FCC SAR Test Report

Report No.	:	**SA131126D16B**
Applicant	:	**Huawei Technologies Co., Ltd**
Address	:	**Huawei Base, Bantian, Longgang District Shenzhen 518129, P.R. China**
Product	:	**HSPA+ Module**
FCC ID	:	**QISMU733**
Brand	:	**Huawei**
Model No.	:	**MU733**
Standards	:	**FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:1992 / IEEE 1528:2003** **IEEE 1528a-2005 / KDB 865664 D01 v01r03 / KDB 447498 D01 v05r02** **KDB 616217 D04 v01r01 / KDB 941225 D01 v02** **KDB 941225 D02 v02r02 / KDB 941225 D03 v01**
Sample Received Date	:	**Jan. 21, 2014**
Date of Testing	:	**Mar. 07, 2014 ~ Mar. 10, 2014**

CERTIFICATION: The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch – Lin Kou Laboratories**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agencies.

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Table of Contents

Release Control Record **3**
1. Summary of Maximum SAR Value **4**
2. Description of Equipment Under Test **5**
3. SAR Measurement System **6**
3.1 Definition of Specific Absorption Rate (SAR) 6
3.2 SPEAG DASY System 6
3.2.1 Robot 7
3.2.2 Probes 8
3.2.3 Data Acquisition Electronics (DAE) 8
3.2.4 Phantoms 9
3.2.5 Device Holder 10
3.2.6 System Validation Dipoles 10
3.2.7 Tissue Simulating Liquids 11
3.3 SAR System Verification 14
3.4 SAR Measurement Procedure 15
3.4.1 Area & Zoom Scan Procedure 15
3.4.2 Volume Scan Procedure 15
3.4.3 Power Drift Monitoring 16
3.4.4 Spatial Peak SAR Evaluation 16
3.4.5 SAR Averaged Methods 16
4. SAR Measurement Evaluation **17**
4.1 EUT Configuration and Setting 17
4.2 EUT Testing Position 18
4.3 Tissue Verification 19
4.4 System Validation 20
4.5 System Verification 20
4.6 Maximum Output Power 21
4.6.1 Maximum Conducted Power 21
4.6.2 Measured Conducted Power Result 22
4.7 SAR Testing Results 25
4.7.1 SAR Results for Body 25
4.7.2 SAR Measurement Variability 26
5. Calibration of Test Equipment **27**
6. Measurement Uncertainty **28**
7. Information on the Testing Laboratories **29**

Appendix A. SAR Plots of System Verification
Appendix B. SAR Plots of SAR Measurement
Appendix C. Calibration Certificate for Probe and Dipole
Appendix D. Photographs of EUT and Setup

Release Control Record

Report No.	Reason for Change	Date Issued
SA131126D16B	Initial release	Jun. 19, 2014

1. Summary of Maximum SAR Value

Equipment Class	Mode	Highest Reported Body SAR_{1g} (W/kg)
PCE	GSM850	0.51
	GSM1900	1.21
	WCDMA II	1.09
	WCDMA IV	1.14
	WCDMA V	0.56

Note:

1. The SAR limit **(Head & Body: SAR_{1g} 1.6 W/kg)** for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

2. Description of Equipment Under Test

EUT Type	HSPA+ Module
FCC ID	QISMU733
Brand Name	Huawei
Model Name	MU733
HW Version	MD1MU733M
SW Version	11.102.13.00.00
Tx Frequency Bands (Unit: MHz)	GSM850 : 824.2 ~ 848.8 GSM1900 : 1850.2 ~ 1909.8 WCDMA Band II : 1852.4 ~ 1907.6 WCDMA Band IV : 1712.4 ~ 1752.6 WCDMA Band V : 826.4 ~ 846.6
Uplink Modulations	GPRS : GMSK EDGE : 8PSK WCDMA : QPSK
Maximum Tune-up Conducted Power (Unit: dBm)	GSM850 : 32.5 GSM1900 : 29.0 WCDMA Band II : 23.0 WCDMA Band IV : 22.5 WCDMA Band V : 23.0
Antenna Type	Fixed Internal Antenna
EUT Stage	Identical Prototype

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

3. SAR Measurement System

3.1 Definition of Specific Absorption Rate (SAR)

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.

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

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be related to the electrical field in the tissue by

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

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

3.2 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4/5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

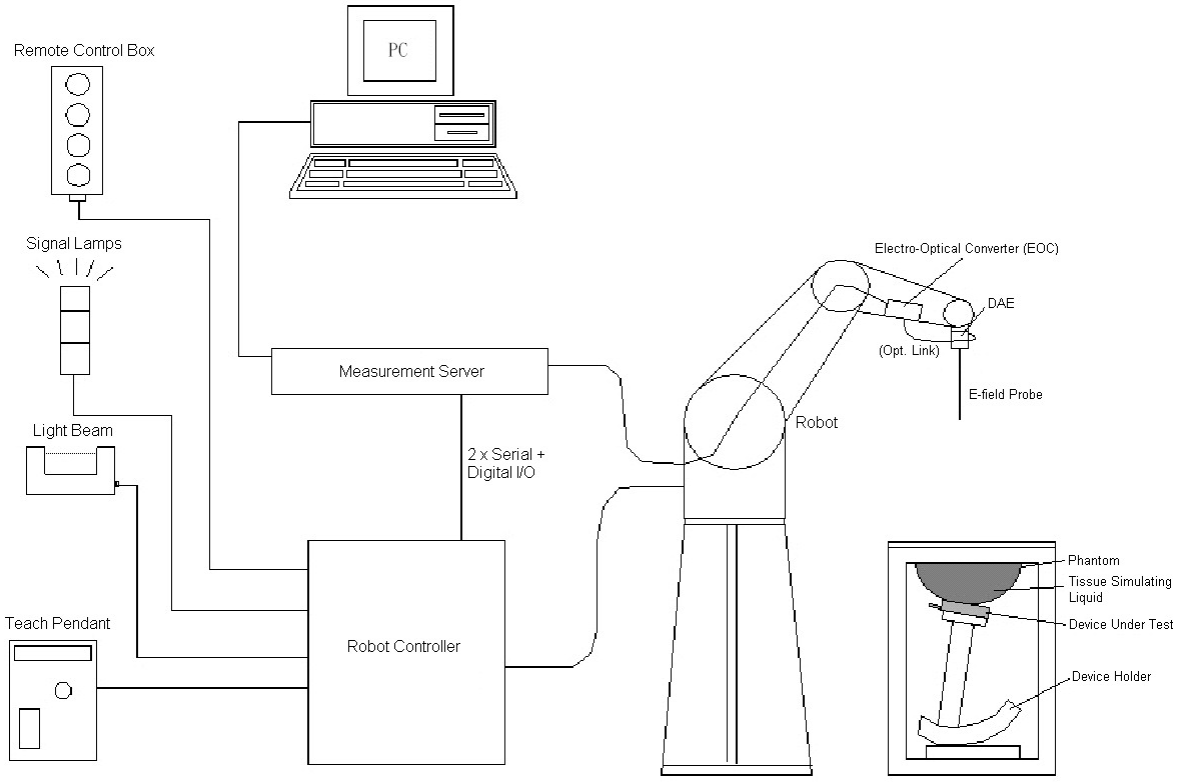

Fig-3.1 DASY System Setup

3.2.1 Robot

The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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

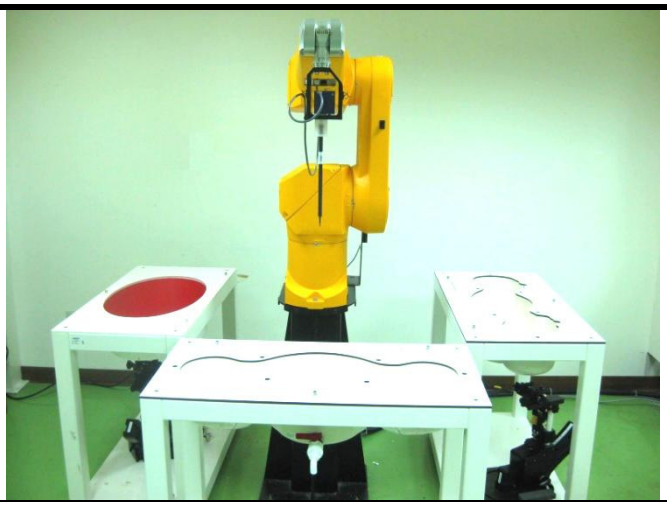

Fig-3.2 DASY4

Fig-3.3 DASY5

3.2.2 Probes

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

Model	EX3DV4	
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Model	ES3DV3	
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	5 µW/g to 100 mW/g Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	

3.2.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4	
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)	
Input Offset Voltage	< 5µV (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

3.2.4 Phantoms

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

3.2.5 Device Holder

Model	Mounting Device	
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
Material	POM	

Model	Laptop Extensions Kit	
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
Material	POM, Acrylic glass, Foam	

3.2.6 System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
Frequency	750 MHz to 5800 MHz	
Return Loss	> 20 dB	
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)	

3.2.7 Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.

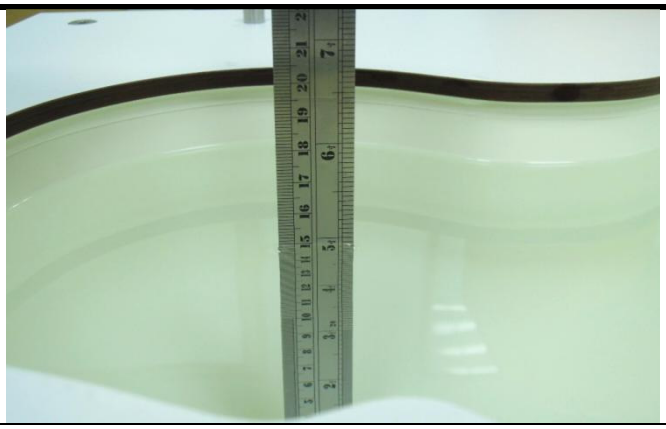	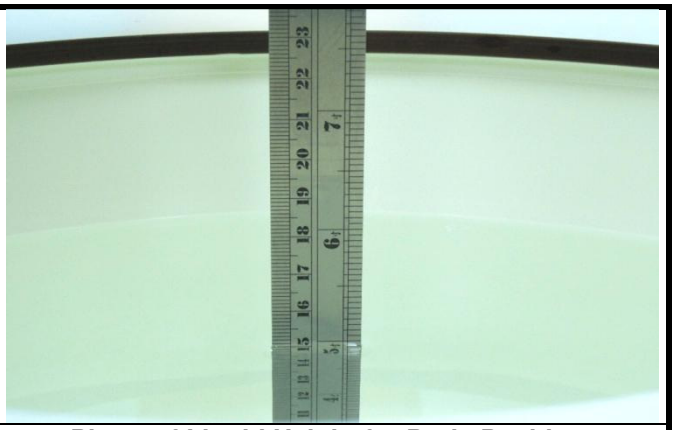
Photo of Liquid Height for Head Position	**Photo of Liquid Height for Body Position**

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528, and KDB 865664 D01 Appendix A. For the body tissue simulating liquids, the dielectric properties are defined in KDB 865664 D01 Appendix A. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

Table-3.1 Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of ±5%	Target Conductivity	Range of ±5%
For Head				
750	41.9	39.8 ~ 44.0	0.89	0.85 ~ 0.93
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
900	41.5	39.4 ~ 43.6	0.97	0.92 ~ 1.02
1450	40.5	38.5 ~ 42.5	1.20	1.14 ~ 1.26
1640	40.3	38.3 ~ 42.3	1.29	1.23 ~ 1.35
1750	40.1	38.1 ~ 42.1	1.37	1.30 ~ 1.44
1800	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2000	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2300	39.5	37.5 ~ 41.5	1.67	1.59 ~ 1.75
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
2600	39.0	37.1 ~ 41.0	1.96	1.86 ~ 2.06
3500	37.9	36.0 ~ 39.8	2.91	2.76 ~ 3.06
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53
For Body				
750	55.5	52.7 ~ 58.3	0.96	0.91 ~ 1.01
835	55.2	52.4 ~ 58.0	0.97	0.92 ~ 1.02
900	55.0	52.3 ~ 57.8	1.05	1.00 ~ 1.10
1450	54.0	51.3 ~ 56.7	1.30	1.24 ~ 1.37
1640	53.8	51.1 ~ 56.5	1.40	1.33 ~ 1.47
1750	53.4	50.7 ~ 56.1	1.49	1.42 ~ 1.56
1800	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
1900	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2000	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2300	52.9	50.3 ~ 55.5	1.81	1.72 ~ 1.90
2450	52.7	50.1 ~ 55.3	1.95	1.85 ~ 2.05
2600	52.5	49.9 ~ 55.1	2.16	2.05 ~ 2.27
3500	51.3	48.7 ~ 53.9	3.31	3.14 ~ 3.48
5200	49.0	46.6 ~ 51.5	5.30	5.04 ~ 5.57
5300	48.9	46.5 ~ 51.3	5.42	5.15 ~ 5.69
5500	48.6	46.2 ~ 51.0	5.65	5.37 ~ 5.93
5600	48.5	46.1 ~ 50.9	5.77	5.48 ~ 6.06
5800	48.2	45.8 ~ 50.6	6.00	5.70 ~ 6.30

The following table gives the recipes for tissue simulating liquids.

Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.5	56.0	-	42.1	-
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H900	0.2	-	0.2	1.4	58.0	-	40.2	-
H1450	-	43.3	-	0.6	-	-	56.1	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	47.0	-	0.4	-	-	52.6	-
H1800	-	44.5	-	0.3	-	-	55.2	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2000	-	44.5	-	0.1	-	-	55.4	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.5	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	31.0	-	0.2	-	-	68.8	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

3.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.

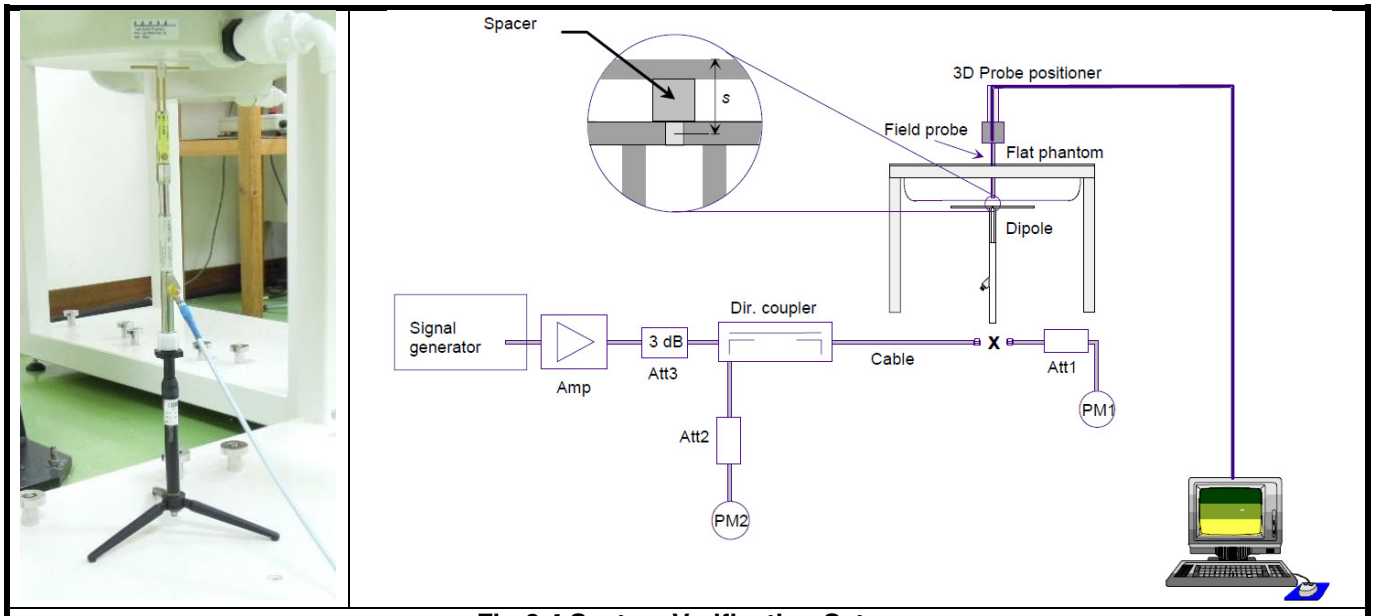

Fig-3.4 System Verification Setup

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

3.4 SAR Measurement Procedure

According to the SAR 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

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

3.4.1 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. According to KDB 865664 D01, the resolution for Area and Zoom scan is specified in the table below.

Items	<= 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	<= 15 mm	<= 12 mm	<= 12 mm	<= 10 mm	<= 10 mm
Zoom Scan (Δx, Δy)	<= 8 mm	<= 5 mm	<= 5 mm	<= 4 mm	<= 4 mm
Zoom Scan (Δz)	<= 5 mm	<= 5 mm	<= 4 mm	<= 3 mm	<= 2 mm
Zoom Scan Volume	>= 30 mm	>= 30 mm	>= 28 mm	>= 25 mm	>= 22 mm

Note:

When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

3.4.2 Volume Scan Procedure

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.

3.4.3 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 drift more than 5%, the SAR will be retested.

3.4.4 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

3.4.5 SAR Averaged Methods

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

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

4. SAR Measurement Evaluation

4.1 EUT Configuration and Setting

Since SAR issue, this device has designed with a proximity sensor which can trigger/not trigger power reduction for WWAN on EUT Rear Face and Top Side orientations for SAR compliance. The power levels for all wireless technologies and the power reduction please refer to section 4.6.1 of this report.

According to the procedures noticed in KDB 616217 D04, the proximity sensor triggering distance is 7 mm for EUT Rear Face and 11 mm for Top Side. The separation distance of 11 mm determined by the smallest triggering distance on Top Side is used to assess the tilt angle influence and the sensor does not release during ±45 degree. Therefore, the smallest separation distance for tilt angle influence is 11 mm for Top Side. The details can be found in technical document. The conservative triggering distances based on the separation distance for the sensor triggered / not triggered as EUT with power reduction at 0 mm, and EUT without power reduction at 6 mm for EUT Rear Face and 10 mm for Top Side is used to test SAR.

The power reduction is depends on the proximity sensor input. For a steady SAR test, the power reduction was enabled/disabled manually by engineering software during SAR testing.

For WWAN SAR testing, the EUT was linked and controlled by base station emulator (Agilent E5515C). Communication between the EUT and the emulator was established by air link. The distance between the EUT and the communicating antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during SAR testing.

For GSM850, the power control level is set to 5. For GPRS850 (GMSK, CS1), the power control level is set to 5. For EDGE850 (8PSK:MCS9), the power control level is set to 8. For GSM1900, the power control level is set to 0. For GPRS1900 (GMSK, CS1), the power control level is set to 0. For EDGE1900 (8PSK:MCS9), the power control level is set to 2.

For WCDMA, body SAR is tested under 12.2k RMC mode with power control set all up bits. SAR for AMR is not required since its power is less than 1/4 dB higher than RMC. SAR for HSDPA/HSUPA is not required since its power is less than 1/4 dB higher than RMC without HSDPA/HSUPA and SAR for 12.2 kbps RMC is less than 75% of the SAR limit (1.2 W/kg).

4.2 EUT Testing Position

According to KDB 616217 D04, SAR evaluation is required for back surface and edges of the devices. The back surface and edges of the tablet are tested with the tablet touching the phantom. Exposures from antennas through the front surface of the display section of a tablet are generally limited to the user's hands. Exposures to hands for typical consumer transmitters used in tablets are not expected to exceed the extremity SAR limit; therefore, SAR evaluation for the front surface of tablet display screens are generally not necessary. When voice mode is supported on a tablet and it is limited to speaker mode or headset operations only, additional SAR testing for this type of voice use is not required.

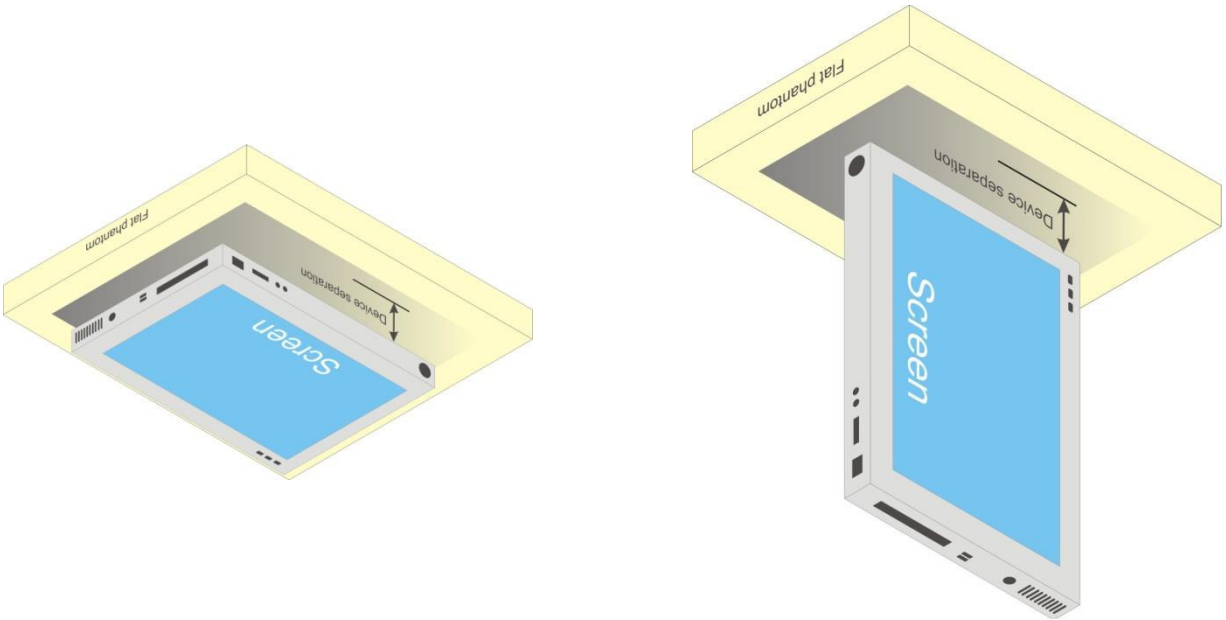

Fig-4.1 Illustration for Tablet Setup

According to KDB 447498 D01, the SAR test exclusion condition is based on source-based time-averaged maximum conducted output power, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The SAR exclusion threshold is determined by the following formula.

1. For the test separation distance <= 50 mm

$$\frac{\text{Max. Tune up Power}_{(mW)}}{\text{Min. Test Separation Distance}_{(mm)}} \times \sqrt{f_{(GHz)}} \leq 3.0$$

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

2. For the test separation distance > 50 mm, and the frequency at 100 MHz to 1500 MHz

$$\left[(\text{Threshold at 50 mm in Step 1}) + (\text{Test Separation Distance} - 50\text{ mm}) \times \left(\frac{f_{(MHz)}}{150}\right)\right]_{(mW)}$$

3. For the test separation distance > 50 mm, and the frequency at > 1500 MHz to 6 GHz

$$[(\text{Threshold at 50 mm in Step 1}) + (\text{Test Separation Distance} - 50\text{ mm}) \times 10]_{(mW)}$$

Mode	Max. Tune-up Power (dBm)	Max. Tune-up Power (mW)	Rear Face			Top Side			Bottom Side			Left Side			Right Side		
			Ant. to Surface (mm)	Calculated Result	Require SAR Testing?	Ant. to Surface (mm)	Calculated Result	Require SAR Testing?	Ant. to Surface (mm)	Calculated Result	Require SAR Testing?	Ant. to Surface (mm)	Calculated Result	Require SAR Testing?	Ant. to Surface (mm)	Calculated Result	Require SAR Testing?
GSM 850	23.0	200	5	36.9	**Yes**	3	36.9	**Yes**	145	700 mW	No	174	865 mW	No	36	5.1	**Yes**
GSM 1900	20.2	105	5	29	**Yes**	3	29	**Yes**	145	1059 mW	No	174	1349 mW	No	36	4	**Yes**
WCDMA II	16.0	40	5	11.1	**Yes**	3	11.1	**Yes**	145	1059 mW	No	174	1349 mW	No	36	1.5	No
WCDMA IV	18.0	63	5	16.7	**Yes**	3	16.7	**Yes**	145	1063 mW	No	174	1353 mW	No	36	2.3	No
WCDMA V	20.0	100	5	18.4	**Yes**	3	18.4	**Yes**	145	699 mW	No	174	863 mW	No	36	2.6	No

4.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (ε_r)	Target Conductivity (σ)	Target Permittivity (ε_r)	Conductivity Deviation (%)	Permittivity Deviation (%)
Mar. 07, 2014	Body	835	21.6	0.973	54.051	0.97	55.2	0.31	-2.08
Mar. 10, 2014	Body	835	20.9	0.972	55.124	0.97	55.2	0.21	-0.14
Mar. 07, 2014	Body	1750	20.9	1.499	52.487	1.49	53.4	0.60	-1.71
Mar. 07, 2014	Body	1900	20.9	1.553	53.382	1.52	53.3	2.17	0.15
Mar. 10, 2014	Body	1900	21.2	1.557	54.485	1.52	53.3	2.43	2.22

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ±5% of the target values. Liquid temperature during the SAR testing must be within ±2 ℃.

4.4 System Validation

The SAR measurement system was validated according to procedures in KDB 865664 D01. The validation status in tabulated summary is as below.

Test Date	Probe S/N	Calibration Point		Measured Conductivity (σ)	Measured Permittivity (ε_r)	Validation for CW			Validation for Modulation		
						Sensitivity Range	Probe Linearity	Probe Isotropy	Modulation Type	Duty Factor	PAR
Mar. 07, 2014	3650	Body	835	0.973	54.051	Pass	Pass	Pass	N/A	N/A	N/A
Mar. 10, 2014	3864	Body	835	0.972	55.124	Pass	Pass	Pass	GMSK	Pass	N/A
Mar. 07, 2014	3650	Body	1750	1.499	52.487	Pass	Pass	Pass	N/A	N/A	N/A
Mar. 07, 2014	3650	Body	1900	1.553	53.382	Pass	Pass	Pass	N/A	N/A	N/A
Mar. 10, 2014	3864	Body	1900	1.557	54.485	Pass	Pass	Pass	GMSK	Pass	N/A

4.5 System Verification

The measuring result for system verification is tabulated as below.

Test Date	Mode	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Mar. 07, 2014	Body	835	9.69	2.25	9.00	-7.12	4d121	3650	913
Mar. 10, 2014	Body	835	9.69	2.59	10.36	6.91	4d121	3864	1277
Mar. 07, 2014	Body	1750	36.90	9.38	37.52	1.68	1055	3650	913
Mar. 07, 2014	Body	1900	40.40	9.94	39.76	-1.58	5d022	3650	913
Mar. 10, 2014	Body	1900	40.40	9.50	38.00	-5.94	5d022	3864	1277

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

4.6 Maximum Output Power

4.6.1 Maximum Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

Mode	GSM850 (without Power Reduction)	GSM850 (with Power Reduction)	Power Reduction (dBm)
GPRS 8 (GMSK, 1 Uplink)	32.5	26.0	6.5
GPRS 10 (GMSK, 2 Uplink)	30.0	26.0	4.0
GPRS 11 (GMSK, 3 Uplink)	28.5	26.0	2.5
GPRS 12 (GMSK, 4 Uplink)	27.0	26.0	1.0
GPRS 30 (GMSK, 1 Uplink)	32.5	26.0	6.5
GPRS 31 (GMSK, 2 Uplink)	30.0	26.0	4.0
GPRS 32 (GMSK, 3 Uplink)	28.4	26.0	2.4
GPRS 33 (GMSK, 4 Uplink)	27.0	25.7	1.3
EDGE 8 (8PSK, 1 Uplink)	27.0	24.5	2.5
EDGE 10 (8PSK, 2 Uplink)	24.5	24.5	0.0
EDGE 11 (8PSK, 3 Uplink)	24.5	24.5	0.0
EDGE 12 (8PSK, 4 Uplink)	24.5	24.5	0.0
EDGE 30 (8PSK, 1 Uplink)	27.0	24.5	2.5
EDGE 31 (8PSK, 2 Uplink)	24.5	24.5	0.0
EDGE 32 (8PSK, 3 Uplink)	24.5	N/A	N/A
EDGE 33 (8PSK, 4 Uplink)	24.5	N/A	N/A

Mode	GSM1900 (without Power Reduction)	GSM1900 (with Power Reduction)	Power Reduction (dBm)
GPRS 8 (GMSK, 1 Uplink)	29.0	23.2	5.8
GPRS 10 (GMSK, 2 Uplink)	26.5	23.2	3.3
GPRS 11 (GMSK, 3 Uplink)	25.0	23.2	1.8
GPRS 12 (GMSK, 4 Uplink)	23.5	23.2	0.3
GPRS 30 (GMSK, 1 Uplink)	29.0	23.2	5.8
GPRS 31 (GMSK, 2 Uplink)	26.5	23.2	3.3
GPRS 32 (GMSK, 3 Uplink)	25.0	23.2	1.8
GPRS 33 (GMSK, 4 Uplink)	23.5	23.2	0.3
EDGE 8 (8PSK, 1 Uplink)	25.5	20.0	5.5
EDGE 10 (8PSK, 2 Uplink)	23.0	20.0	3.0
EDGE 11 (8PSK, 3 Uplink)	21.5	20.0	1.5
EDGE 12 (8PSK, 4 Uplink)	20.0	20.0	0.0
EDGE 30 (8PSK, 1 Uplink)	25.5	20.0	5.5
EDGE 31 (8PSK, 2 Uplink)	23.0	20.0	3.0
EDGE 32 (8PSK, 3 Uplink)	21.5	N/A	N/A
EDGE 33 (8PSK, 4 Uplink)	20.0	N/A	N/A

Mode	WCDMA Band II (without Power Reduction)	WCDMA Band II (with Power Reduction)	Power Reduction (dBm)
RMC 12.2K	23.0	16.0	7.0

Mode	WCDMA Band IV (without Power Reduction)	WCDMA Band IV (with Power Reduction)	Power Reduction (dBm)
RMC 12.2K	22.5	18.0	4.5

Mode	WCDMA Band V (without Power Reduction)	WCDMA Band V (with Power Reduction)	Power Reduction (dBm)
RMC 12.2K	23.0	20.0	3.0

4.6.2 Measured Conducted Power Result

The measuring conducted average power (Unit: dBm) is shown as below.

Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
EUT without Power Reduction (P-Sensor NOT Triggered)						
Maximum Burst-Averaged Output Power						
GPRS 8 (GMSK, 1 Uplink)	**32.05**	31.91	31.92	28.68	**28.82**	28.75
GPRS 10 (GMSK, 2 Uplink)	29.67	29.53	29.54	26.15	26.29	26.22
GPRS 11 (GMSK, 3 Uplink)	28.24	28.07	28.08	24.67	24.81	24.74
GPRS 12 (GMSK, 4 Uplink)	26.76	26.62	26.63	23.20	23.34	23.27
GPRS 30 (GMSK, 1 Uplink)	32.00	31.86	31.87	28.67	28.81	28.74
GPRS 31 (GMSK, 2 Uplink)	29.65	29.51	29.52	26.16	26.30	26.23
GPRS 32 (GMSK, 3 Uplink)	28.23	28.09	28.10	24.63	24.77	24.70
GPRS 33 (GMSK, 4 Uplink)	26.75	26.61	26.62	23.20	23.34	23.27
EDGE 8 (8PSK, 1 Uplink)	26.59	26.45	26.46	24.98	25.12	25.05
EDGE 10 (8PSK, 2 Uplink)	24.31	24.17	24.18	22.70	22.84	22.77
EDGE 11 (8PSK, 3 Uplink)	22.81	22.67	22.68	21.23	21.37	21.30
EDGE 12 (8PSK, 4 Uplink)	21.36	21.22	21.23	19.79	19.93	19.86
EDGE 30 (8PSK, 1 Uplink)	26.60	26.46	26.47	24.98	25.12	25.05
EDGE 31 (8PSK, 2 Uplink)	24.31	24.17	24.18	22.70	22.84	22.77
EDGE 32 (8PSK, 3 Uplink)	22.81	22.67	22.68	21.23	21.37	21.30
EDGE 33 (8PSK, 4 Uplink)	21.36	21.22	21.23	19.80	19.94	19.87
Maximum Frame-Averaged Output Power						
GPRS 8 (GMSK, 1 Uplink)	23.05	22.91	22.92	19.68	19.82	19.75
GPRS 10 (GMSK, 2 Uplink)	23.67	23.53	23.54	20.15	20.29	20.22
GPRS 11 (GMSK, 3 Uplink)	**23.98**	23.81	23.82	20.41	**20.55**	20.48
GPRS 12 (GMSK, 4 Uplink)	23.76	23.62	23.63	20.20	20.34	20.27
GPRS 30 (GMSK, 1 Uplink)	23.00	22.86	22.87	19.67	19.81	19.74
GPRS 31 (GMSK, 2 Uplink)	23.65	23.51	23.52	20.16	20.30	20.23
GPRS 32 (GMSK, 3 Uplink)	23.97	23.83	23.84	20.37	20.51	20.44
GPRS 33 (GMSK, 4 Uplink)	23.75	23.61	23.62	20.20	20.34	20.27
EDGE 8 (8PSK, 1 Uplink)	17.59	17.45	17.46	15.98	16.12	16.05
EDGE 10 (8PSK, 2 Uplink)	18.31	18.17	18.18	16.70	16.84	16.77
EDGE 11 (8PSK, 3 Uplink)	18.55	18.41	18.42	16.97	17.11	17.04
EDGE 12 (8PSK, 4 Uplink)	18.36	18.22	18.23	16.79	16.93	16.86
EDGE 30 (8PSK, 1 Uplink)	17.60	17.46	17.47	15.98	16.12	16.05
EDGE 31 (8PSK, 2 Uplink)	18.31	18.17	18.18	16.70	16.84	16.77
EDGE 32 (8PSK, 3 Uplink)	18.55	18.41	18.42	16.97	17.11	17.04
EDGE 33 (8PSK, 4 Uplink)	18.36	18.22	18.23	16.80	16.94	16.87

Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
EUT with Power Reduction (P-Sensor Triggered)						
Maximum Burst-Averaged Output Power						
GPRS 8 (GMSK, 1 Uplink)	25.62	25.61	25.64	23.04	23.13	23.12
GPRS 10 (GMSK, 2 Uplink)	25.63	25.62	25.65	23.05	23.14	23.13
GPRS 11 (GMSK, 3 Uplink)	25.66	25.65	25.68	23.08	23.17	23.16
GPRS 12 (GMSK, 4 Uplink)	25.65	25.64	**25.69**	23.09	**23.19**	23.17
GPRS 30 (GMSK, 1 Uplink)	25.62	25.61	25.64	23.04	23.13	23.12
GPRS 31 (GMSK, 2 Uplink)	25.63	25.62	25.65	23.05	23.14	23.13
GPRS 32 (GMSK, 3 Uplink)	25.66	25.65	25.68	23.06	23.15	23.14
GPRS 33 (GMSK, 4 Uplink)	25.65	25.64	25.67	23.09	23.15	23.16
EDGE 8 (8PSK, 1 Uplink)	24.24	24.23	24.26	19.53	19.62	19.61
EDGE 10 (8PSK, 2 Uplink)	24.24	24.23	24.26	19.55	19.64	19.63
EDGE 11 (8PSK, 3 Uplink)	24.25	24.24	24.27	19.55	19.64	19.63
EDGE 12 (8PSK, 4 Uplink)	24.25	24.24	24.27	19.57	19.66	19.65
EDGE 30 (8PSK, 1 Uplink)	24.24	24.23	24.26	19.56	19.65	19.64
EDGE 31 (8PSK, 2 Uplink)	24.24	24.23	24.26	19.55	19.64	19.63
EDGE 32 (8PSK, 3 Uplink)	25.62	25.61	25.64	23.04	23.13	23.12
EDGE 33 (8PSK, 4 Uplink)	25.63	25.62	25.65	23.05	23.14	23.13
Maximum Frame-Averaged Output Power						
GPRS 8 (GMSK, 1 Uplink)	16.62	16.61	16.64	14.04	14.13	14.12
GPRS 10 (GMSK, 2 Uplink)	19.63	19.62	19.65	17.05	17.14	17.13
GPRS 11 (GMSK, 3 Uplink)	21.40	21.39	21.42	18.82	18.91	18.90
GPRS 12 (GMSK, 4 Uplink)	22.65	22.64	**22.69**	20.09	**20.19**	20.17
GPRS 30 (GMSK, 1 Uplink)	16.62	16.61	16.64	14.04	14.13	14.12
GPRS 31 (GMSK, 2 Uplink)	19.63	19.62	19.65	17.05	17.14	17.13
GPRS 32 (GMSK, 3 Uplink)	21.40	21.39	21.42	18.80	18.89	18.88
GPRS 33 (GMSK, 4 Uplink)	22.65	22.64	22.67	20.09	20.15	20.16
EDGE 8 (8PSK, 1 Uplink)	15.24	15.23	15.26	10.53	10.62	10.61
EDGE 10 (8PSK, 2 Uplink)	18.24	18.23	18.26	13.55	13.64	13.63
EDGE 11 (8PSK, 3 Uplink)	19.99	19.98	20.01	15.29	15.38	15.37
EDGE 12 (8PSK, 4 Uplink)	21.25	21.24	21.27	16.57	16.66	16.65
EDGE 30 (8PSK, 1 Uplink)	15.24	15.23	15.26	10.56	10.65	10.64
EDGE 31 (8PSK, 2 Uplink)	18.24	18.23	18.26	13.55	13.64	13.63
EDGE 32 (8PSK, 3 Uplink)	16.62	16.61	16.64	14.04	14.13	14.12
EDGE 33 (8PSK, 4 Uplink)	19.63	19.62	19.65	17.05	17.14	17.13

Note:

1. SAR testing was performed on the maximum frame-averaged power mode.
2. The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:
   Frame-averaged power = 10 x log (Burst-averaged power mW x Slot used / 8)

Band	WCDMA Band II			WCDMA Band V			3GPP MPR (dB)
Channel	9262	9400	9538	4132	4182	4233	
Frequency (MHz)	1852.4	1880.0	1907.6	826.4	836.4	846.6	
EUT without Power Reduction (P-Sensor NOT Triggered)							
RMC 12.2K	**22.56**	22.16	22.01	**22.78**	22.59	22.68	-
HSDPA Subtest-1	22.52	22.12	21.97	22.76	22.57	22.66	0
HSDPA Subtest-2	21.94	21.54	21.39	22.34	22.15	22.24	0
HSDPA Subtest-3	21.42	21.02	20.87	21.87	21.68	21.77	0.5
HSDPA Subtest-4	21.02	20.62	20.47	21.63	21.44	21.53	0.5
HSUPA Subtest-1	21.15	20.75	20.60	21.74	21.55	21.64	0
HSUPA Subtest-2	19.91	19.51	19.36	20.21	20.02	20.11	2
HSUPA Subtest-3	20.64	20.24	20.09	20.97	20.78	20.87	1
HSUPA Subtest-4	20.06	19.66	19.51	20.44	20.25	20.34	2
HSUPA Subtest-5	20.94	20.54	20.39	22.48	22.29	22.38	0
EUT with Power Reduction (P-Sensor Triggered)							
RMC 12.2K	**15.73**	15.16	15.29	**19.71**	19.56	19.60	-
HSDPA Subtest-1	15.55	15.15	15.28	19.54	19.47	19.33	-
HSDPA Subtest-2	15.52	15.12	15.25	19.59	19.52	19.38	-
HSDPA Subtest-3	15.52	15.12	15.25	19.58	19.51	19.37	-
HSDPA Subtest-4	15.61	15.21	15.34	19.57	19.50	19.36	-
HSUPA Subtest-1	15.01	14.61	14.74	18.97	18.90	18.76	-
HSUPA Subtest-2	13.99	13.59	13.72	17.62	17.55	17.41	-
HSUPA Subtest-3	14.83	14.43	14.56	18.69	18.62	18.48	-
HSUPA Subtest-4	13.93	13.53	13.66	17.21	17.14	17.00	-
HSUPA Subtest-5	15.50	15.33	15.46	19.62	19.55	19.41	-

Band	WCDMA Band IV			3GPP MPR (dB)
Channel	1312	1413	1513	
Frequency (MHz)	1712.4	1732.6	1752.6	
EUT without Power Reduction (P-Sensor NOT Triggered)				
RMC 12.2K	22.11	**22.21**	22.09	-
HSDPA Subtest-1	22.08	22.18	22.06	0
HSDPA Subtest-2	21.62	21.72	21.60	0
HSDPA Subtest-3	21.14	21.24	21.12	0.5
HSDPA Subtest-4	20.90	21.00	20.88	0.5
HSUPA Subtest-1	21.09	21.19	21.07	0
HSUPA Subtest-2	19.48	19.58	19.46	2
HSUPA Subtest-3	20.27	20.37	20.25	1
HSUPA Subtest-4	19.83	19.93	19.81	2
HSUPA Subtest-5	21.73	21.83	21.71	0
EUT with Power Reduction (P-Sensor Triggered)				
RMC 12.2K	**17.82**	17.46	17.25	-
HSDPA Subtest-1	17.57	17.31	17.10	-
HSDPA Subtest-2	17.50	17.24	17.03	-
HSDPA Subtest-3	17.62	17.36	17.15	-
HSDPA Subtest-4	17.72	17.56	17.35	-
HSUPA Subtest-1	17.04	16.78	16.57	-
HSUPA Subtest-2	15.40	15.14	14.93	-
HSUPA Subtest-3	16.89	16.63	16.42	-
HSUPA Subtest-4	15.64	15.38	15.17	-
HSUPA Subtest-5	17.74	17.48	17.27	-

4.7 SAR Testing Results

4.7.1 SAR Results for Body

Plot No.	Band	Mode	Test Position	Separation Distance (mm)	Ch.	Power Reduction	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
01	GSM850	GPRS12	Rear Face	0	251	w/	26.0	25.69	1.07	0.09	0.478	**0.51**
	GSM850	GPRS11	Rear Face	6	128	w/o	28.5	28.24	1.06	0.09	0.217	0.23
	GSM850	GPRS12	Top Side	0	251	w/	26.0	25.69	1.07	0.02	0.239	0.26
	GSM850	GPRS11	Top Side	10	128	w/o	28.5	28.24	1.06	0.02	0.043	0.05
	GSM850	GPRS11	Right Side	0	128	w/o	28.5	28.24	1.06	0.10	0.041	0.04
	GSM1900	GPRS12	Rear Face	0	661	w/	23.2	23.19	1.00	0.05	0.47	0.48
	GSM1900	GPRS11	Rear Face	6	661	w/o	25.0	24.81	1.04	-0.15	0.663	0.69
	GSM1900	GPRS12	Top Side	0	661	w/	23.2	23.19	1.00	0.01	1.14	1.14
	GSM1900	GPRS11	Top Side	10	661	w/o	25.0	24.81	1.04	0.04	0.422	0.44
	GSM1900	GPRS11	Right Side	0	661	w/o	25.0	24.81	1.04	0.06	0.02	0.02
02	GSM1900	GPRS12	Top Side	0	512	w/	23.2	23.09	1.03	0.13	1.18	**1.21**
	GSM1900	GPRS12	Top Side	0	810	w/	23.2	23.17	1.01	0.06	1.05	1.05
	GSM1900	GPRS12	Top Side	0	512	w/	23.2	23.09	1.03	0.08	1.17	1.20
	WCDMA II	RMC12.2K	Rear Face	0	9262	w/	16.0	15.73	1.06	-0.03	0.489	0.52
03	WCDMA II	RMC12.2K	Rear Face	6	9262	w/o	23.0	22.56	1.11	-0.02	0.983	**1.09**
	WCDMA II	RMC12.2K	Top Side	0	9262	w/	16.0	15.73	1.06	-0.02	0.596	0.63
	WCDMA II	RMC12.2K	Top Side	10	9262	w/o	23.0	22.56	1.11	-0.02	0.338	0.37
	WCDMA II	RMC12.2K	Rear Face	6	9400	w/o	23.0	22.16	1.21	-0.08	0.837	1.01
	WCDMA II	RMC12.2K	Rear Face	6	9538	w/o	23.0	22.01	1.26	0.03	0.796	1.00
	WCDMA II	RMC12.2K	Rear Face	6	9262	w/o	23.0	22.56	1.11	-0.10	0.898	1.00
	WCDMA IV	RMC12.2K	Rear Face	0	1312	w/	18.0	17.82	1.04	-0.03	0.465	0.48
	WCDMA IV	RMC12.2K	Rear Face	6	1413	w/o	22.5	22.21	1.07	-0.10	0.486	0.52
	WCDMA IV	RMC12.2K	Top Side	0	1312	w/	18.0	17.82	1.04	-0.02	0.803	0.84
	WCDMA IV	RMC12.2K	Top Side	10	1413	w/o	22.5	22.21	1.07	-0.04	0.449	0.48
	WCDMA IV	RMC12.2K	Top Side	0	1413	w/	18.0	17.46	1.13	-0.07	0.793	0.90
04	WCDMA IV	RMC12.2K	Top Side	0	1513	w/	18.0	17.25	1.19	-0.04	0.957	**1.14**
	WCDMA IV	RMC12.2K	Top Side	0	1513	w/	18.0	17.25	1.19	0.08	0.916	1.09
05	WCDMA V	RMC12.2K	Rear Face	0	4132	w/	20.0	19.71	1.07	0.08	0.524	**0.56**
	WCDMA V	RMC12.2K	Rear Face	6	4132	w/o	23.0	22.78	1.05	0.07	0.313	0.33
	WCDMA V	RMC12.2K	Top Side	0	4132	w/	20.0	19.71	1.07	-0.05	0.3	0.32
	WCDMA V	RMC12.2K	Top Side	10	4132	w/o	23.0	22.78	1.05	-0.09	0.045	0.05

Note:

1. SAR is performed on the highest power channel. When the reported SAR value of highest power channel is <= 0.8 W/kg, SAR testing for optional channel is not required.

4.7.2 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
3. If the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20, or when the original or repeated measurement is >= 1.45 W/kg, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20, and the original, first or second repeated measurement is >= 1.5 W/kg, perform a third repeated measurement.

Band	Mode	Test Position	Ch.	Original Measured SAR-1g (W/kg)	1st Repeated SAR-1g (W/kg)	L/S Ratio	2nd Repeated SAR-1g (W/kg)	L/S Ratio	3rd Repeated SAR-1g (W/kg)	L/S Ratio
GSM1900	GPRS12	Top Side	512	1.18	1.17	1.01	N/A	N/A	N/A	N/A
WCDMA II	RMC12.2K	Rear Face	9262	0.983	0.898	1.09	N/A	N/A	N/A	N/A
WCDMA IV	RMC12.2K	Top Side	1513	0.957	0.916	1.04	N/A	N/A	N/A	N/A

Test Engineer： Sam Onn, and Mars Chang

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D835V2	4d121	Apr. 25, 2013	2 Years
System Validation Dipole	SPEAG	D1750V2	1055	Aug. 27, 2013	2 Years
System Validation Dipole	SPEAG	D1900V2	5d022	Jul. 29, 2013	2 Years
Dosimetric E-Field Probe	SPEAG	EX3DV4	3650	Apr. 30, 2013	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	3864	Jul. 31, 2013	1 Year
Data Acquisition Electronics	SPEAG	DAE4	913	Dec. 17, 2013	1 Year
Data Acquisition Electronics	SPEAG	DAE4	1277	Jul. 26, 2013	1 Year
Wireless Communication Test Set	Agilent	E5515C	MY50260642	Nov. 25, 2013	2 Years
ENA Series Network Analyzer	Agilent	E5071C	MY46212595	Nov. 14, 2013	1 Year
EXA Spectrum Analyzer	Agilent	N9010A	MY53400225	Sep. 18, 2013	1 Year
MXG Analong Signal Generator	Agilent	N5182B	MY53050162	Oct. 24, 2013	1 Year
Power Meter	Anritsu	ML2495A	0824011	Jul. 29, 2013	1 Year
Power Sensor	Anritsu	MA2411B	0738171	Jul. 29, 2013	1 Year
Thermometer	YFE	YF-160A	110600361	Feb. 27, 2014	1 Year

6. Measurement Uncertainty

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)	Vi
Measurement System						
Probe Calibration	6.0	Normal	1	1	± 6.0 %	∞
Axial Isotropy	4.7	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	± 3.9 %	∞
Boundary Effects	1.0	Rectangular	√3	1	± 0.6 %	∞
Linearity	4.7	Rectangular	√3	1	± 2.7 %	∞
System Detection Limits	1.0	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	0.6	Normal	1	1	± 0.6 %	∞
Response Time	0.0	Rectangular	√3	1	± 0.0 %	∞
Integration Time	1.7	Rectangular	√3	1	± 1.0 %	∞
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	0.5	Rectangular	√3	1	± 0.3 %	∞
Probe Positioning	2.9	Rectangular	√3	1	± 1.7 %	∞
Max. SAR Eval.	2.3	Rectangular	√3	1	± 1.3 %	∞
Test Sample Related						
Device Positioning	3.9	Normal	1	1	± 3.9 %	31
Device Holder	2.7	Normal	1	1	± 2.7 %	19
Power Drift	5.0	Rectangular	√3	1	± 2.9 %	∞
Phantom and Setup						
Phantom Uncertainty	4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	± 1.8 %	∞
Liquid Conductivity (Meas.)	5.0	Normal	1	0.64	± 3.2 %	29
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %	∞
Liquid Permittivity (Meas.)	5.0	Normal	1	0.6	± 3.0 %	29
Combined Standard Uncertainty					± 11.7 %	
Expanded Uncertainty (K=2)					**± 23.4 %**	

Uncertainty budget for frequency range 300 MHz to 3 GHz

7. Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Fax: 886-3-593-5342

Email: service.adt@tw.bureauveritas.com
Web Site: www.adt.com.tw

The road map of all our labs can be found in our web site also.

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Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2014/03/07

System Check_B835_140307

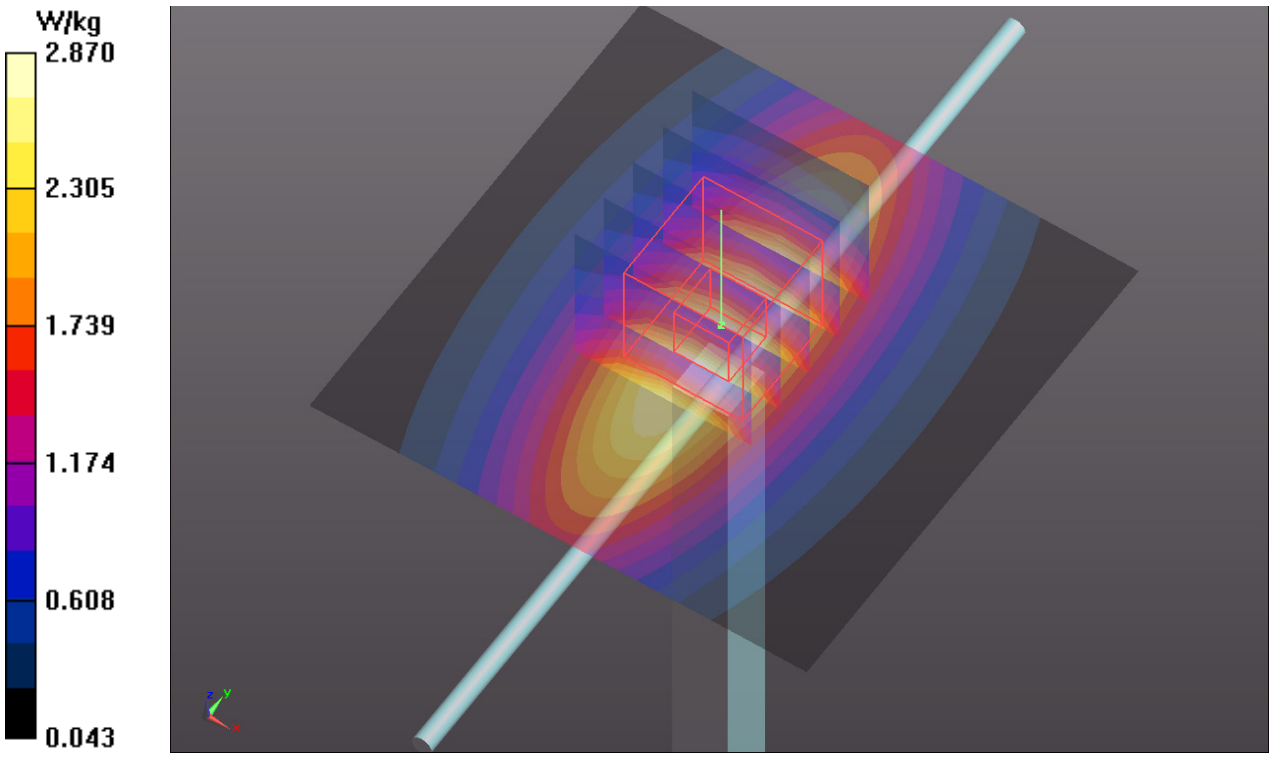
DUT: Dipole 835 MHz; Type: D835V2; SN: 4d121

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: B835_0307 Medium parameters used: f = 835 MHz; σ = 0.973 S/m; ε_r = 54.051; ρ = 1000 kg/m^3
Ambient Temperature：21.9 ℃； Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(9.35, 9.35, 9.35); Calibrated: 2013/04/30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn913; Calibrated: 2013/12/17
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: TP:1206
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.87 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 51.982 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.43 W/kg
SAR(1 g) = 2.25 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.86 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2014/03/07

System Check_B1750_140307

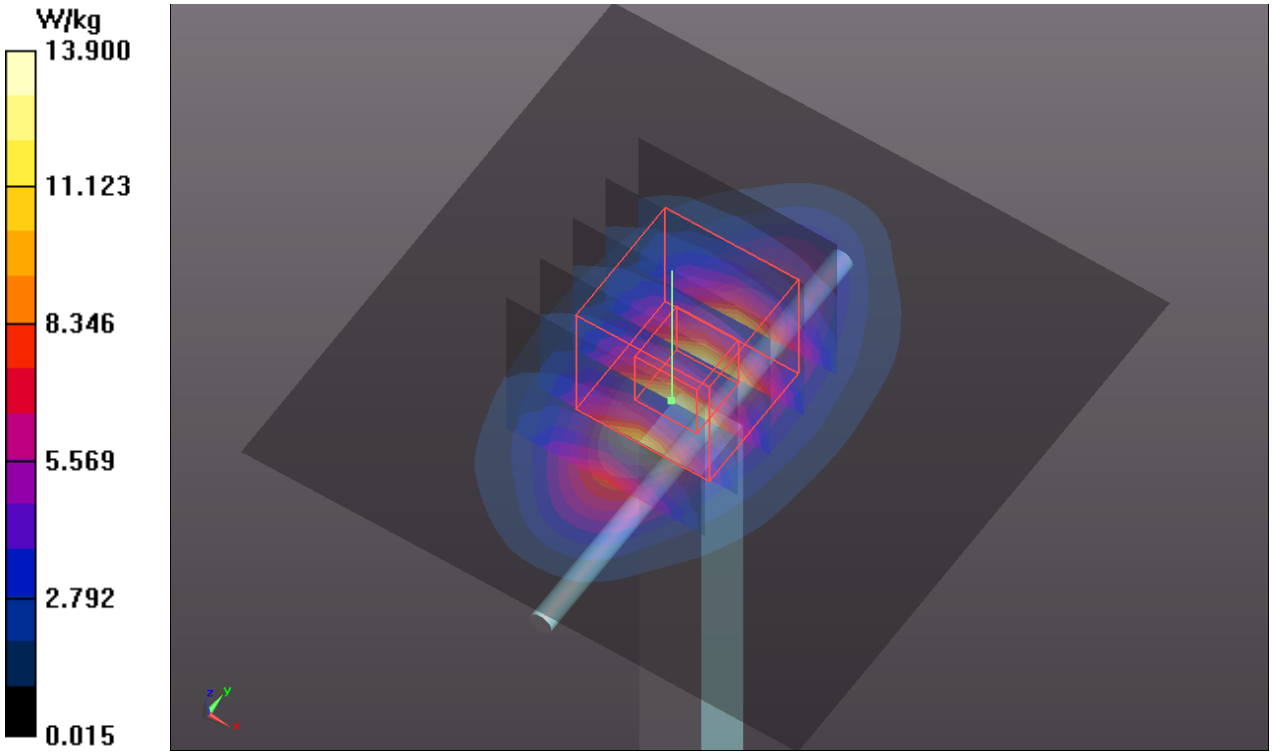
DUT: Dipole 1750 MHz; Type: D1750V2; SN: 1055

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: B1750_0307 Medium parameters used: f = 1750 MHz; σ = 1.499 S/m; ε_r = 52.487; ρ = 1000 kg/m^3
Ambient Temperature：21.1 ℃； Liquid Temperature：20.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(7.57, 7.57, 7.57); Calibrated: 2013/04/30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn913; Calibrated: 2013/12/17
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: TP:1206
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.9 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 94.610 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.38 W/kg; SAR(10 g) = 5.05 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2014/03/10

System Check_B1900_140310

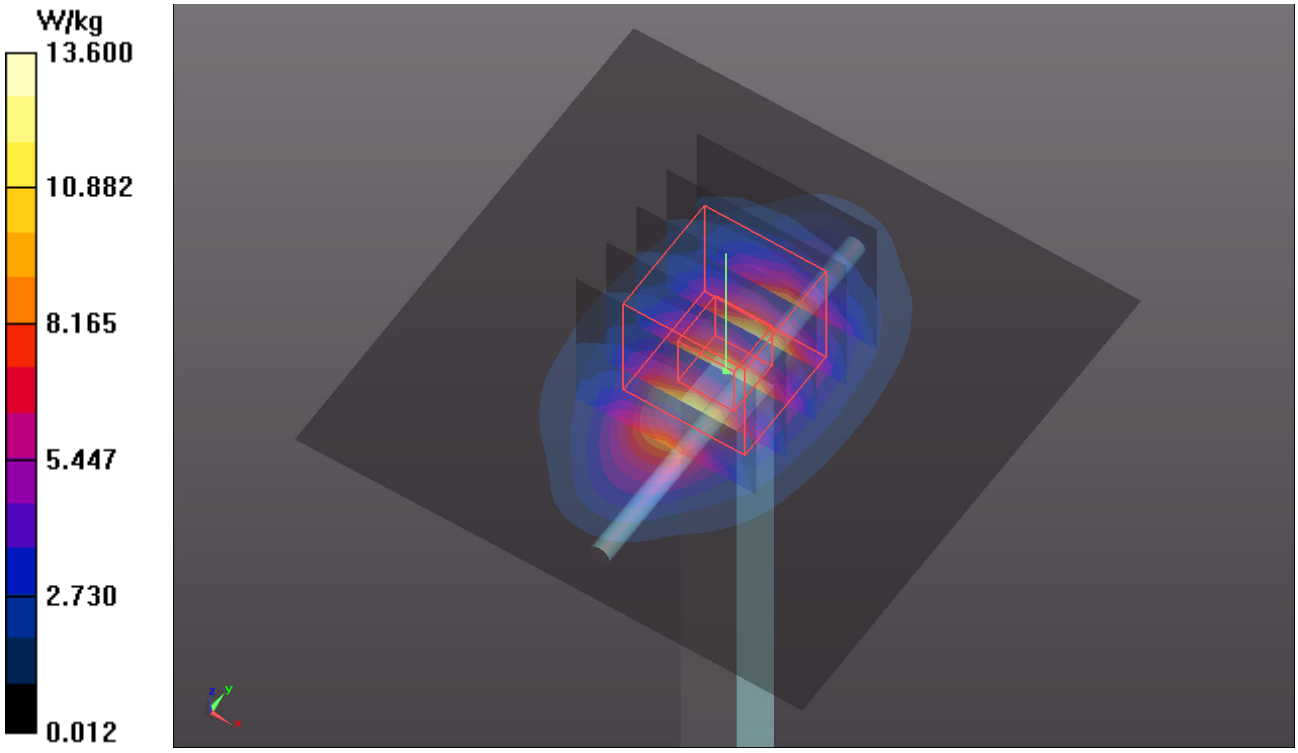
DUT: Dipole 1900 MHz; Type: D1900V2; SN: 5d022

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: B1900_0310 Medium parameters used: f = 1900 MHz; σ = 1.557 S/m; ε_r = 54.485; ρ = 1000 kg/m^3
Ambient Temperature：21.6℃； Liquid Temperature：21.2℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3864; ConvF(7.87, 7.87, 7.87); Calibrated: 2013/07/31;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2013/07/26
- Phantom: ELI v4.0_Right; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.6 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 95.140 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.5 W/kg; SAR(10 g) = 4.92 W/kg
Maximum value of SAR (measured) = 13.6 W/kg



Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

P01 GSM850_GPRS12_Rear Face_0cm_Ch251_w/ Pw Reduction

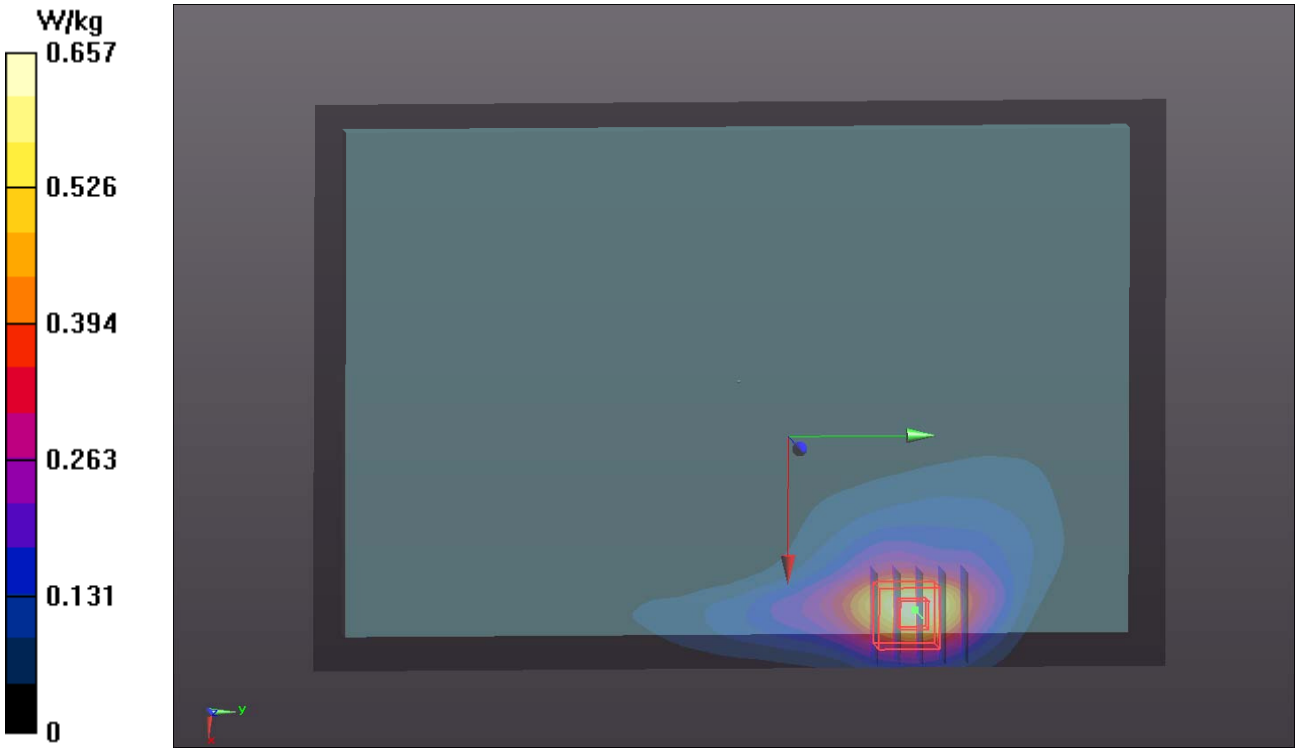
DUT: 140121D03

Communication System: GPRS12; Frequency: 848.8 MHz;Duty Cycle: 1:2
Medium: B835_0310 Medium parameters used: f = 849 MHz; σ = 0.986 S/m; ε_r = 55.027; ρ = 1000 kg/m^3
Ambient Temperature：21.7℃； Liquid Temperature：20.9℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3864; ConvF(10.14, 10.14, 10.14); Calibrated: 2013/07/31;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2013/07/26
- Phantom: ELI v4.0_Left; Type: QDOVA001BB; Serial: TP:1039
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (141x201x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.657 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.226 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.983 W/kg
SAR(1 g) = 0.478 W/kg; SAR(10 g) = 0.260 W/kg
Maximum value of SAR (measured) = 0.741 W/kg



P02 GSM1900_GPRS12_Top Side_0cm_Ch512_w/ Pw Reduction

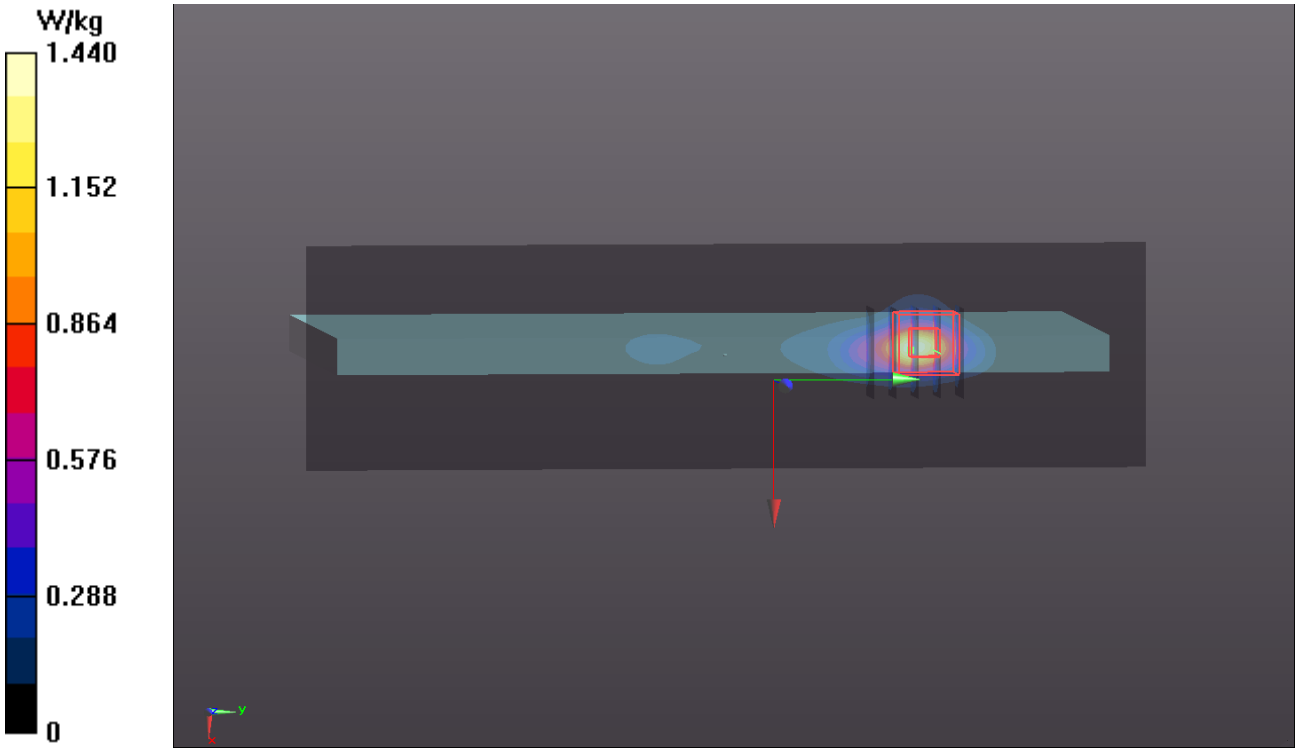
DUT: 140121D03

Communication System: GPRS12; Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium: B1900_0310 Medium parameters used: f = 1850.2 MHz; σ = 1.512 S/m; ε_r = 54.549; ρ = 1000 kg/m^3
Ambient Temperature：21.6℃； Liquid Temperature：21.2℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3864; ConvF(7.87, 7.87, 7.87); Calibrated: 2013/07/31;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2013/07/26
- Phantom: ELI v4.0_Right; Type: QDOVA001BA; Serial: TP:1043
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (201x201x1): Interpolated grid: dx=0.400 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.44 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.407 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.29 W/kg
SAR(1 g) = 1.18 W/kg; SAR(10 g) = 0.506 W/kg
Maximum value of SAR (measured) = 1.56 W/kg



P03 WCDMA II_RMC12.2K_Rear Face_0.6cm_Ch9262_w/o Pw Reduction

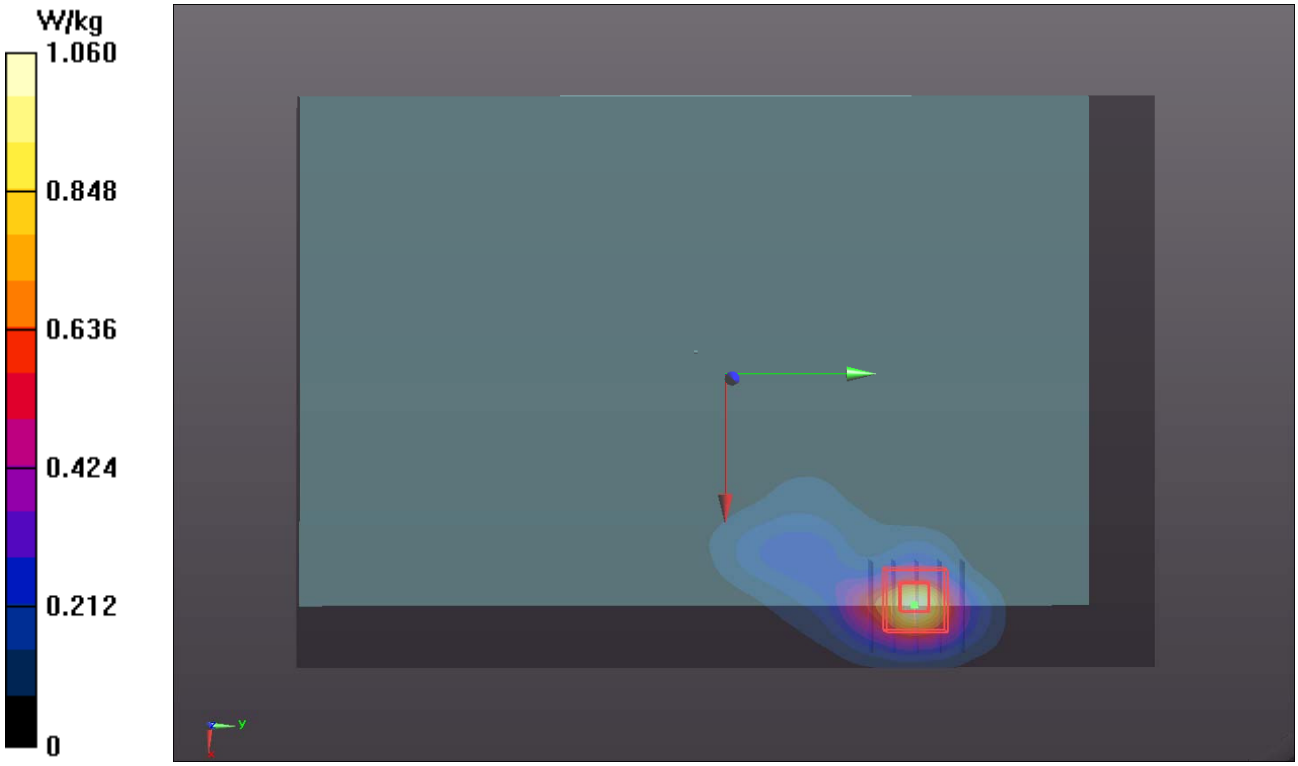
DUT: 140121D03

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1
Medium: B1900_0307 Medium parameters used: f = 1852.4 MHz; σ = 1.493 S/m; ε_r = 53.527; ρ = 1000 kg/m^3
Ambient Temperature：21.1℃； Liquid Temperature：20.9℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(7.39, 7.39, 7.39); Calibrated: 2013/04/30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn913; Calibrated: 2013/12/17
- Phantom: ELI v4.0_Left; Type: QDOVA001BA; Serial: TP:1206
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (151x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.06 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.555 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.43 W/kg
SAR(1 g) = 0.983 W/kg; SAR(10 g) = 0.444 W/kg
Maximum value of SAR (measured) = 1.08 W/kg



P04 WCDMA IV_RMC12.2K_Top Side_0cm_Ch1513_w/ Pw Reduction

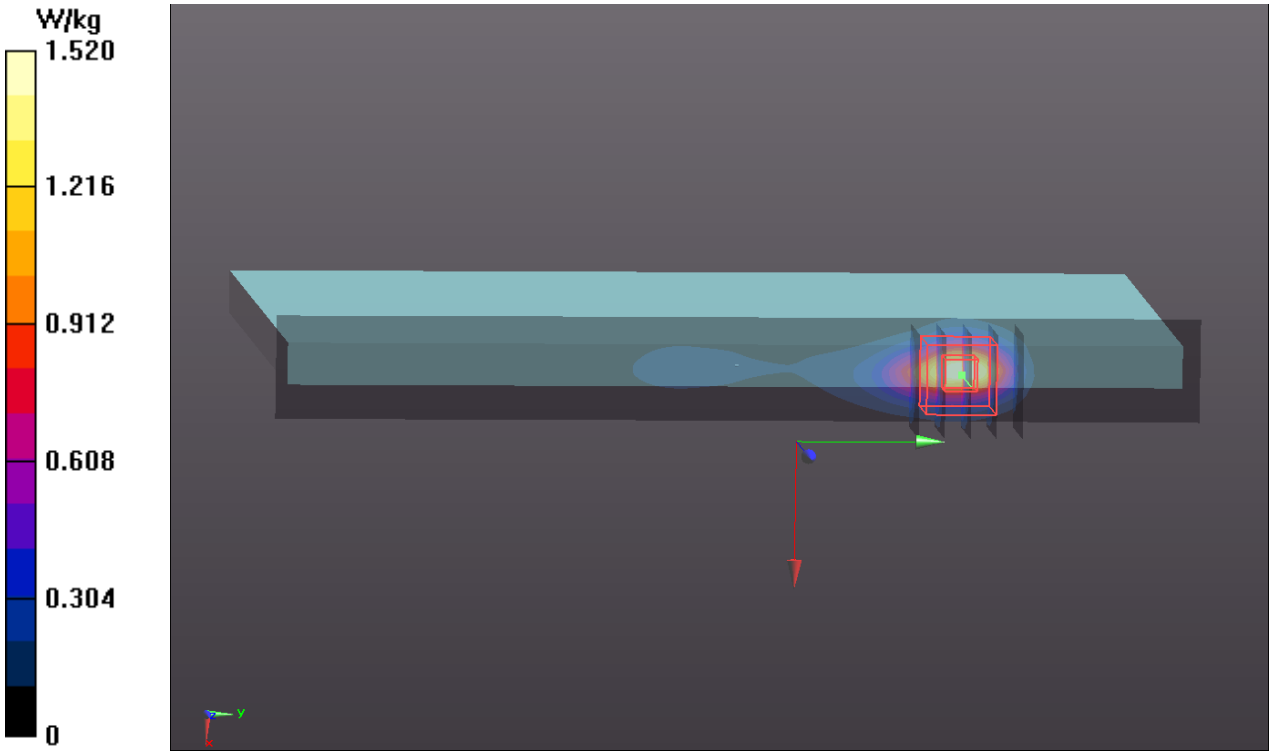
DUT: 140121D03

Communication System: WCDMA; Frequency: 1752.6 MHz;Duty Cycle: 1:1
Medium: B1750_0307 Medium parameters used: f = 1753 MHz; σ = 1.503 S/m; ε_r = 52.476; ρ = 1000 kg/m^3
Ambient Temperature：21.1 ℃； Liquid Temperature：20.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(7.57, 7.57, 7.57); Calibrated: 2013/04/30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn913; Calibrated: 2013/12/17
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: TP:1206
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (81x191x1): Interpolated grid: dx=0.400 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.52 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.203 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.90 W/kg
SAR(1 g) = 0.957 W/kg; SAR(10 g) = 0.439 W/kg
Maximum value of SAR (measured) = 1.42 W/kg



P05 WCDMA V_RMC12.2K_Rear Face_0cm_Ch4132_w/ Pw Reduction

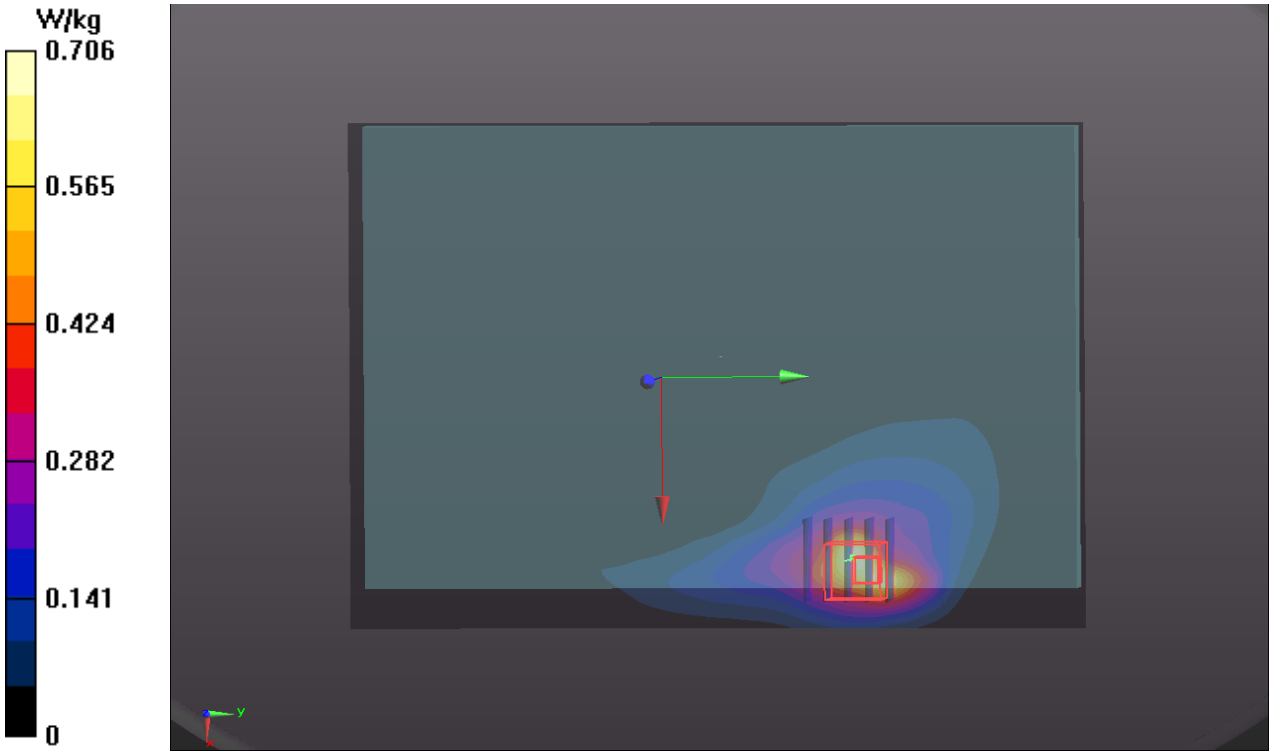
DUT: 140121D03

Communication System: WCDMA; Frequency: 826.4 MHz;Duty Cycle: 1:1
Medium: B835_0307 Medium parameters used: f = 826.4 MHz; σ = 0.963 S/m; ε_r = 54.12; ρ = 1000 kg/m^3
Ambient Temperature：21.9 ℃； Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(9.35, 9.35, 9.35); Calibrated: 2013/04/30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn913; Calibrated: 2013/12/17
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: TP:1206
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (131x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.706 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.578 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.524 W/kg; SAR(10 g) = 0.280 W/kg
Maximum value of SAR (measured) = 0.796 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG 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 **B.V. ADT (Auden)**

Certificate No: D835V2-4d121_Apr13

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d121
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 25, 2013

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	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: 909	11-Sep-12 (No. DAE4-909_Sep12)	Sep-13

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

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

Issued: April 26, 2013

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 1528-2003, "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
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

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	V52.8.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.68 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.62 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.30 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.0 ± 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	2.51 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.69 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.64 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.38 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω - 2.1 jΩ
Return Loss	- 30.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω - 3.8 jΩ
Return Loss	- 26.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.395 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 29, 2010

DASY5 Validation Report for Head TSL

Date: 25.04.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d121

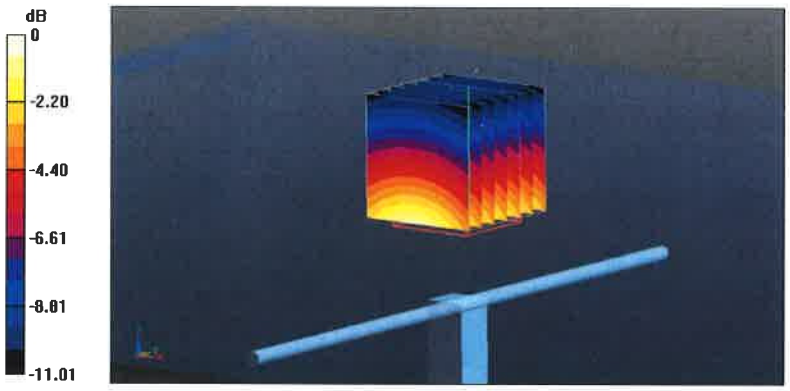
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 11.09.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

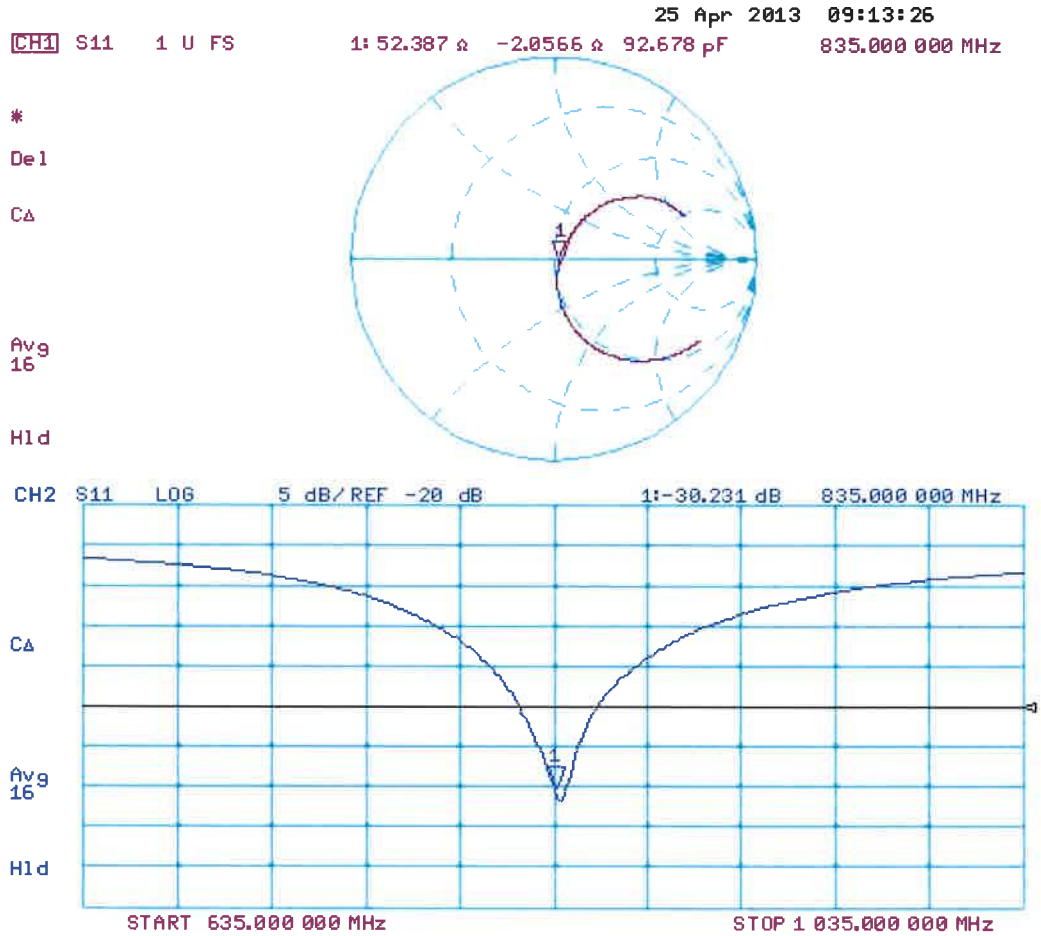
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.380 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.86 W/kg
SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.62 W/kg
Maximum value of SAR (measured) = 2.94 W/kg



0 dB = 2.94 W/kg = 4.68 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.04.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d121

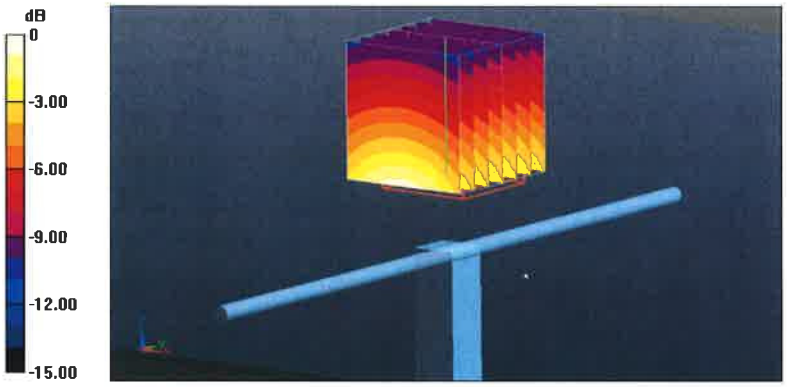
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 11.09.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

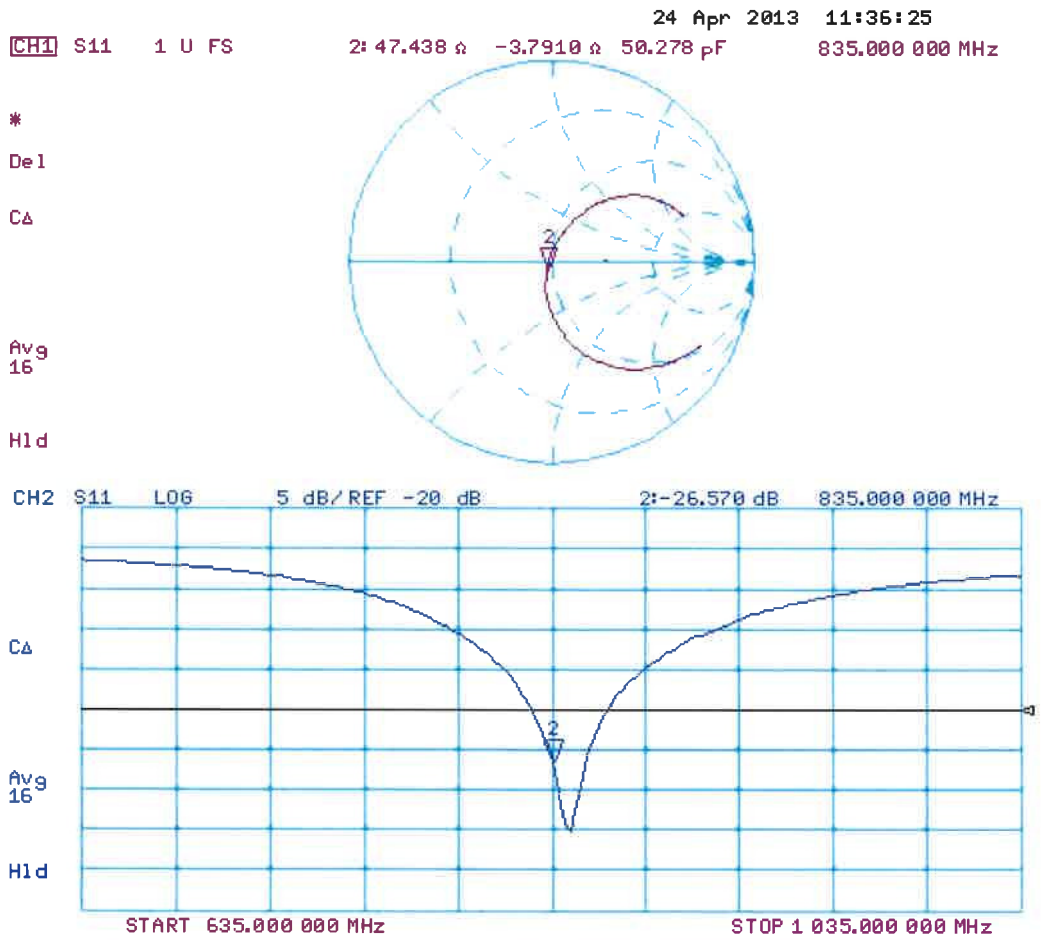
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.573 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.72 W/kg
SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.64 W/kg
Maximum value of SAR (measured) = 2.93 W/kg



0 dB = 2.93 W/kg = 4.67 dBW/kg

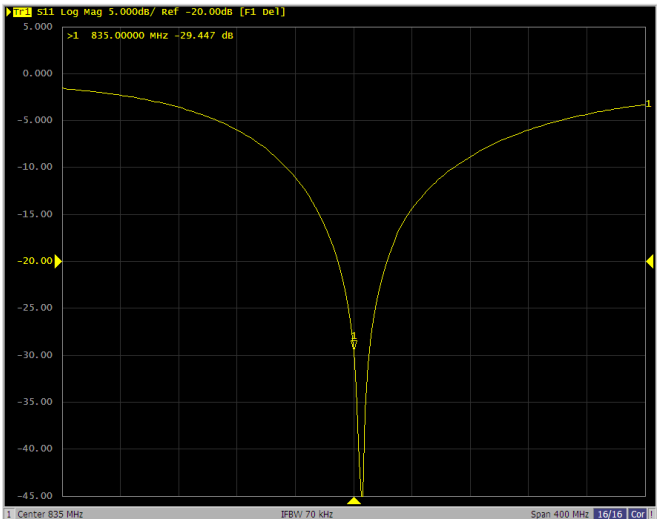
Impedance Measurement Plot for Body TSL

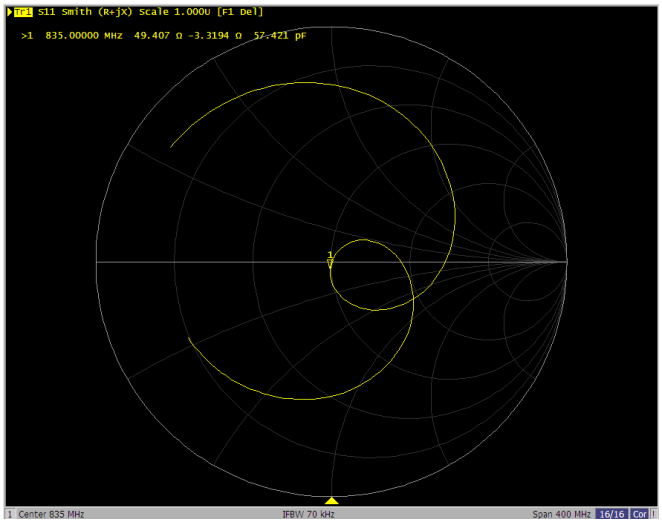


Annual Confirmation of SAR Reference Dipole

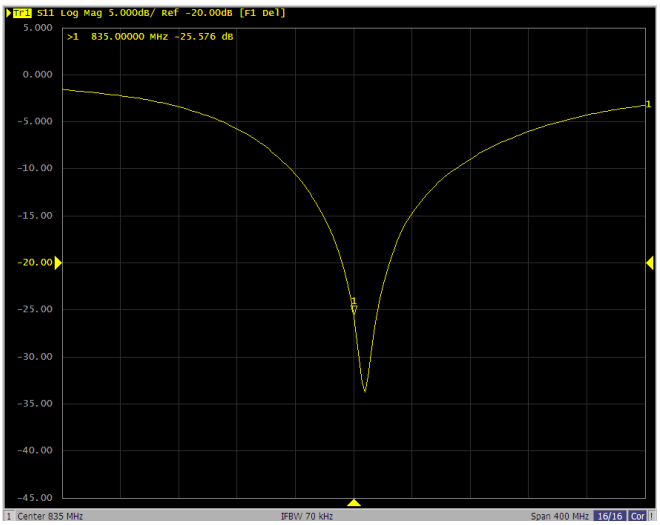
Model: D835V2 **S/N :** 4d121 **Measured Date :** Apr. 24, 2014

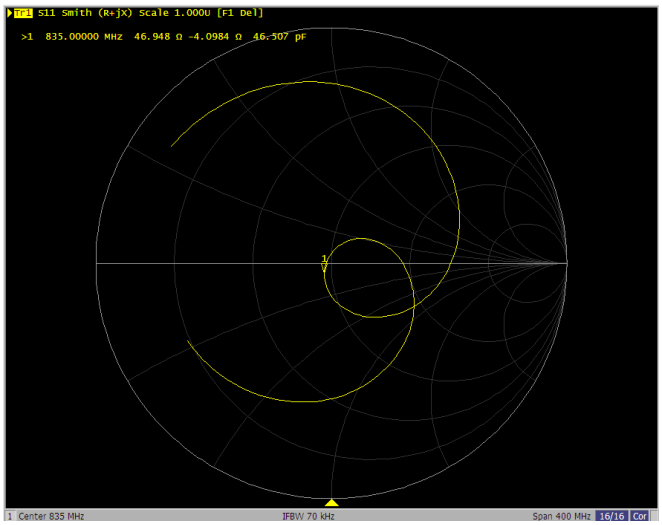
Frequency (MHz)	Type	Item	Previous Measurement	Annual Check	Deviation	Accepted Tolerance	Note
835	Head TSL	Return Loss	-30.231	**-29.447**	-2.6 %	±20 %	**PASS**
		Real Impedance	52.387	**49.407**	-2.98	±5 Ω	**PASS**
		Imaginary Impedance	-2.0566	**-3.3194**	-1.2628	±5 Ω	**PASS**
835	Body TSL	Return Loss	-26.57	**-25.576**	-3.7 %	±20 %	**PASS**
		Real Impedance	47.438	**46.948**	-0.49	±5 Ω	**PASS**
		Imaginary Impedance	-3.791	**-4.0984**	-0.3074	±5 Ω	**PASS**





835 MHz, Head TSL





835 MHz, 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 **B.V. ADT (Auden)**

Certificate No: D1750V2-1055_Aug13

CALIBRATION CERTIFICATE

Object	D1750V2 - SN: 1055
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	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
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 27, 2013

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 1528-2003, "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
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	39.0 ± 6 %	1.32 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	8.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.4 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.4 ± 6 %	1.49 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	9.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**36.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.01 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.9 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω + 2.4 jΩ
Return Loss	- 32.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω + 2.0 jΩ
Return Loss	- 27.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.223 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	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 27.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1055

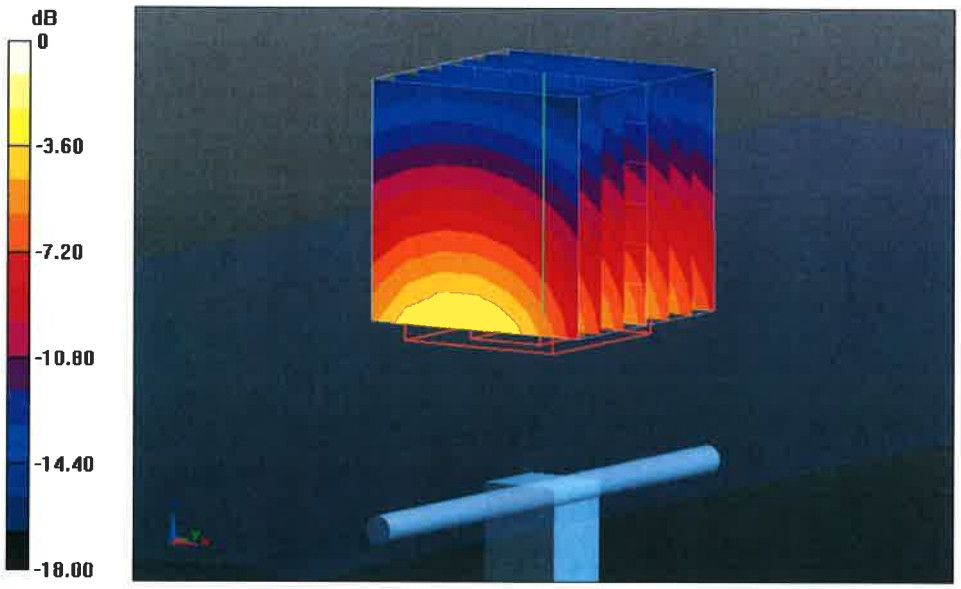
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.32 S/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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)

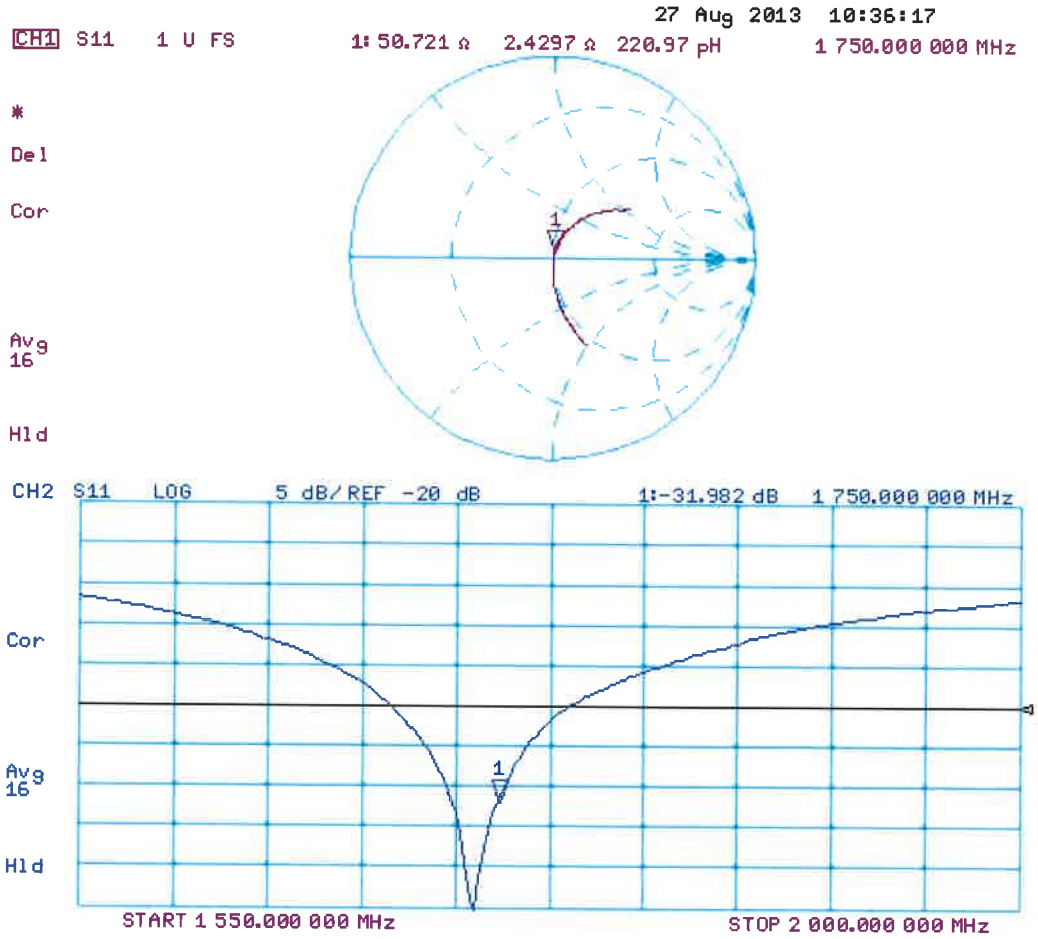
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.937 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 8.96 W/kg; SAR(10 g) = 4.79 W/kg
Maximum value of SAR (measured) = 10.9 W/kg



0 dB = 10.9 W/kg = 10.37 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 27.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1055

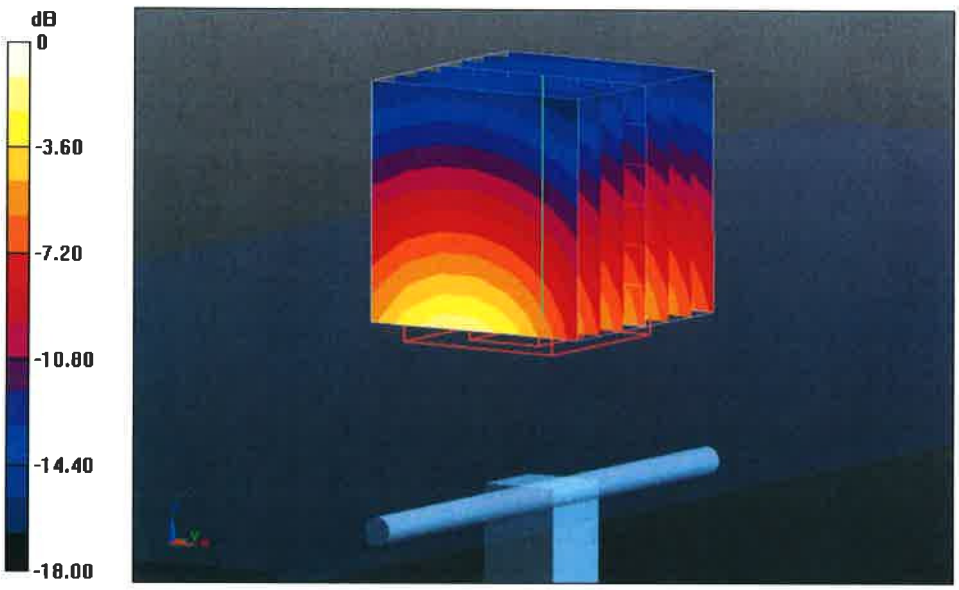
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.49 S/m; ε_r = 51.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.83, 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)

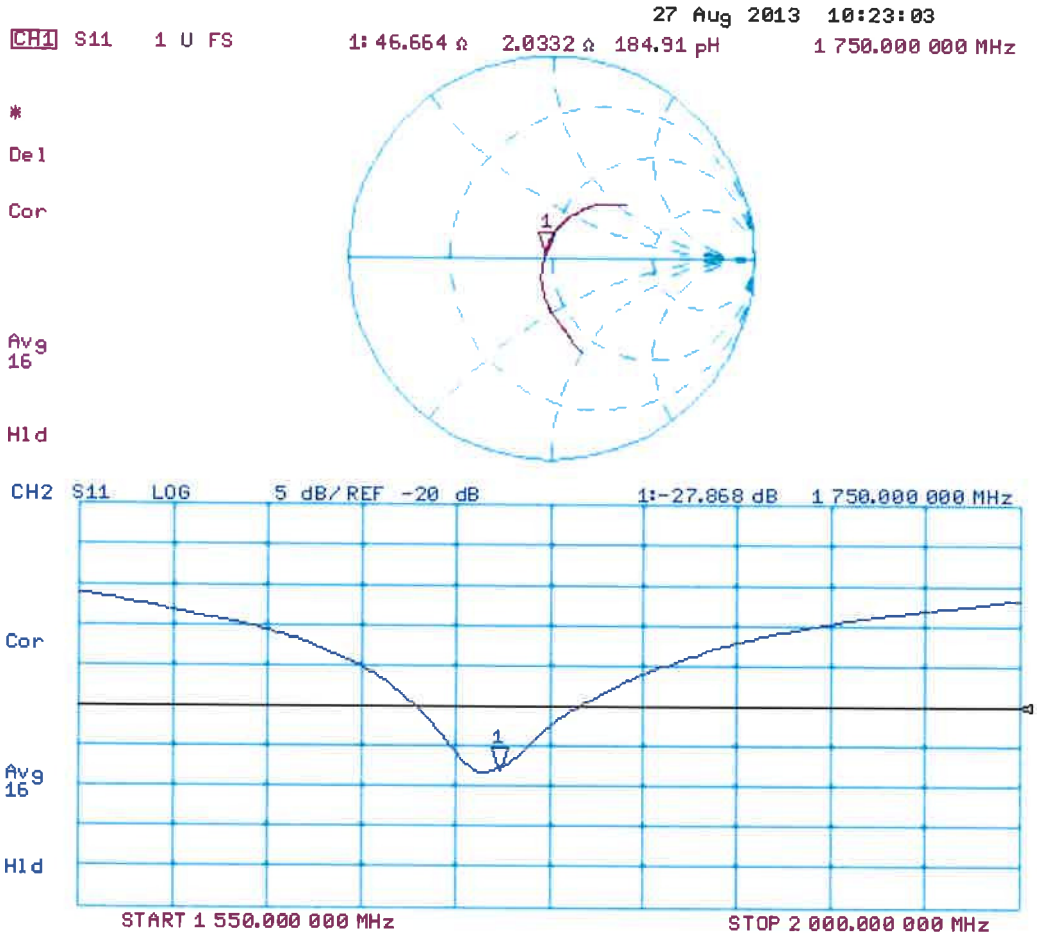
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.937 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 15.9 W/kg
SAR(1 g) = 9.3 W/kg; SAR(10 g) = 5.01 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 Body TSL



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

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C Service suisse d'étalonnage
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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 **B.V. ADT (Auden)**

Certificate No: D1900V2-5d022_Jul13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d022
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 29, 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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	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
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: July 30, 2013

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 1528-2003, "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
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

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	38.9 ± 6 %	1.36 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	9.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.9 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.49 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	9.97 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω + 3.7 jΩ
Return Loss	- 28.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.5 Ω + 3.9 jΩ
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 29, 2002

DASY5 Validation Report for Head TSL

Date: 29.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d022

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.36 S/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

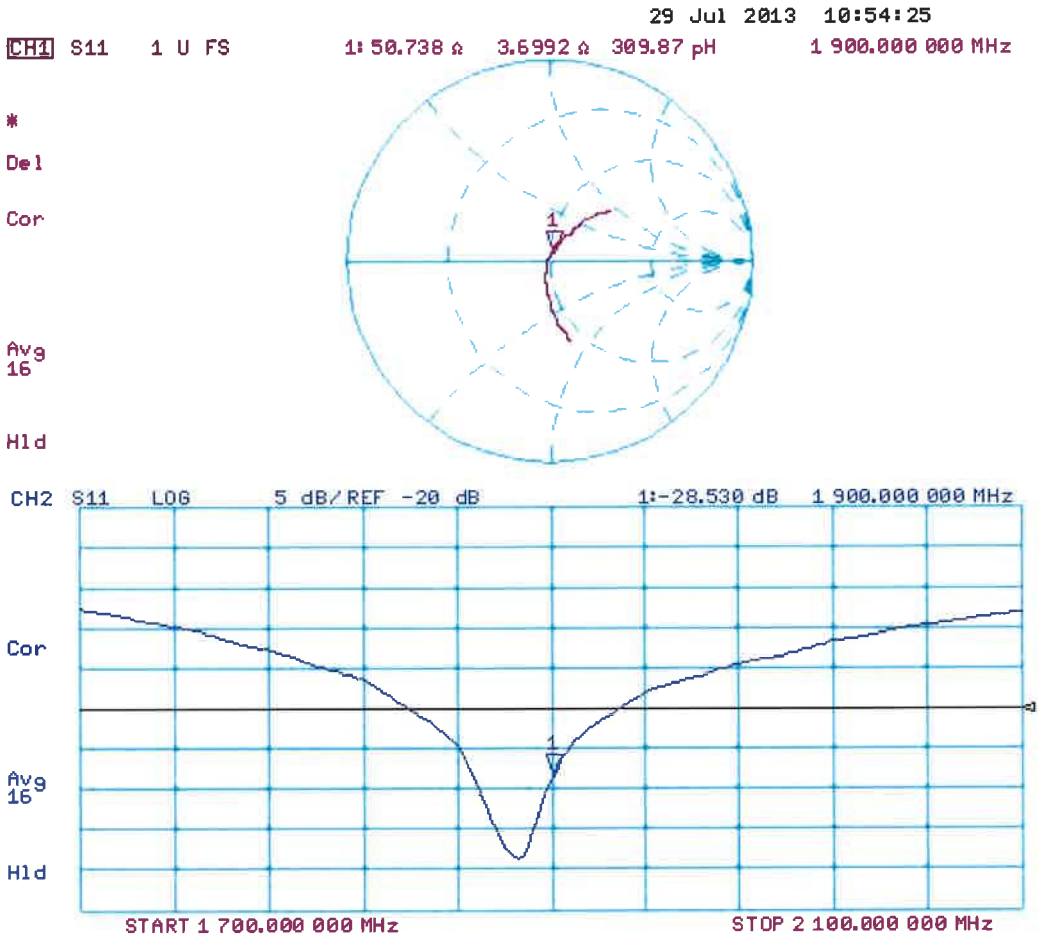
- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.326 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.9 W/kg
SAR(1 g) = 9.88 W/kg; SAR(10 g) = 5.18 W/kg
Maximum value of SAR (measured) = 12.3 W/kg

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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d022

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.49 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

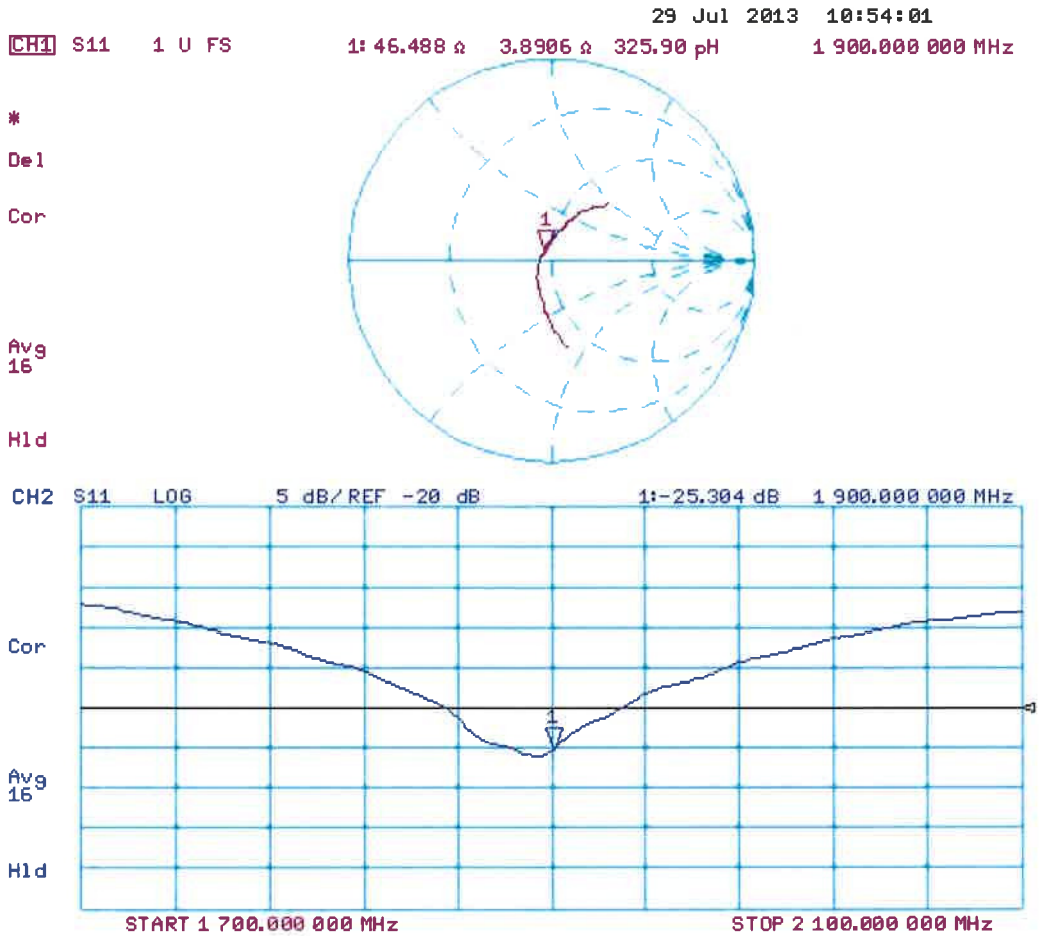
- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.326 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.31 W/kg
Maximum value of SAR (measured) = 12.6 W/kg

0 dB = 12.6 W/kg = 11.00 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **B.V. ADT (Auden)**

Certificate No: EX3-3650_Apr13

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3650
Calibration procedure(s)	QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	April 30, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: May 1, 2013

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

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:3650

Manufactured:	March 18, 2008
Repaired:	April 22, 2013
Calibrated:	April 30, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3650

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.39	0.37	0.40	± 10.1 %
DCP (mV)[B]	99.0	98.4	98.6	

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	103.4	±3.5 %
		Y	0.0	0.0	1.0		132.3	
		Z	0.0	0.0	1.0		108.8	

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:3650

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	9.69	9.69	9.69	0.41	0.87	± 12.0 %
835	41.5	0.90	9.37	9.37	9.37	0.66	0.67	± 12.0 %
900	41.5	0.97	9.22	9.22	9.22	0.46	0.72	± 12.0 %
1450	40.5	1.20	8.04	8.04	8.04	0.31	1.01	± 12.0 %
1640	40.3	1.29	8.07	8.07	8.07	0.40	0.80	± 12.0 %
1750	40.1	1.37	7.91	7.91	7.91	0.80	0.50	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.35	0.88	± 12.0 %
2000	40.0	1.40	7.59	7.59	7.59	0.80	0.57	± 12.0 %
2300	39.5	1.67	7.34	7.34	7.34	0.67	0.62	± 12.0 %
2450	39.2	1.80	6.99	6.99	6.99	0.47	0.74	± 12.0 %
2600	39.0	1.96	6.85	6.85	6.85	0.48	0.78	± 12.0 %
3500	37.9	2.91	6.96	6.96	6.96	0.85	0.62	± 13.1 %
5200	36.0	4.66	5.20	5.20	5.20	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.07	5.07	5.07	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.57	4.57	4.57	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.56	4.56	4.56	0.45	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3650

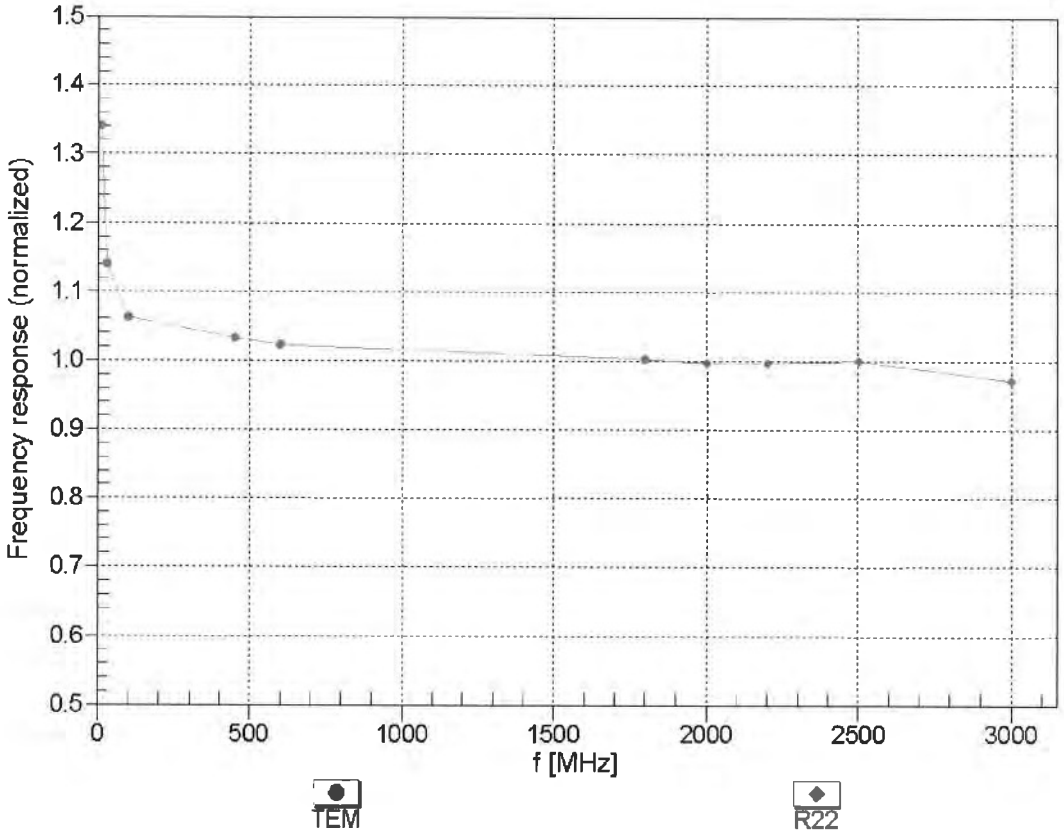
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	9.51	9.51	9.51	0.73	0.64	± 12.0 %
835	55.2	0.97	9.35	9.35	9.35	0.80	0.50	± 12.0 %
900	55.0	1.05	9.23	9.23	9.23	0.78	0.62	± 12.0 %
1450	54.0	1.30	8.40	8.40	8.40	0.80	0.50	± 12.0 %
1640	53.8	1.40	8.36	8.36	8.36	0.80	0.62	± 12.0 %
1750	53.4	1.49	7.57	7.57	7.57	0.74	0.66	± 12.0 %
1900	53.3	1.52	7.39	7.39	7.39	0.40	0.86	± 12.0 %
2000	53.3	1.52	7.57	7.57	7.57	0.51	0.77	± 12.0 %
2300	52.9	1.81	6.73	6.73	6.73	0.51	0.73	± 12.0 %
2450	52.7	1.95	7.09	7.09	7.09	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.91	6.91	6.91	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.58	6.58	6.58	0.38	1.16	± 13.1 %
5200	49.0	5.30	4.51	4.51	4.51	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.31	4.31	4.31	0.45	1.90	± 13.1 %
5600	48.5	5.77	4.00	4.00	4.00	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.21	4.21	4.21	0.55	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

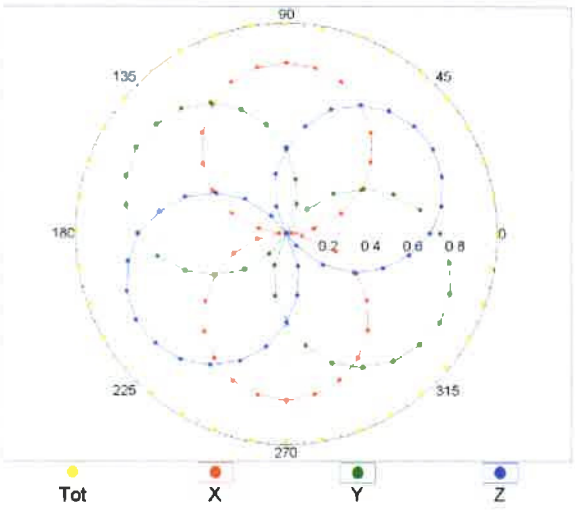
(TEM-Cell:ifi110 EXX, Waveguide: R22)



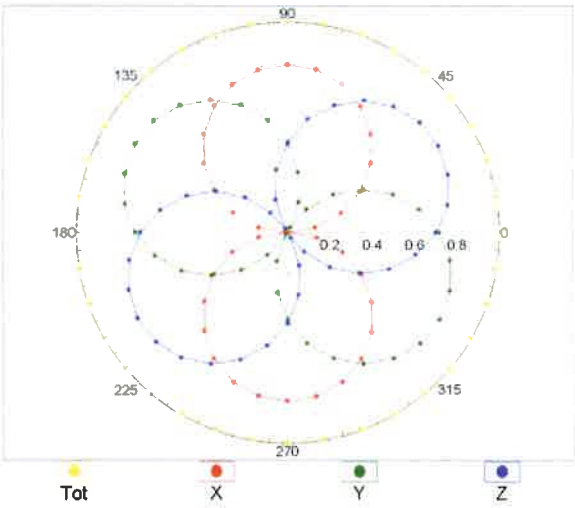
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

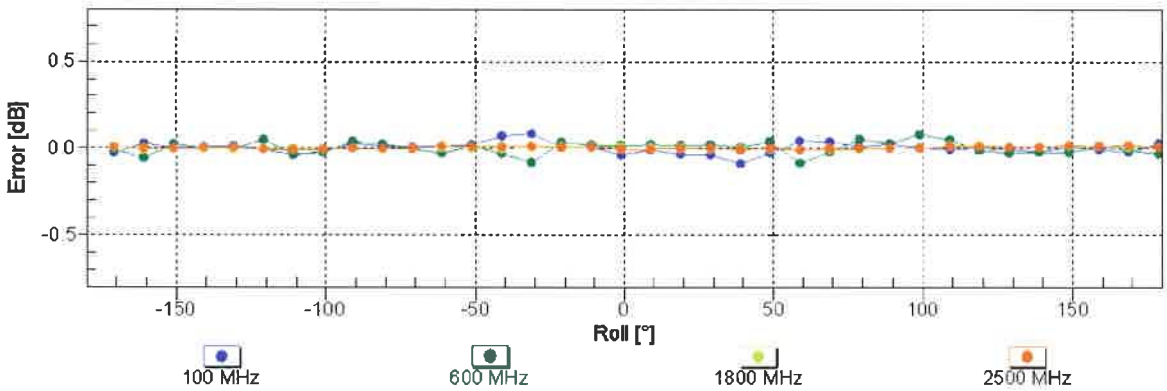
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

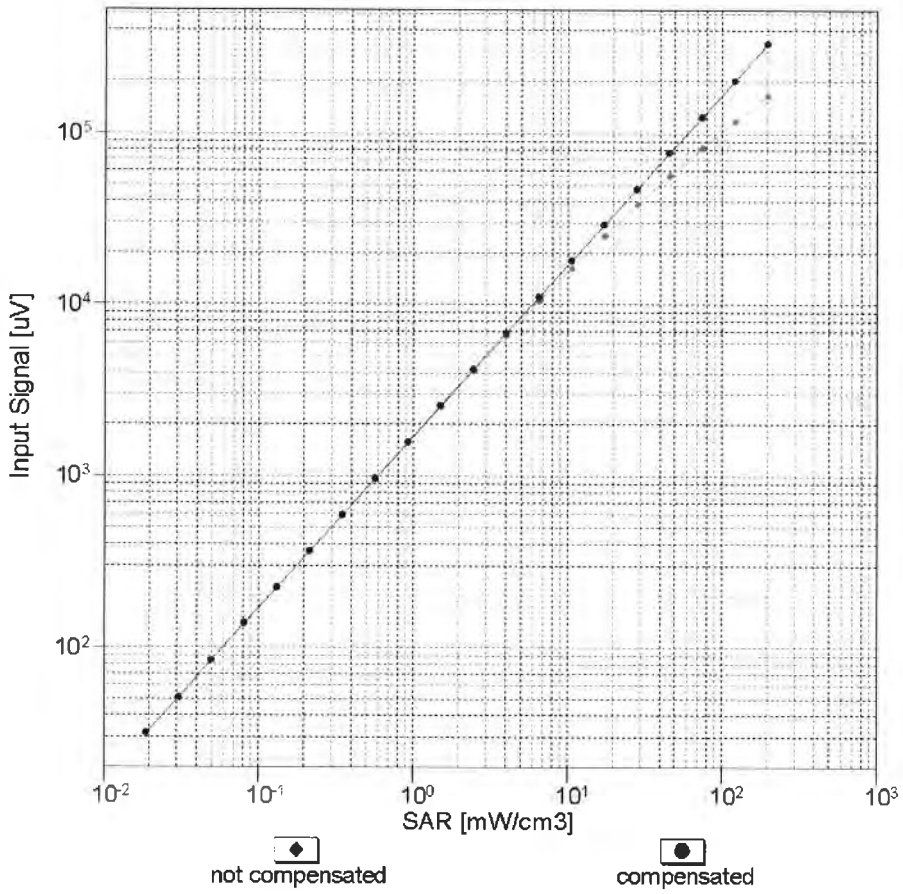


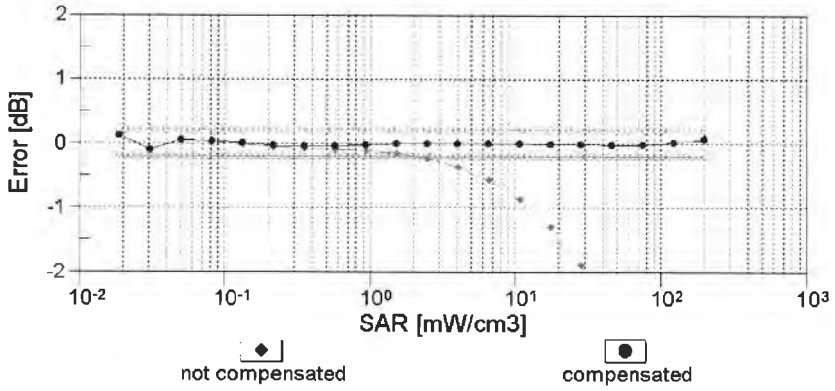


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)

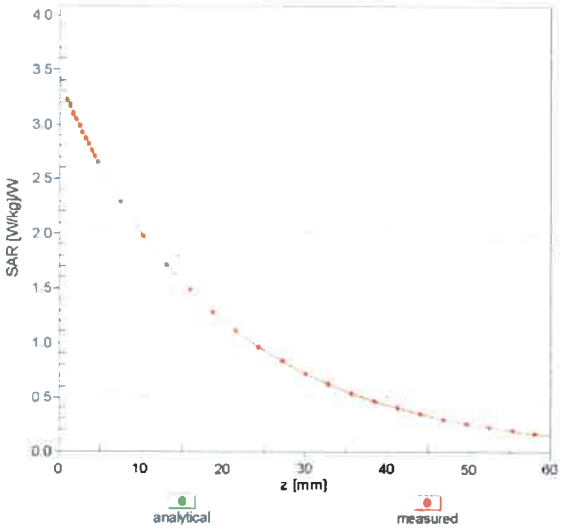




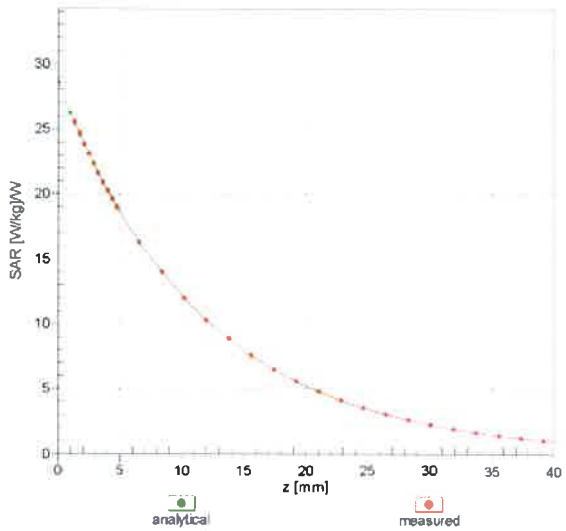
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

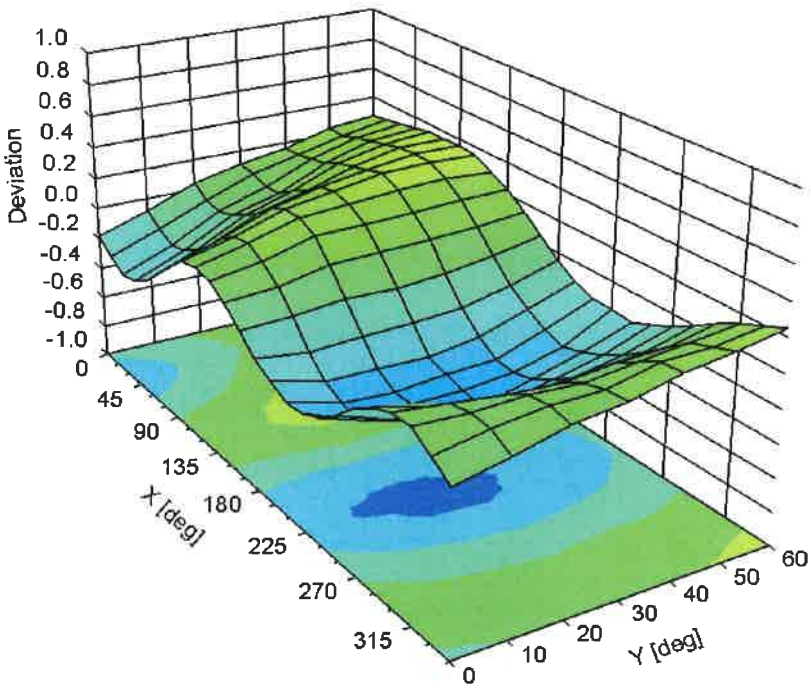


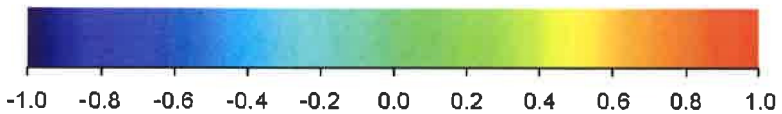
f = 1900 MHz,WGLS R22 (H_convF)



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:3650

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-21.1
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

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

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

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

Accreditation No.: SCS 108

Client **B.V. ADT (Auden)**

Certificate No: EX3-3864_Jul13/2

CALIBRATION CERTIFICATE (Replacement of No: EX3-3864_Jul13)

Object	EX3DV4 - SN:3864
Calibration procedure(s)	QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	July 31, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 13, 2013

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

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:3864

Manufactured: February 2, 2012
Calibrated: July 31, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3864

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.47	0.44	0.49	± 10.1 %
DCP (mV)[B]	96.0	100.3	98.7	

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	155.8	±2.5 %
		Y	0.0	0.0	1.0		150.7	
		Z	0.0	0.0	1.0		119.2	

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:3864

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	10.41	10.41	10.41	0.42	0.78	± 12.0 %
835	41.5	0.90	9.96	9.96	9.96	0.26	0.98	± 12.0 %
900	41.5	0.97	9.77	9.77	9.77	0.16	1.53	± 12.0 %
1450	40.5	1.20	9.33	9.33	9.33	0.20	1.50	± 12.0 %
1640	40.3	1.29	8.52	8.52	8.52	0.36	0.85	± 12.0 %
1750	40.1	1.37	8.49	8.49	8.49	0.25	0.95	± 12.0 %
1900	40.0	1.40	8.20	8.20	8.20	0.52	0.67	± 12.0 %
2000	40.0	1.40	8.32	8.32	8.32	0.57	0.63	± 12.0 %
2300	39.5	1.67	7.76	7.76	7.76	0.34	0.84	± 12.0 %
2450	39.2	1.80	7.47	7.47	7.47	0.37	0.81	± 12.0 %
2600	39.0	1.96	7.26	7.26	7.26	0.32	0.94	± 12.0 %
3500	37.9	2.91	6.87	6.87	6.87	0.33	1.23	± 13.1 %
5200	36.0	4.66	5.33	5.33	5.33	0.31	1.80	± 13.1 %
5300	35.9	4.76	5.13	5.13	5.13	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.96	4.96	4.96	0.33	1.80	± 13.1 %
5600	35.5	5.07	4.78	4.78	4.78	0.34	1.80	± 13.1 %
5800	35.3	5.27	4.67	4.67	4.67	0.38	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3864

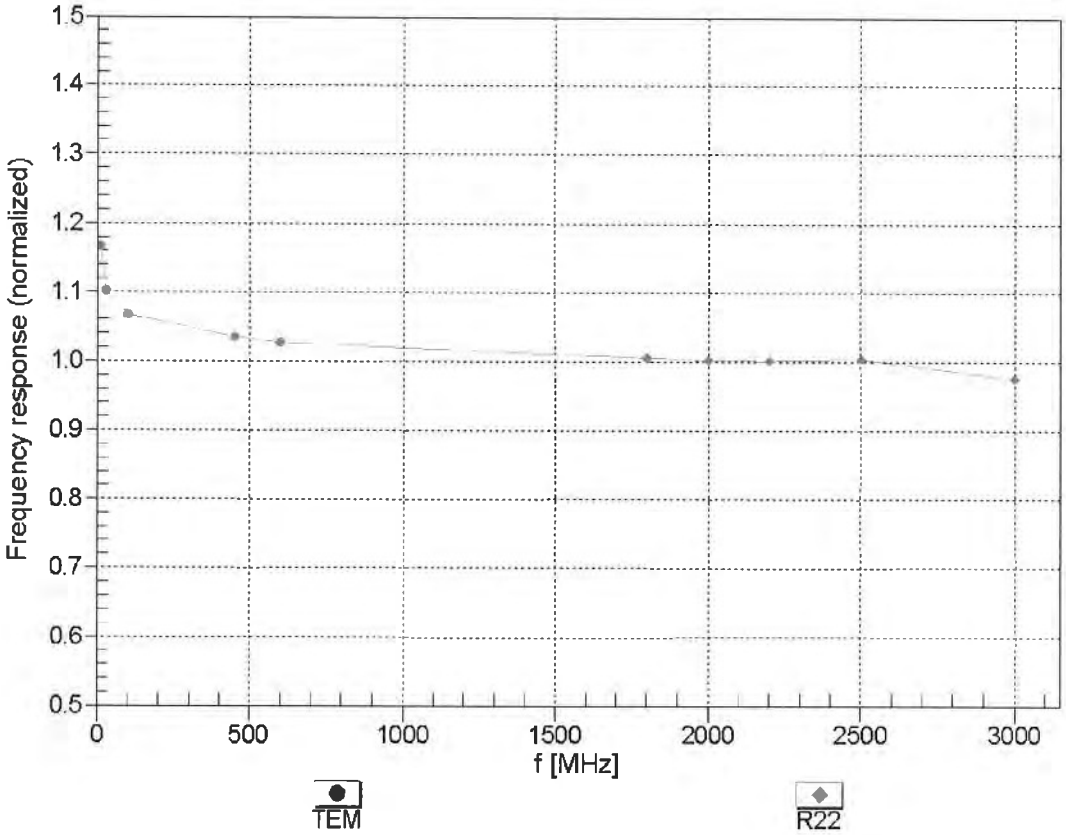
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	10.15	10.15	10.15	0.23	1.32	± 12.0 %
835	55.2	0.97	10.14	10.14	10.14	0.37	0.91	± 12.0 %
900	55.0	1.05	9.90	9.90	9.90	0.29	1.09	± 12.0 %
1450	54.0	1.30	8.39	8.39	8.39	0.22	1.23	± 12.0 %
1640	53.8	1.40	8.53	8.53	8.53	0.80	0.61	± 12.0 %
1750	53.4	1.49	8.10	8.10	8.10	0.58	0.70	± 12.0 %
1900	53.3	1.52	7.87	7.87	7.87	0.23	1.10	± 12.0 %
2000	53.3	1.52	8.00	8.00	8.00	0.27	1.04	± 12.0 %
2300	52.9	1.81	7.67	7.67	7.67	0.74	0.58	± 12.0 %
2450	52.7	1.95	7.40	7.40	7.40	0.76	0.55	± 12.0 %
2600	52.5	2.16	7.26	7.26	7.26	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.47	6.47	6.47	0.38	1.13	± 13.1 %
5200	49.0	5.30	4.49	4.49	4.49	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.01	4.01	4.01	0.42	1.90	± 13.1 %
5500	48.6	5.65	3.90	3.90	3.90	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.69	3.69	3.69	0.53	1.90	± 13.1 %
5800	48.2	6.00	3.93	3.93	3.93	0.54	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

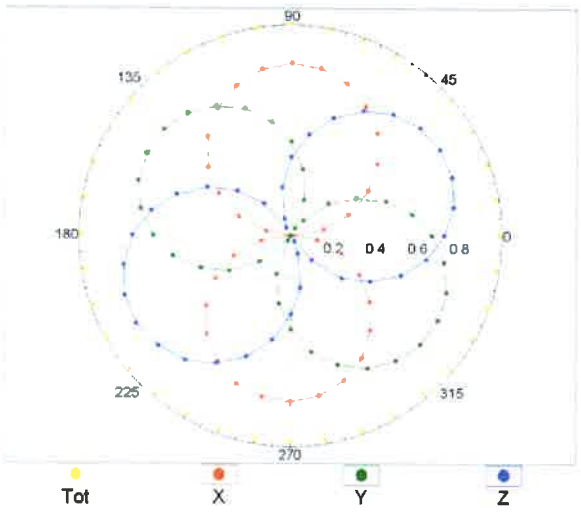
(TEM-Cell:ifi110 EXX, Waveguide: R22)



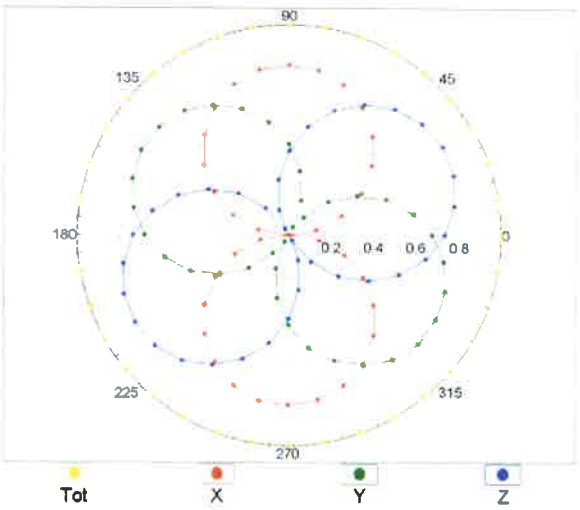
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

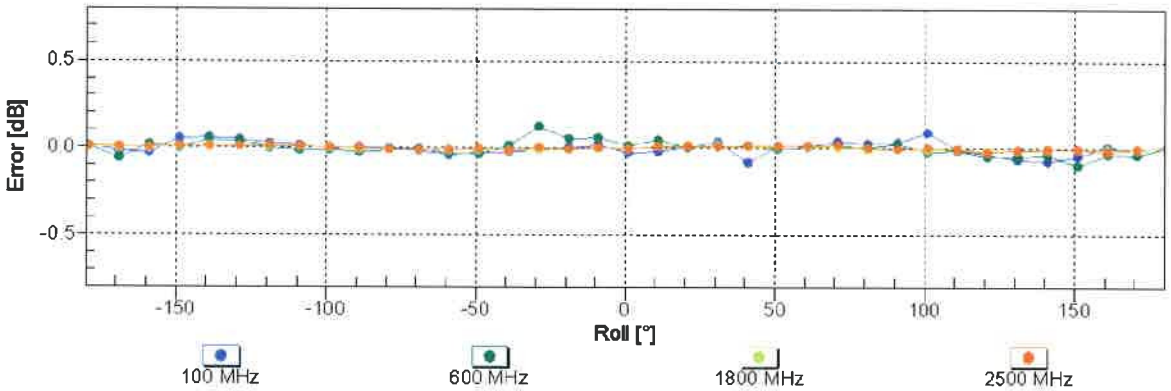
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



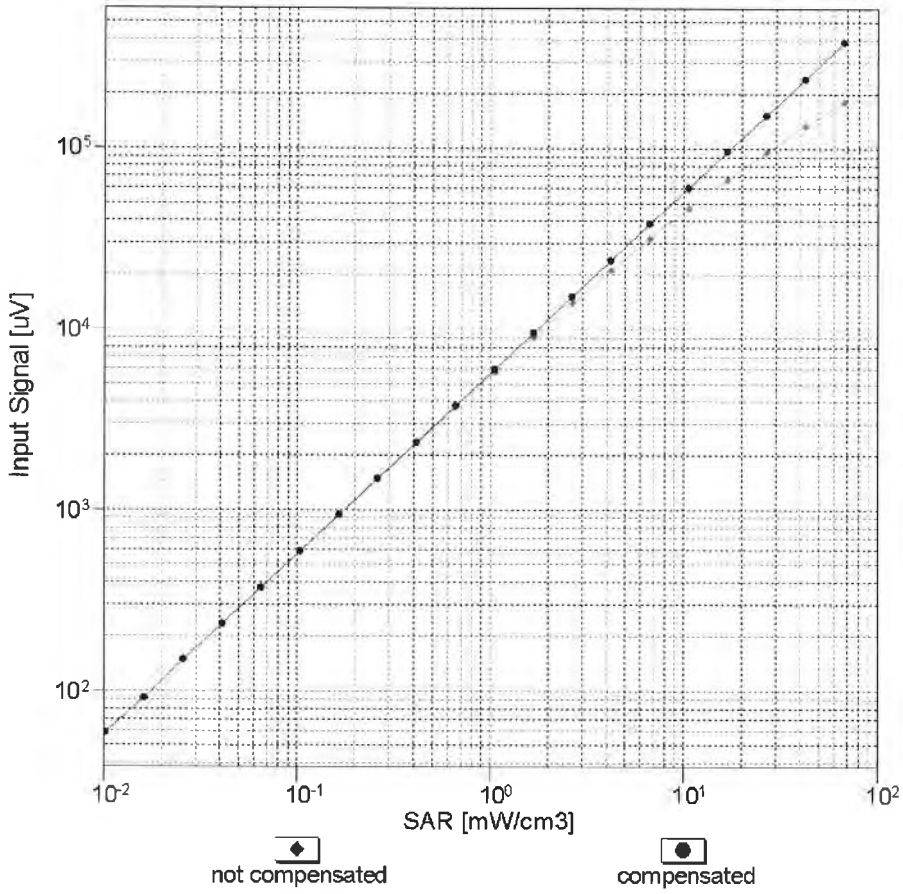
f=1800 MHz,R22

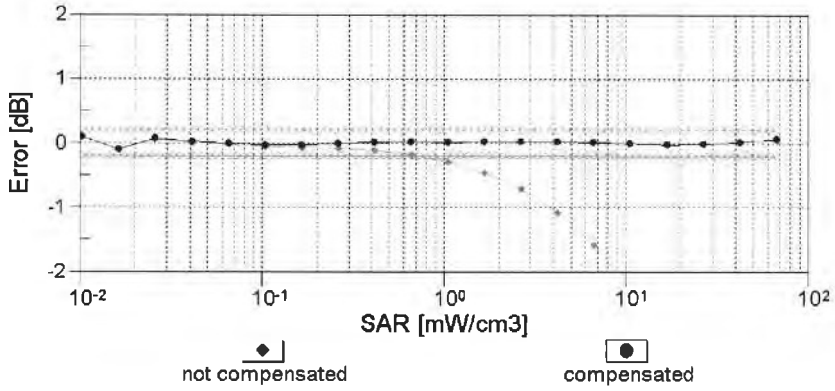




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

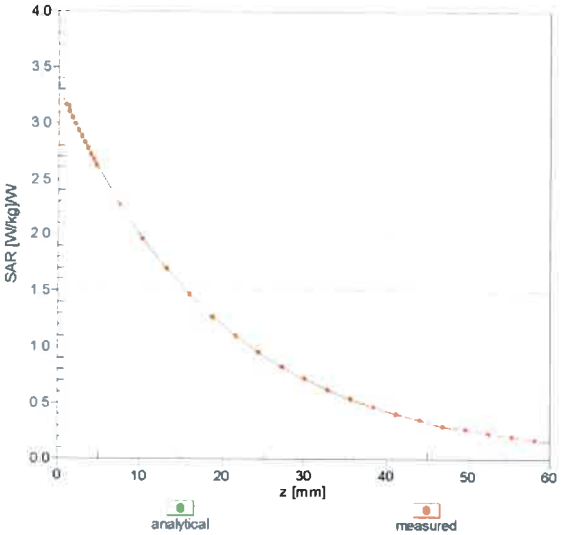




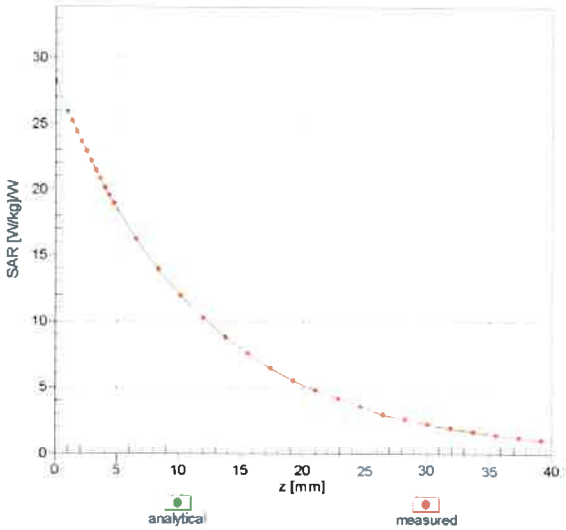
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

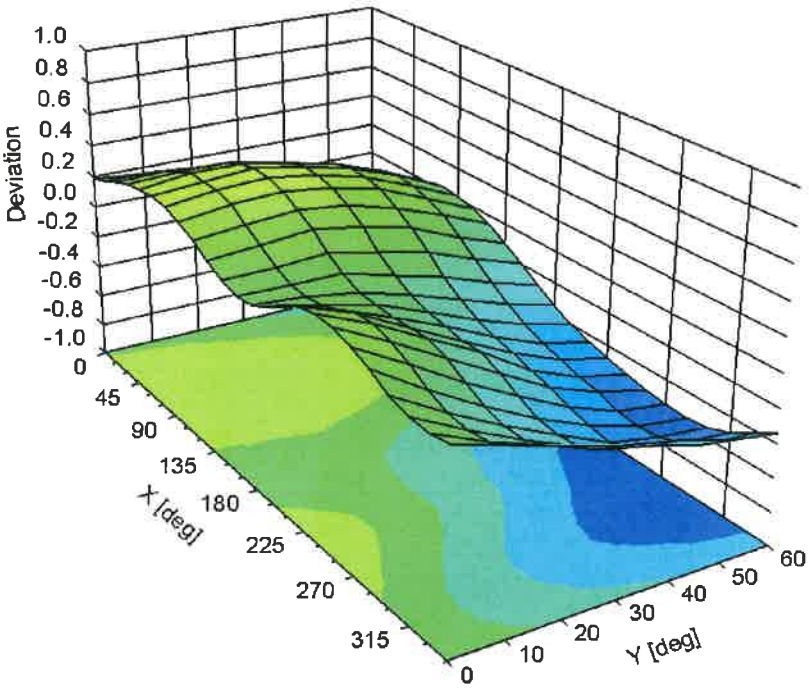


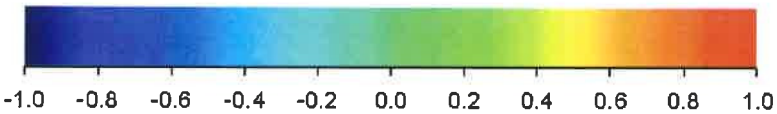
f = 1900 MHz,WGLS R22 (H_convF)



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:3864

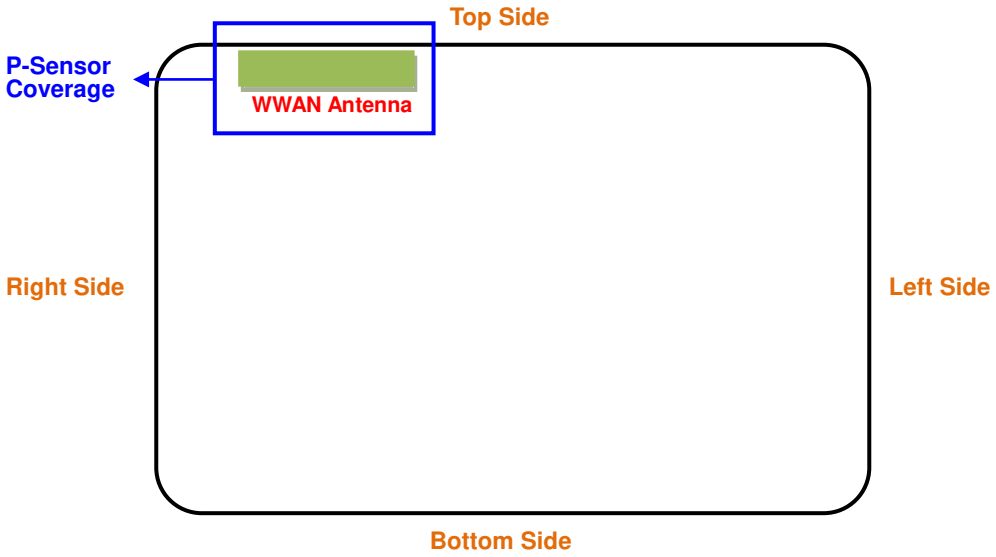
Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-119
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

Appendix D. Photographs of EUT and Setup

<Photographs of EUT>

<Antenna Location>



<EUT Rear View>

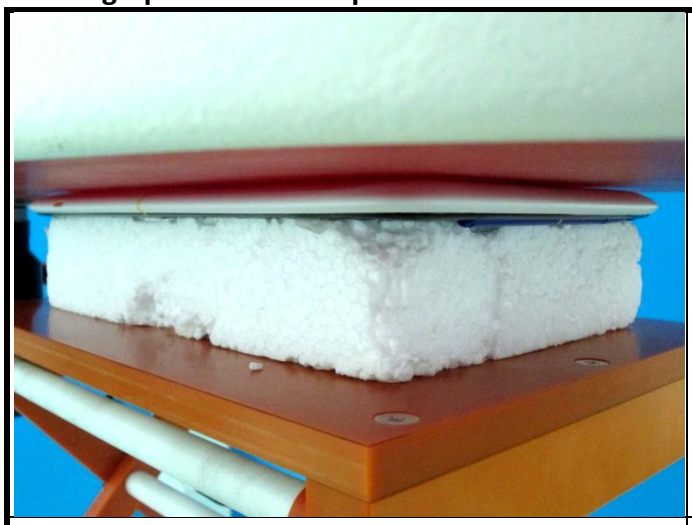
The separation distance for antenna to edge:

Antenna	To Top Side (mm)	To Bottom Side (mm)	To Left Side (mm)	To Right Side (mm)
WWAN	3	145	174	36

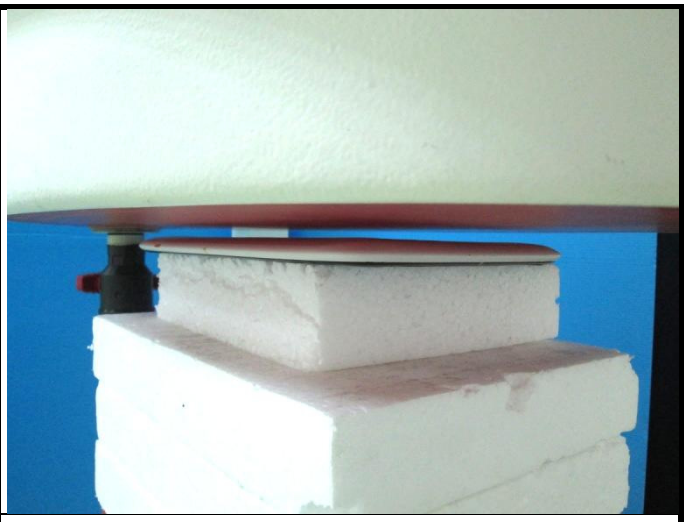
Note:

Since the technical document related to the design of proximity sensor and power reduction is confidential, the detail about proximity sensor does not be described in this SAR report. Please refer to the technical documents as “Proximity Sensor Technical Description” for the details.

<Photographs of SAR Setup>



Rear Face of EUT with 0 mm Gap



Rear Face of EUT with 6 mm Gap

Top Side of EUT with 0 mm Gap

Top Side of EUT with 10 mm Gap

Right Side of EUT with 0 mm Gap