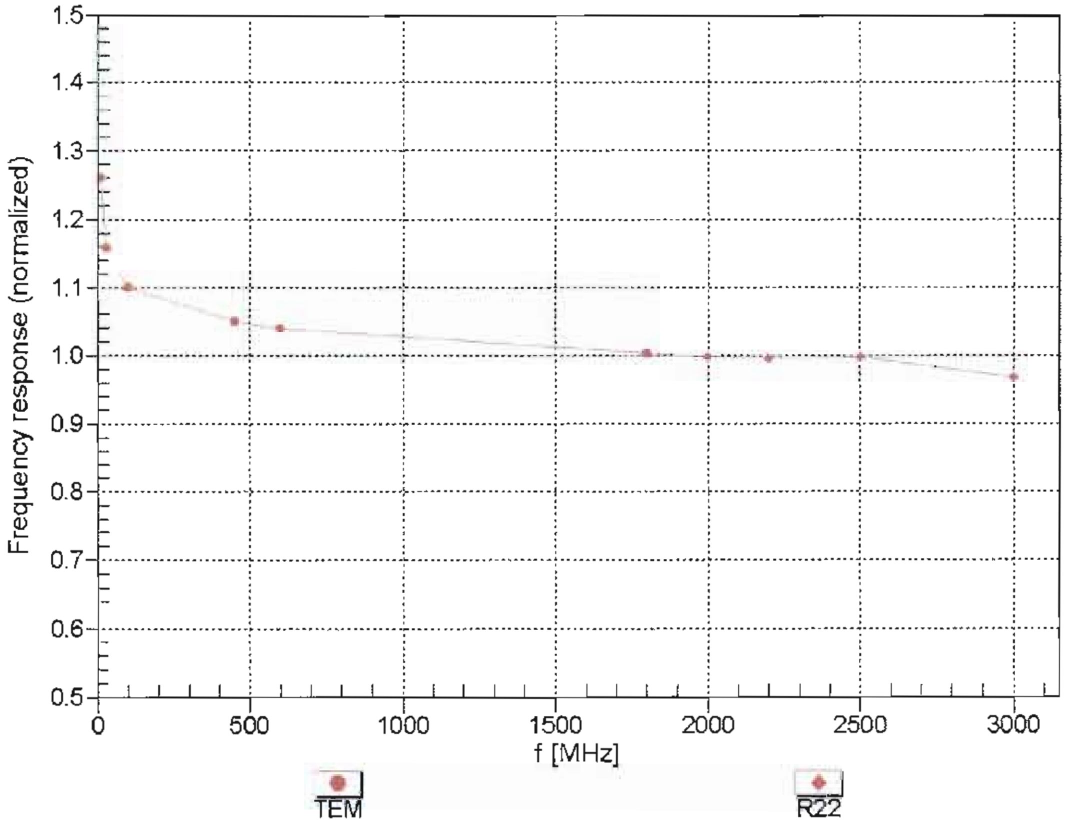
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3935

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 [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	10.09	10.09	10.09	0.38	0.89	± 12.0 %
900	55.0	1.05	9.86	9.86	9.86	0.43	0.87	± 12.0 %
1750	53.4	1.49	8.30	8.30	8.30	0.76	0.62	± 12.0 %
1900	53.3	1.52	7.85	7.85	7.85	0.58	0.68	± 12.0 %
2000	53.3	1.52	7.95	7.95	7.95	0.51	0.71	± 12.0 %
2300	52.9	1.81	7.62	7.62	7.62	0.62	0.68	± 12.0 %
2450	52.7	1.95	7.32	7.32	7.32	0.78	0.59	± 12.0 %
2600	52.5	2.16	7.08	7.08	7.08	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.78	6.78	6.78	0.30	1.35	± 13.1 %
5200	49.0	5.30	4.61	4.61	4.61	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.18	4.18	4.18	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.83	3.83	3.83	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.69	3.69	3.69	0.55	1.90	± 13.1 %
5800	48.2	6.00	4.09	4.09	4.09	0.50	1.90	± 13.1 %

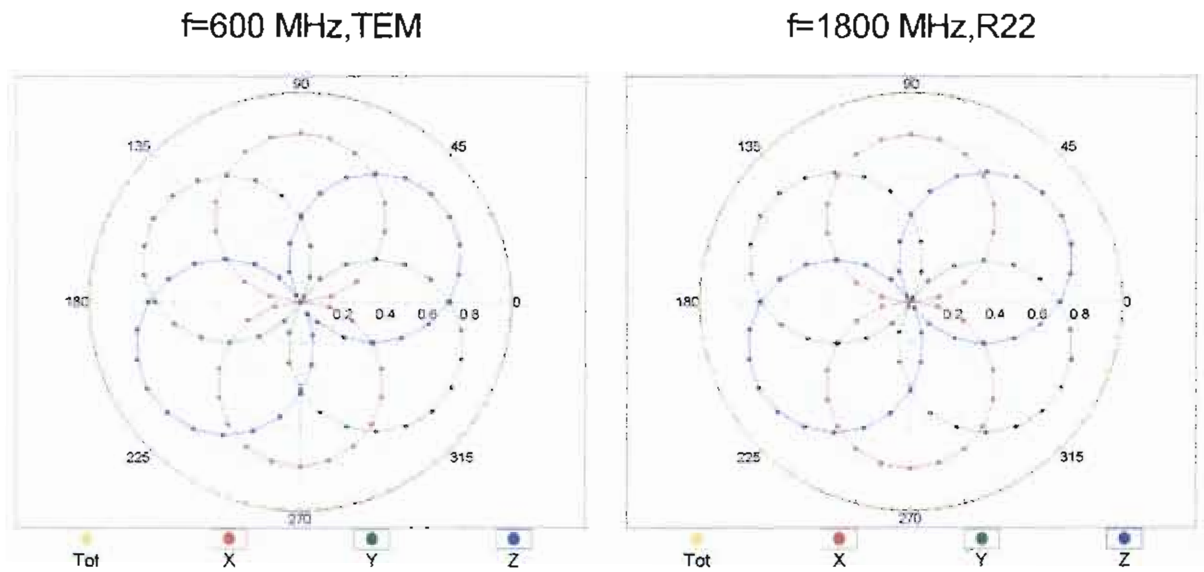
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of 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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

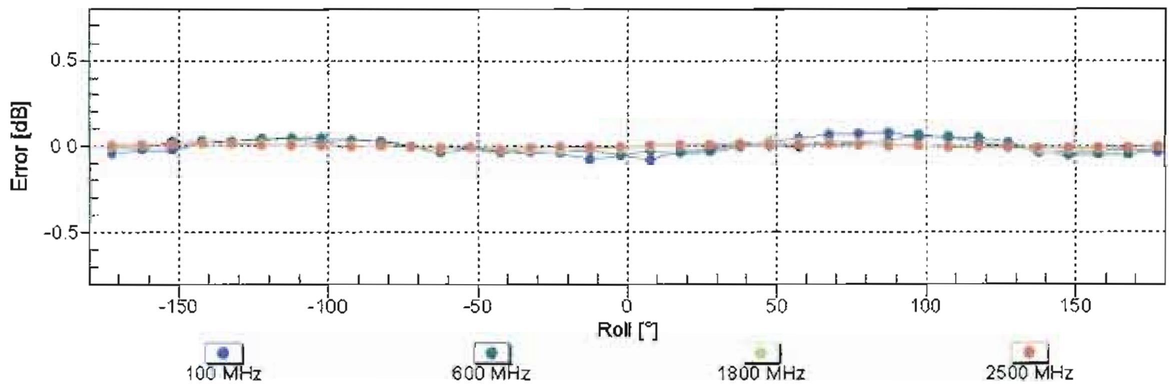
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

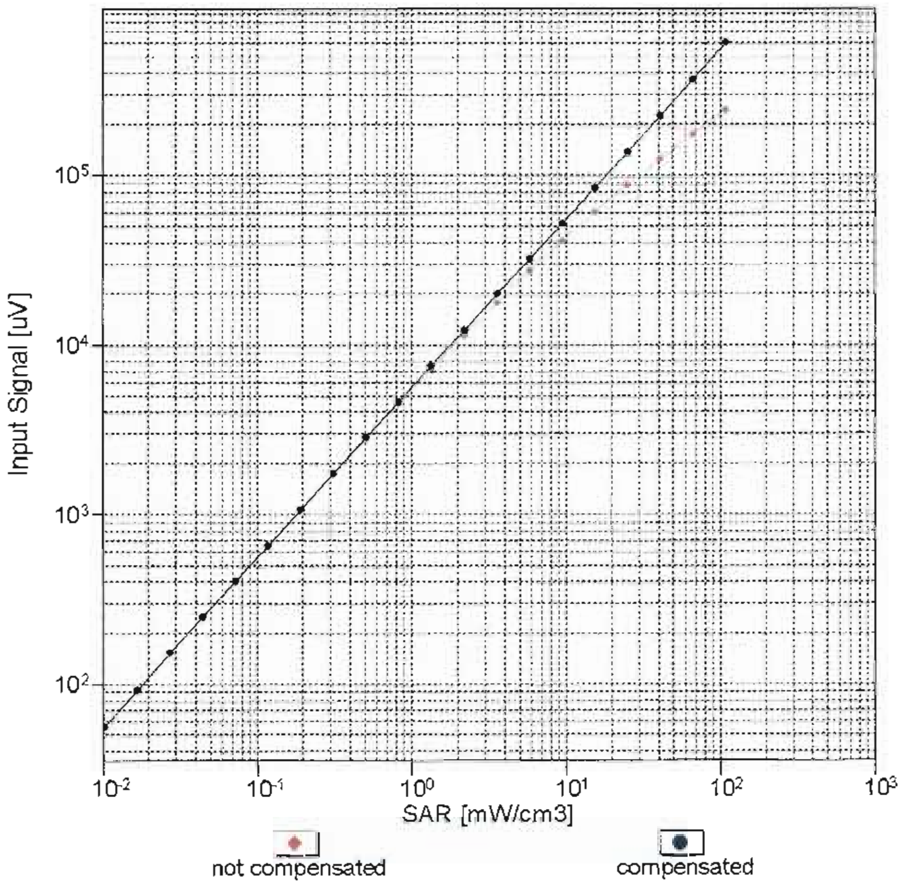
Receiving Pattern (ϕ), $\vartheta = 0°$

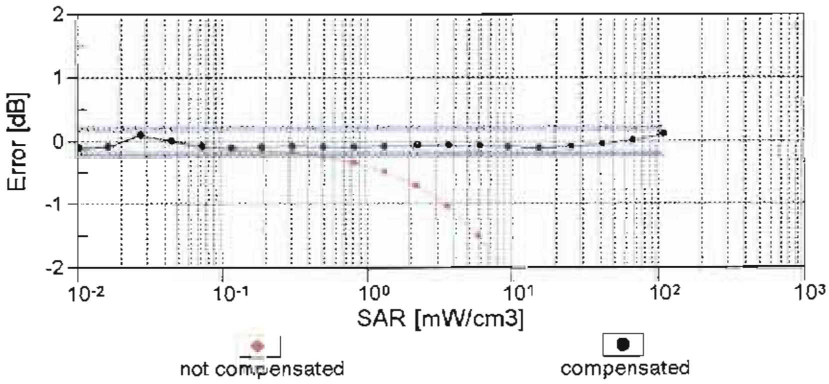




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

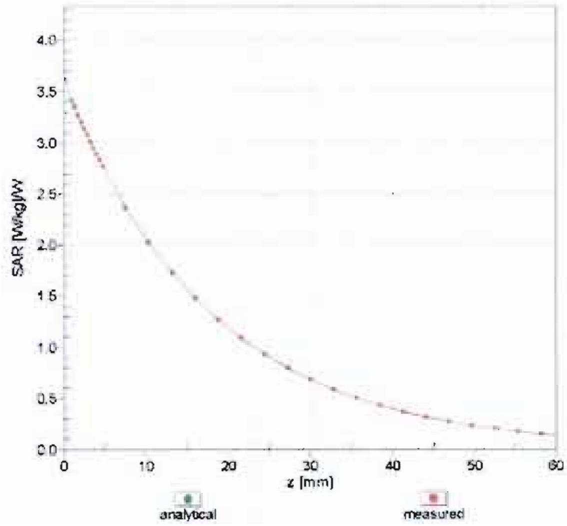




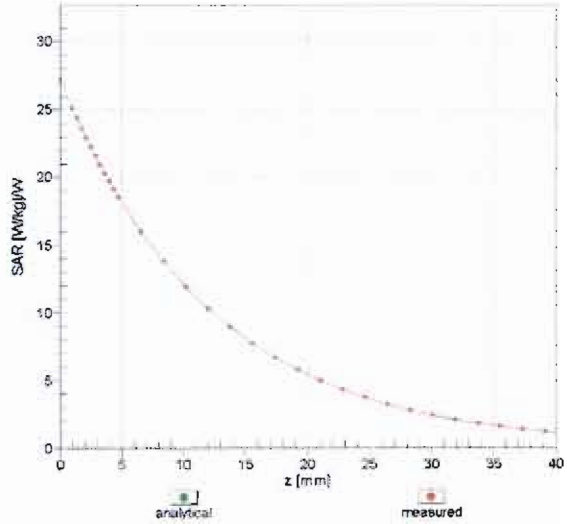
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

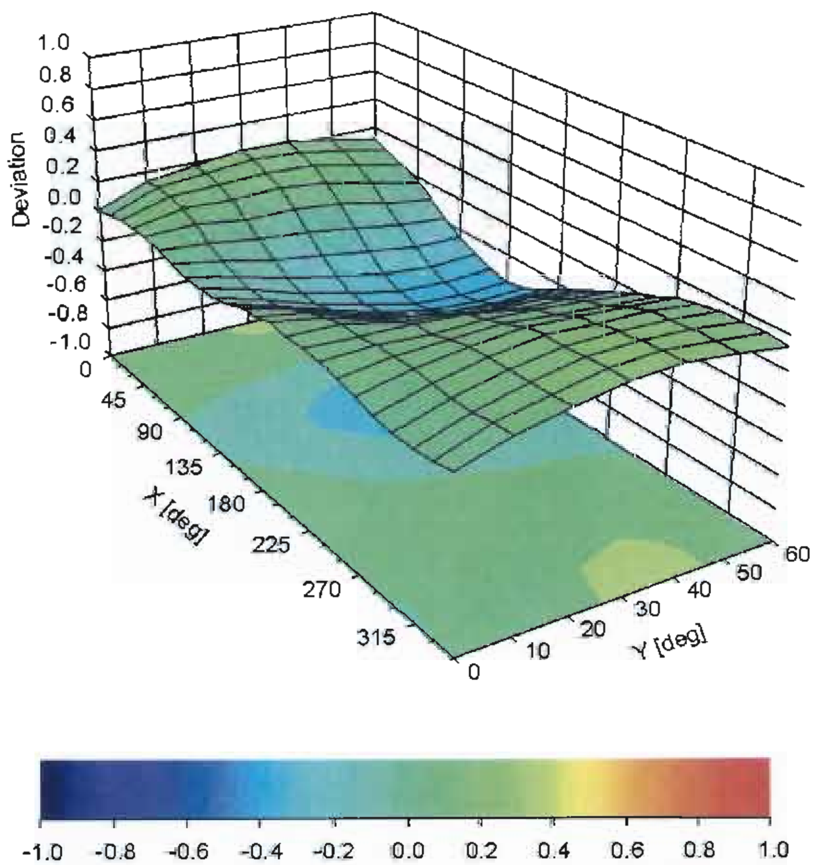


f = 1750 MHz,WGLS R22 (H_convF)



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:3935

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-142.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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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

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

Calibration Laboratory of
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Multilateral Agreement for the recognition of calibration certificates

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 ≤ 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: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$\sqrt{\mu V}$	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

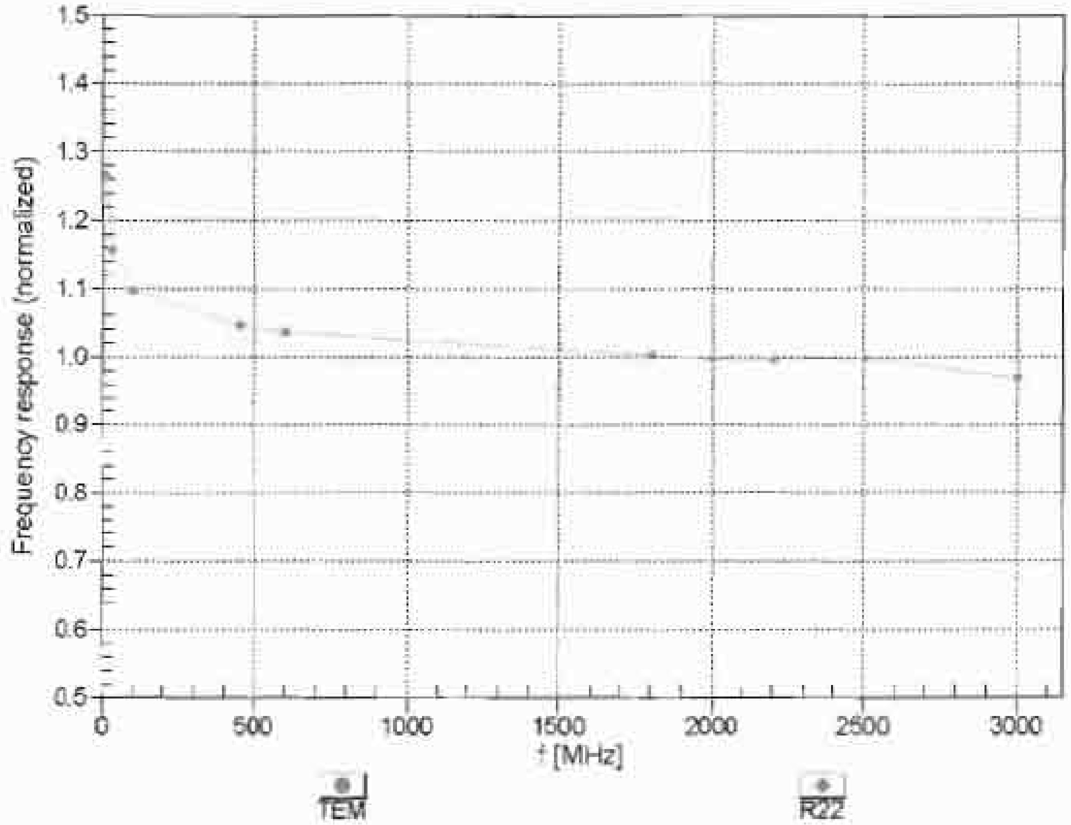
Calibration Parameter Determined in Body Tissue Simulating Media

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)

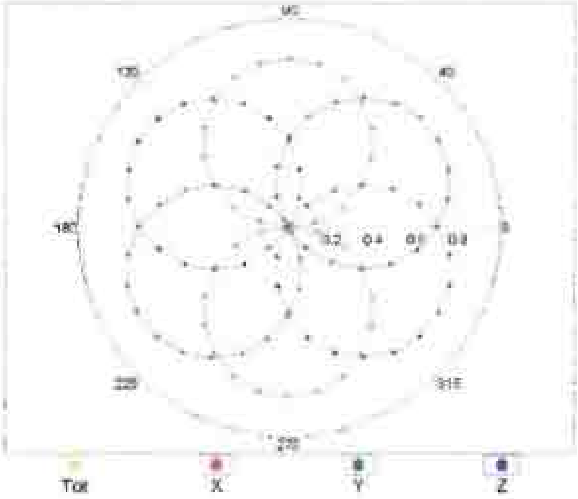


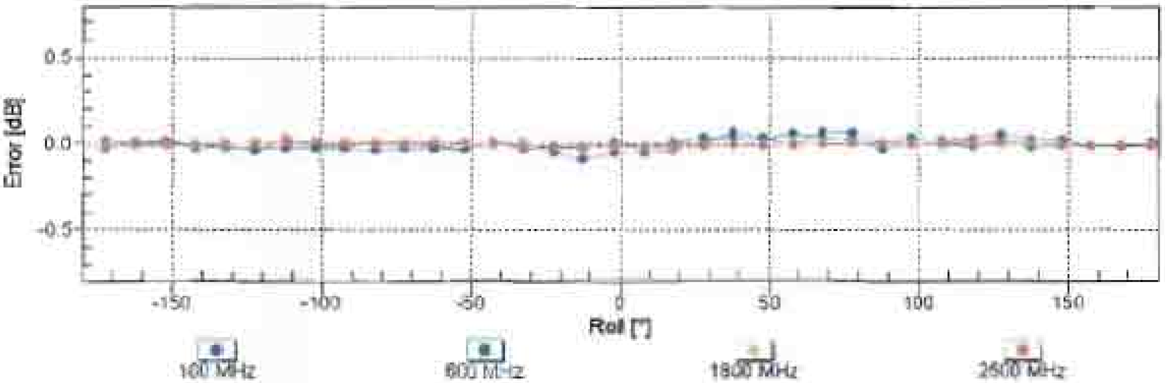
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM

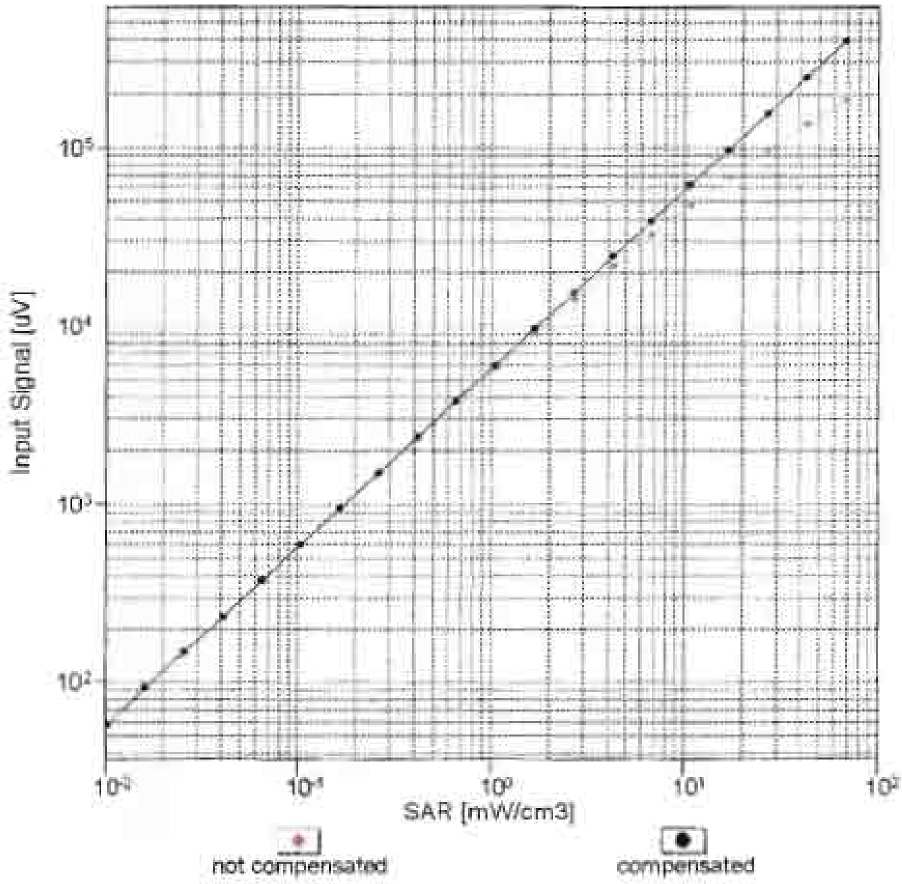
f=1800 MHz,R22

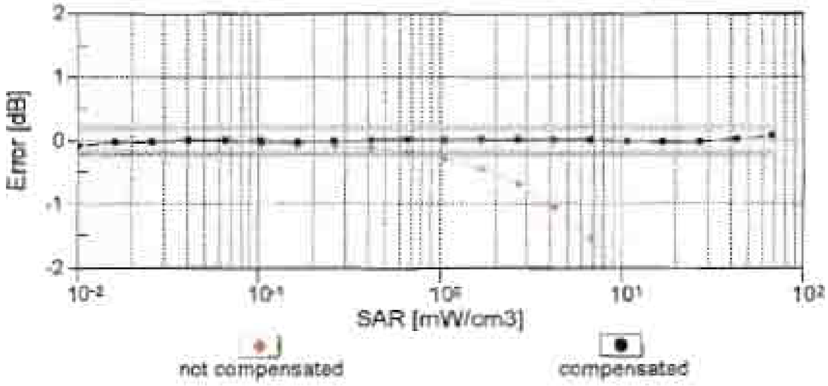




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

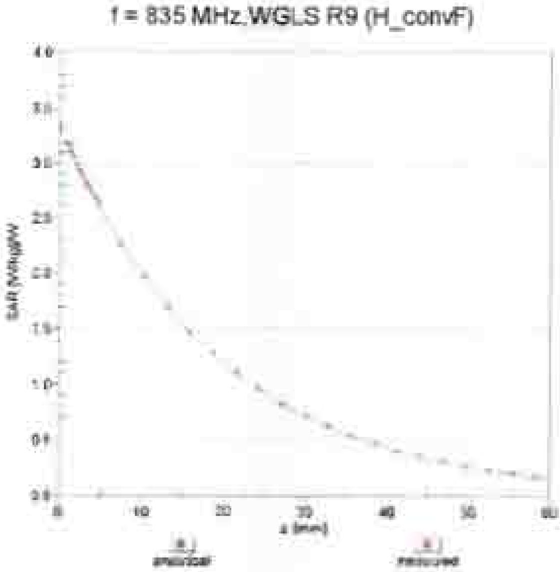
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

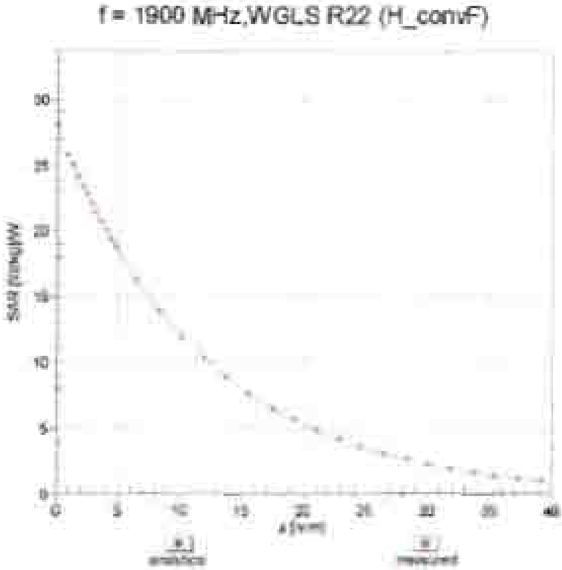




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

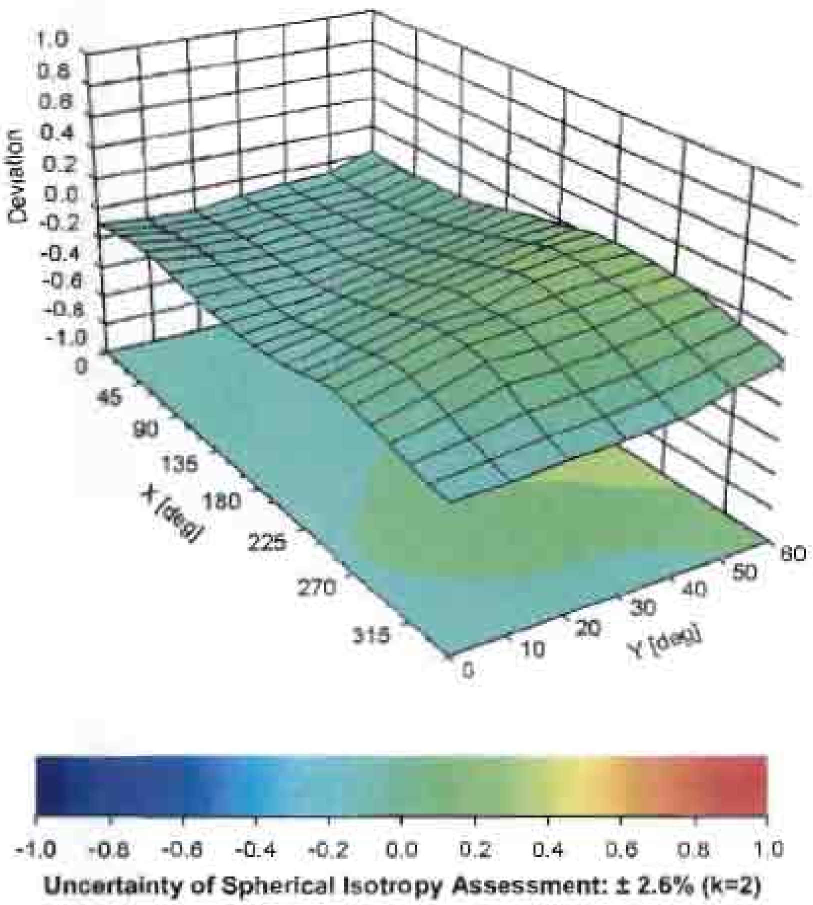
Conversion Factor Assessment





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: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

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Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3925_May14**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3925

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: May 22, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 23, 2014

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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *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.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3925

Manufactured: March 8, 2013
Calibrated: May 22, 2014

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]	97.0	96.5	102.4	

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	132.7	±2.7 %
		Y	0.0	0.0	1.0		133.4	
		Z	0.0	0.0	1.0		148.4	

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 [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	10.26	10.26	10.26	0.26	1.04	± 12.0 %
835	41.5	0.90	9.79	9.79	9.79	0.22	1.19	± 12.0 %
900	41.5	0.97	9.60	9.60	9.60	0.24	1.10	± 12.0 %
1750	40.1	1.37	8.54	8.54	8.54	0.43	0.79	± 12.0 %
1900	40.0	1.40	8.26	8.26	8.26	0.66	0.63	± 12.0 %
2000	40.0	1.40	8.18	8.18	8.18	0.59	0.66	± 12.0 %
2150	39.7	1.53	7.89	7.89	7.89	0.80	0.57	± 12.0 %
2450	39.2	1.80	7.26	7.26	7.26	0.47	0.71	± 12.0 %
2600	39.0	1.96	7.17	7.17	7.17	0.44	0.78	± 12.0 %
5200	36.0	4.66	5.31	5.31	5.31	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.09	5.09	5.09	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.83	4.83	4.83	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.69	4.69	4.69	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.63	4.63	4.63	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. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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

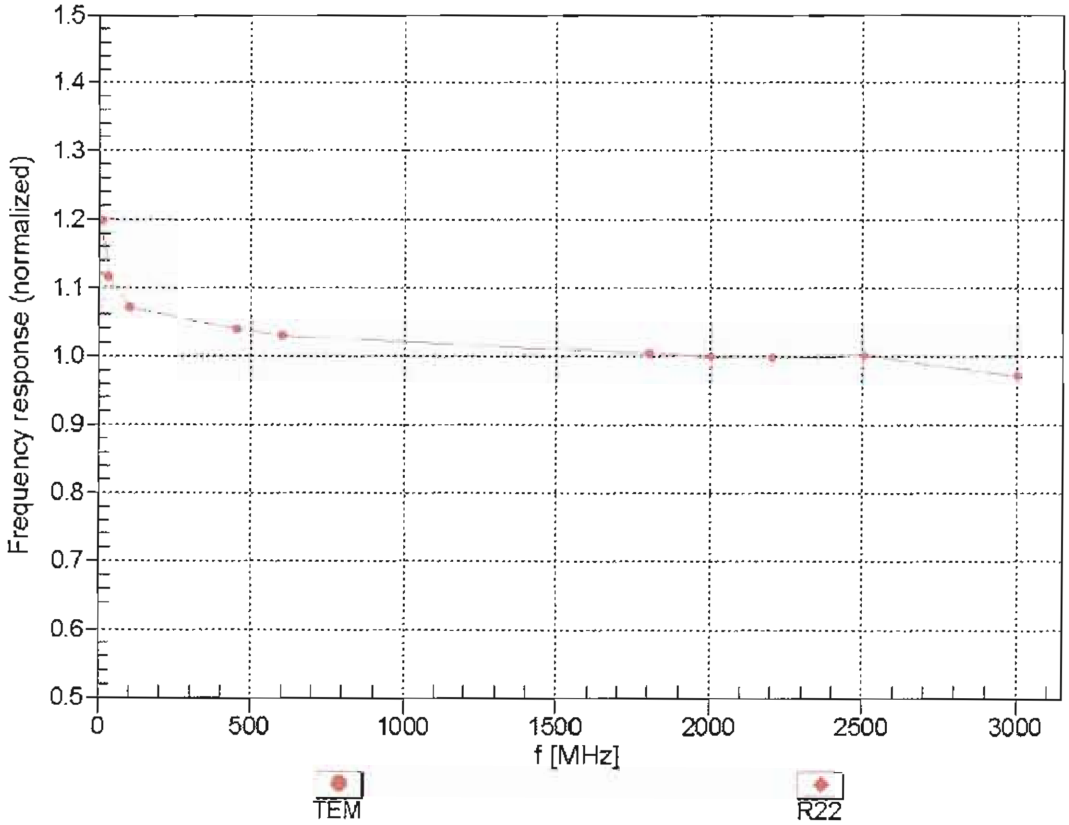
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	9.92	9.92	9.92	0.43	0.84	± 12.0 %
835	55.2	0.97	9.83	9.83	9.83	0.58	0.74	± 12.0 %
900	55.0	1.05	9.63	9.63	9.63	0.52	0.79	± 12.0 %
1750	53.4	1.49	8.30	8.30	8.30	0.51	0.78	± 12.0 %
1900	53.3	1.52	7.87	7.87	7.87	0.53	0.75	± 12.0 %
2000	53.3	1.52	7.98	7.98	7.98	0.48	0.80	± 12.0 %
2150	53.1	1.66	7.82	7.82	7.82	0.51	0.76	± 12.0 %
2450	52.7	1.95	7.36	7.36	7.36	0.76	0.59	± 12.0 %
2600	52.5	2.16	7.08	7.08	7.08	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.53	4.53	4.53	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.36	4.36	4.36	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.21	4.21	4.21	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.12	4.12	4.12	0.40	1.90	± 13.1 %
5800	48.2	6.00	4.09	4.09	4.09	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. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

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

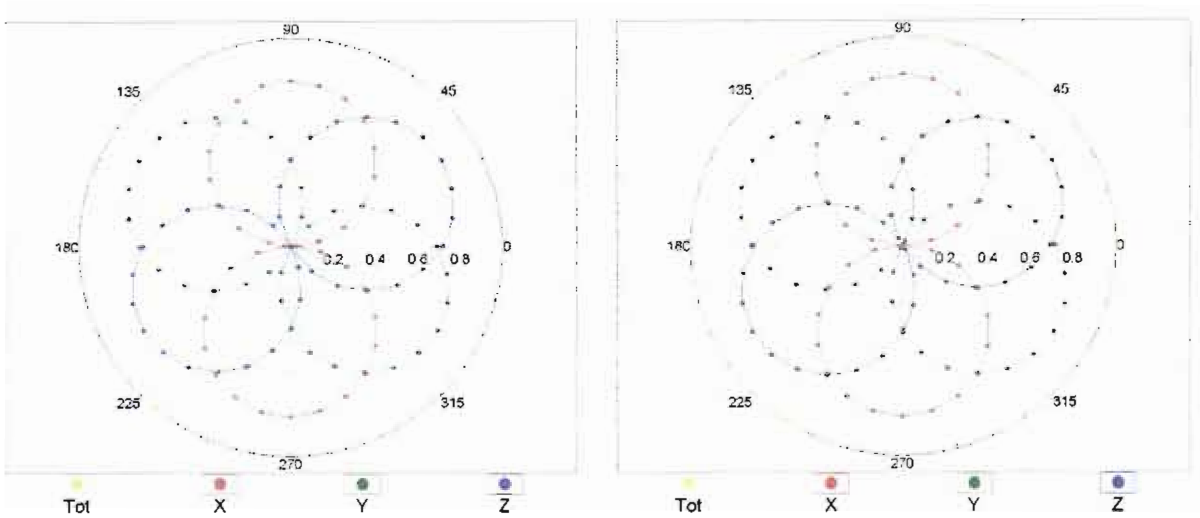


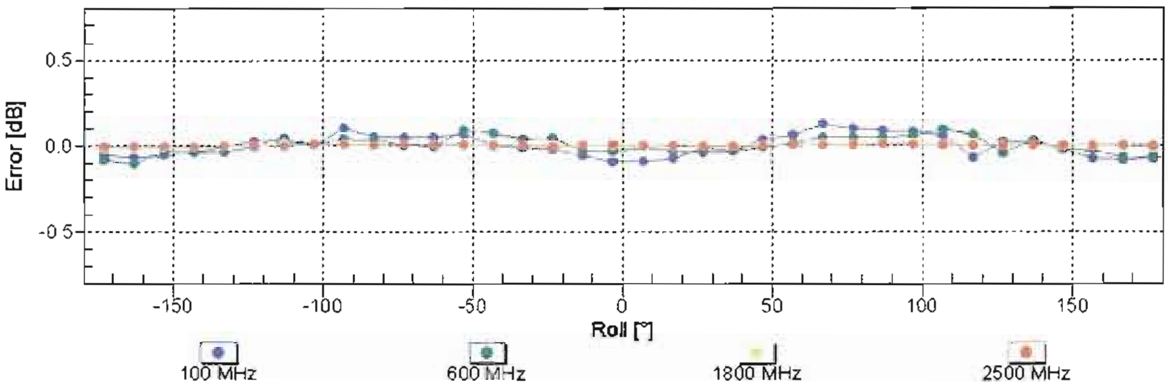
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM

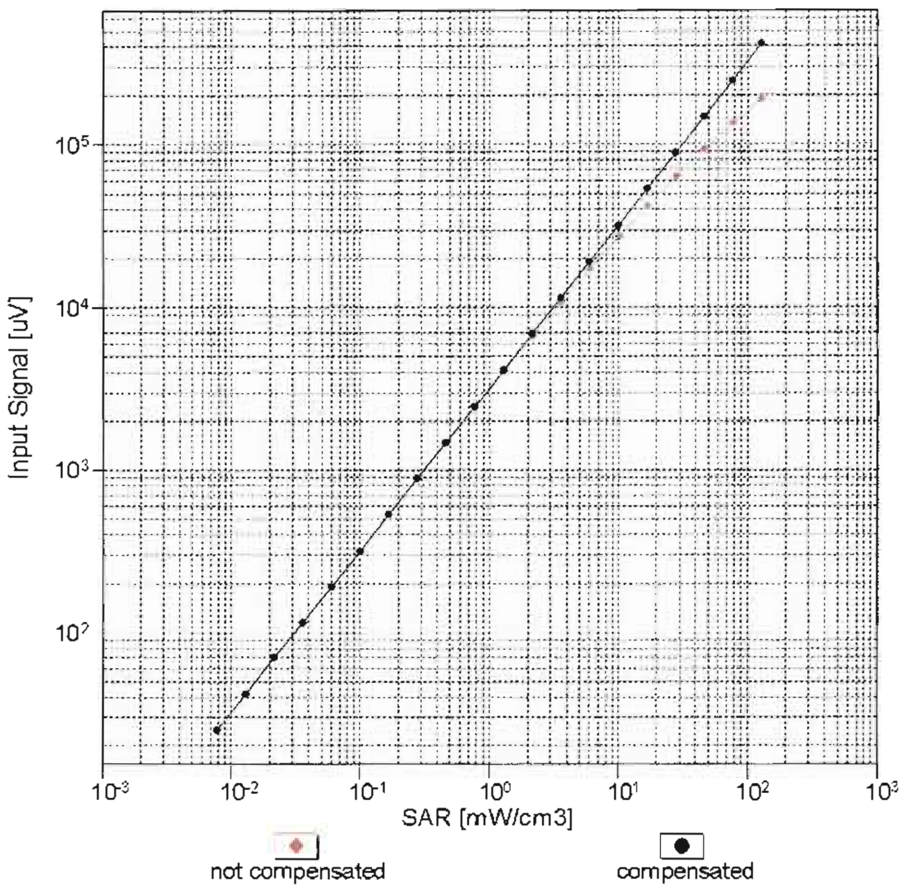
f=1800 MHz,R22

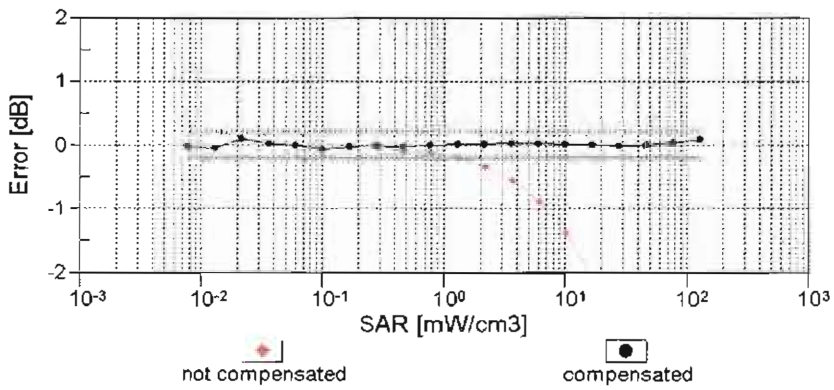




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

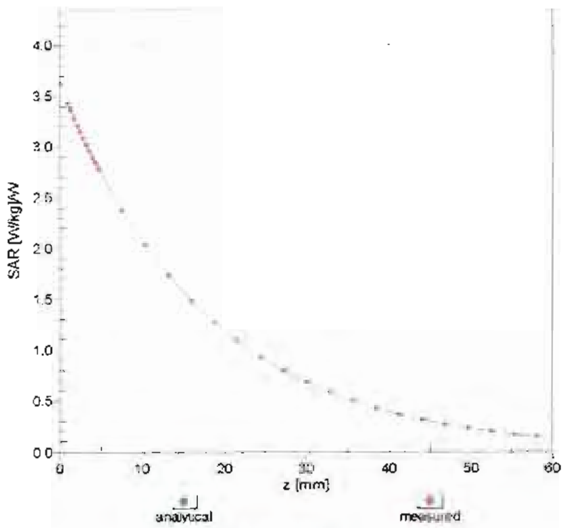




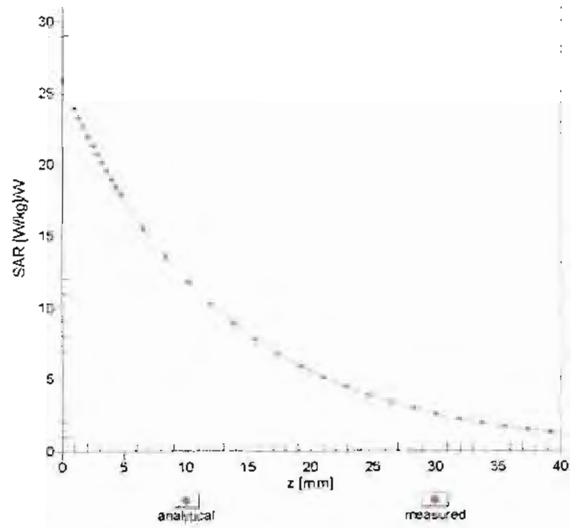
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

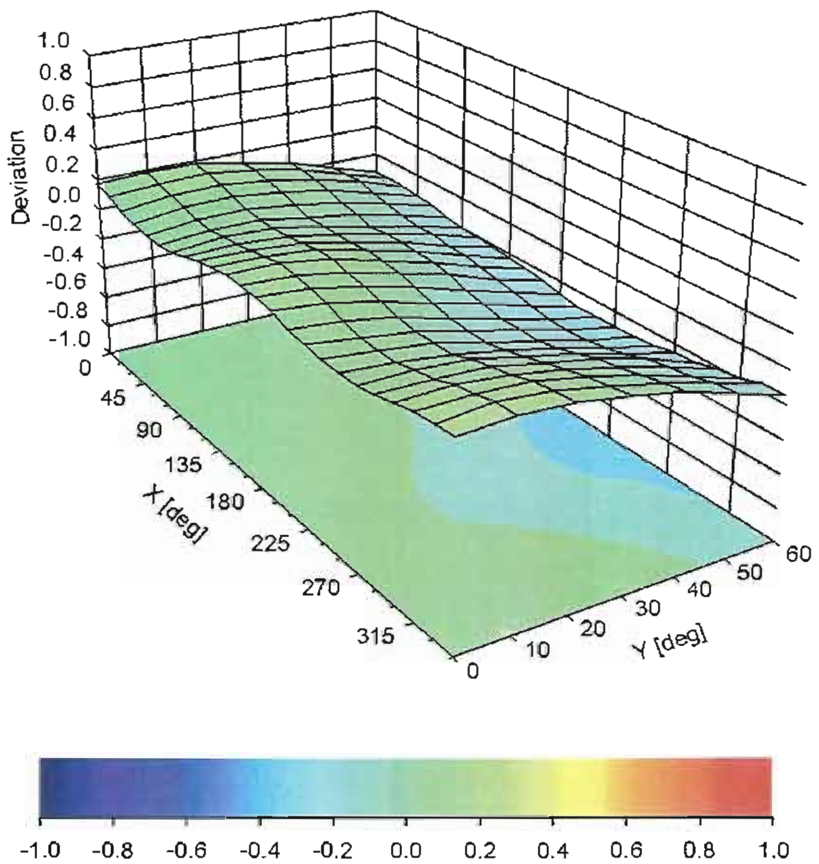


f = 1750 MHz,WGLS R22 (H_convF)



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 (°)	-93.1
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