D-PL-12111-01-01

CNAS L0447

Registration No.910917

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

Report No.: SRTC2015-9004(F)-0003

Product Name: GSM quad band mobile phone

Product Model: 1017D

Applicant: TCL Communication Ltd.

Manufacturer: TCL Communication Ltd.

Specification: FCC Part 2.1093

FCC RF Exposure KDB Procedures

IEEE Std 1528-2003

IEEE Std 1528a-2005

FCC ID: 2ACCJB016

The State Radio_monitoring_center Testing Center (SRTC)

No.80 Beilishi Road Xicheng District Beijing, China

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Executive summary

Test report no.:	SRTC2015-9004(F)-0003
Product Model:	1017D
Period of test:	2015.04.21~2015.04.23
Date of report:	2015.04.24
Laboratory:	The State Radio_monitoring_center Testing Center (SRTC)
Test has been Carried out in accordance with:	The tests documented in this report were performed in accordance with FCC 47 CFR Parts 1 & 2, IEEE Std 1528-2003, IEEE Std 1528a-2005 and following FCC RF exposure KDB procedures: ☒447498 D01 General RF Exposure Guidance v05r01 ☐648474 D04 SAR Handsets Multi Xmiter and Ant v01r01 ☐941225 D01 SAR test for 3G devices v02 ☐941225 D02 HSPA and 1x Advanced v02r02 ☒941225 D03 SAR Test Reduction GSM GPRS EDGE v01 ☐941225 D06 Hot Spot SAR v01r01 ☐248227 D01 SAR Meas for 802 11abg v01r02 ☒865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01 ☒865664 D02 SAR Reporting v01r01
Documentation:	The documentation of the testing performed on the tested devices is archived for 5 years at SRTC

Result summary:

Mode	CH/*f*(MHz)	Power (dBm)	Position	SAR Limit (1g avg) (W/kg)	Reported SAR (1g avg)(W/kg)	Result
GPRS850	189/836.4	30.65	Towards ground	1.6	**1.113**	PASS

This Test Report Is Issued by: Ms. Xu Qiaochun	Checked by: Mr. Li Bin
Tested by: Mr. Zhang Wentao	Issued date: 2015-04-24

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1. GENERAL INFORMATION

1.1 Notes of the test report

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written permission of The State Radio_monitoring_center Testing Center (SRTC).
The test results relate only to individual items of the samples which have been tested.

1.2 Information about the testing laboratory

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1.5 Test Details

Period of test	2015.04.21~2015.04.23
Battery	LI-ION Battery/ BYD/ CAB0400000C1
Headsets	JIAYIKANG/ CCB0010A11C7
	JIAYIKANG/ CCB0010A10C7
State of sample	Production unit
H/W Version S/W Version	1203_MB_PCB_V0.1 1017D_L3EN_V01_150408_MCP32+32_FM_LATAM_AL
IMEI	359161060005656
Notes	As the information described above, there are two different models of headset. The relevant tests have been performed in order to verify that the EUT has the worst features when exercised by one model. So all the tests shown in this test report are performed with the model CCB0010A11C7.

1.6 Maximum Results

The maximum reported SAR values for Head configuration and Body Worn configuration are given as follows. The device conforms to the requirements of the standard(s) when the maximum reported SAR value is less than or equal to the limit.

Exposure Position	Frequency Band	1g-SAR Reported Result (W/kg)	Highest 1g-SAR Reported Result (W/kg)
Head	GSM 850	0.688	0.688
	GSM 1900	0.278	
Body (10mm Gap)	GSM 850	1.113	**1.113**
	GSM 1900	0.609	

2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	production unit
Exposure environment	General population/uncontrolled
Description of the Antenna	The device has an internal antenna.

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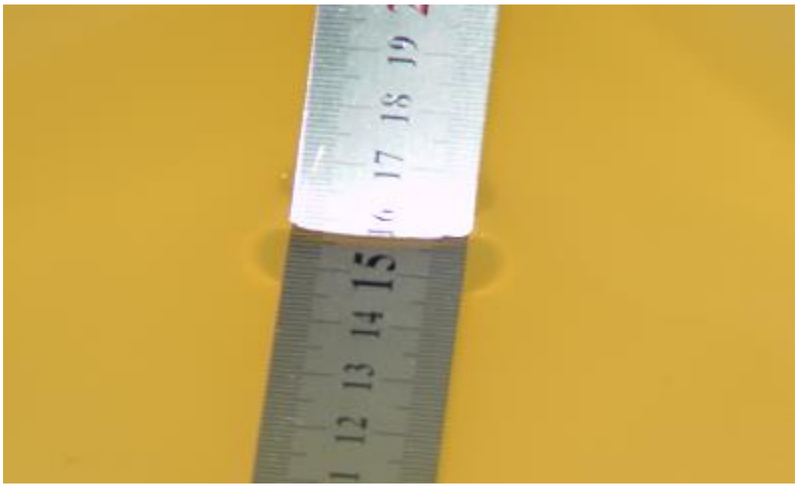
2.1 Wireless Technologies

Wireless Technology and Frequency Bands	☒GSM Band : GSM850/PCS1900 ☐WCDMA Band: FDD II/FDD V ☐Wi-Fi Band: 2.4GHz~2.4835GHz ☐Bluetooth Band: 2.4GHz~2.4835GHz
Mode	GSM ☒Voice (GMSK) ☒GPRS (GMSK) ☐EDGE (GMSK/8PSK) WCDMA ☐UMTS Rel. 99 (Voice & Data) ☐HSDPA (Rel. 5) ☐HSUPA (Rel. 6) ☐HSPA+ (Rel.) ☐DC-HSDPA (Rel.) Wi-Fi 2.4GHz (802.11b/g/n) ☐802.11b ☐802.11g ☐802.11n (20MHz) ☐802.11n (40MHz) Bluetooth ☐BR(GFSK) ☐EDR(π/4 DQPSK , 8-DPSK) ☐BLE(GFSK)
Duty Cycle	GSM Voice: 12.5%; GPRS: 12.5% (1 Slot), 25% (2 Slots), 37.5% (3 Slots), 50% (4 Slots) WCDMA: 100% Wi-Fi 802.11b/g/n: 100% Bluetooth: 32.25% (DH1), 66.68% (DH3), 77.52% (DH5)
GPRS Multi-Slot Class	☐Class 8 - One Up ☐Class 10 - Two Up ☒Class 12 - Four Up
Mobile Phone Capability	☐Class A - Mobile phones can be connected to both GPRS and GSM services simultaneously. ☒Class B - Mobile phones can be attached to both GPRS and GSM services, using one service at a time. ☐Class C - Mobile phones are attached to either GPRS or GSM voice service. You need to switch manually between services
DTM (Dual Transfer Mode)	Not Supported

2.2 Picture to demonstrate the required liquid depth

The liquid depth in the used SAM phantoms



Liquid depth for SAR Measurement

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (ºC)	21.0 to 23.0
Ambient humidity (RH %)	30 to 45

3.2 Test Signal, Frequencies and Output Power

The device was put into operation by using a call tester. Communication between the device and the call tester was established by air link.
The device output power was set to maximum power level for all tests; a fully charged battery was used for every test sequence.
In all operating bands the measurements were performed on lowest, middle and highest channels.

3.3 SAR Measurement Set-up

The system is based on a high precision robot (working range greater than 0.9m), which positions the probes with a positional repeatability of better than ± 0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length =300mm) to the data acquisition unit. A cell controller system contains the power supply, robot controller, teaches pendant (Joystick), and remote control, is used to drive the robot motors.

The PC consists of the Micron Pentium IV computer with Win7 system and SAR Measurement Software DASY5 Professional, A/D interface card, monitor, mouse, and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot.
A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAEand transfers data to the PC plug-in card. The DAE consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines.
The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection
The robot uses its own controller with a built in VME-bus computer.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY5, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland. The SAR extrapolation algorithm used in all measurements was the ‘advanced extrapolation’ algorithm.

The following table lists calibration dates of SPEAG components:

Test Equipment	Serial Number	Calibration interval	Calibration expiry
DAE4	546	1 year	2015.08.13
DAE4	725	1year	2015.10.24
Dosimetric E-field Probe ES3DV3	3127	1 year	2015.08.19
Dosimetric E-field Probe EX3DV4	3708	1 year	2015.10.17
Dipole Validation Kit D835V2	4d023	1 year	2015.10.09
Dipole Validation Kit D1900V2	5d113	1 year	2015.10.13
DASY5 No.1	52.8.7.1137	N/A	N/A
DASY5 No.2	52.8.7.1137	N/A	N/A

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	E4428C	MY45280865	1 year	2015.08.20
Signal Generator	SML 03	103514	1 year	2015.08.20
Amplifier	5S1G4	0323472	N/A	N/A
Amplifier	5S1G4	301305	N/A	N/A
Power meter	E4417A	MY45101182	1 year	2015.08.20
Power Sensor	E4412A	MY41502214	1 year	2015.08.20
Power Sensor	E4412A	MY41502130	1 year	2015.08.20
Power meter	E4417A	MY45101004	1 year	2015.08.20
Power Sensor	E9300B	MY41496001	1 year	2015.08.20
Power Sensor	E9300B	MY41496003	1 year	2015.08.20
Communications Test Set	8960	GB43194054	1 year	2015.08.20
Communication Tester	CMU200	114666	1 year	2015.08.20
Network Analyzer	8714ET	US40372083	1 year	2015.08.20
Dielectric Probe Kit	85070D	US33030365	N/A	N/A

Detailed information of Isotropic E-field Probe Type 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)
Calibration	Calibration certificate in Appendix C
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
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
Dynamic Range	5 µW/g to > 100 W/kg; Linearity: ± 0.2 dB
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

Detailed information of Isotropic E-field Probe Type EX3DV4

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Calibration certificate in Appendix C
Frequency	10 MHz to > 6 GHz

	Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Optical Surface Detection	± 0.3 mm repeatability in air and clear liquids over diffuse reflecting surfaces
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
Dynamic Range	10 µW/g to > 100 W/kg Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

4.2 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 - 2003.
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.
The SPEAG device holder (see Section 5.1) was used to position the device in all tests whilst a tripod was used to position the validation dipoles against the flat section of phantom.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 - 2003 and FCC Supplement C to OET Bulletin 65. All tests were carried out using simulants whose dielectric parameters were within ± 5% of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.
The depth of the tissue simulant was 15.0 ± 0.5 cm measured from the ear reference point during system checking and device measurements.

4.3.1 Tissue Simulant Recipes

The following recipe(s) were used for Head and Body tissue stimulant(s):

835MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Water	41.45	52.50
Sugar	56.00	45.0
Nacl	1.45	1.40
Cellulose	1.00	1.00
Preventol	0.10	0.10

1900MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Water	44,45	70.17
DGBE	55.24	29.44
Nacl	0.31	0.39

4.3.2 System Checking

The manufacturer calibrates the probes annully. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyser. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system checking results (dielectric parameters and SAR values) are given in the table below.

Date Tested	System Serial No.	System dipole	T.S. Liquid	SAR measured (normalized to 1W)		Target (Ref.Value)	Delta (%)	Tolerance (%)
2015.04.21	No.1	D835V2	Head	1g	9.76	9.23	5.74	±10
2015.04.23	No.2	D835V2	Body	1g	9.12	9.52	4.20	±10
2015.04.21	No.1	D1900V2	Head	1g	43.20	40.30	7.20	±10
2015.04.22	No.2	D1900V2	Body	1g	38.68	40.10	3.54	±10

Plots of the system checking scans are given in Appendix A.

4.3.3 Tissue Simulants used in the Measurements

For the measurement of the following parameters the SPEAG DAKS-3.5 dielectric parameter probe is used, representing the open-ended coaxial probe measurement procedure.

Date Tested	Freq.(MHz)	Liquid parameters	measured	Target	Delta(%)	Tolerance(%)
2015.04.21	Head 835	εr	42.11	41.50	1.47	±5
		σ[S/m]	0.91	0.90	1.1	±5
2015.04.23	Body 835	εr	53.85	55.20	2.45	±5
		σ[S/m]	0.98	0.97	1.03	±5
2015.04.21	Head 1900	εr	40.84	40.00	2.10	±5
		σ[S/m]	1.41	1.40	0.71	±5
2015.04.22	Body 1900	εr	52.18	53.30	2.10	±5
		σ[S/m]	1.53	1.52	0.66	±5

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.

Device holder supplied by SPEAG

5.2 Test positions

5.2.1 Against Phantom Head

Measurements were made in “cheek” and “tilt” positions on both the left hand and right hand sides of the phantom.
The positions used in the measurements were according to IEEE 1528 - 2003 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques".

5.2.2 Body Worn Configuration

The device was placed in the SPEAG holder below the flat section of the phantom. The distance between the device and the phantom was kept at the separation distance using a separate flat spacer that was removed before the start of the measurements. And the distance is 10mm.The device was oriented with its antenna facing the phantom since this orientation gives higher results.

5.3 Scan Procedure

First, area scans were used for determination of the field distribution and the approximate location of the local peak SAR values. The SAR distribution is scanned along the inside surface, at least for an area larger than the projection of the handset and antenna. The angle between the probe axis and the surface normal line is recommended but not required to be less than 30°. The SAR distribution is first measured on a 2-D coarse grid. The scan region should cover all areas that are exposed and encompassed by the projection of the handset. It is a 15 mm × 15 mm measurement grid used when two staggered one-dimensional cubic splines are used to estimate the maximum SAR location. Next, a zoom scan, a minimum of 7 x 7x7 points covering a volume of at least 30x30x30mm, was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

5.4 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation.
The interpolation, extrapolation and maximum search routines within DASY5 are all based on the modified Quadratic Shepard's method (Robert J. Renka,"Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).
The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.
In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

6. MEASUREMENT UNCERTAINTY

DASY5 Uncertainty Budget								
Error description	Uncertainty value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std.Unc (1g).	Std.Unc. (10g)	(vi) Veff
Measurement system								
Probe calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System detection limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF ambient noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF ambient reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max.SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test Sample Related								
Device holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Power drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid conductivity (target.)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid conductivity (mea.)	±2.5%	R	$\sqrt{3}$	0.64	0.43	±0.9%	±0.6%	∞
Liquid Permittivity (target.)	±5.0%	R	$\sqrt{3}$	0.60	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (mea.)	±2.5%	R	$\sqrt{3}$	0.60	0.49	±0.9%	±0.7%	∞
Combined std. Uncertainty						±10.9%	±10.7%	387
Expanded STD Uncertainty						**±21.7%**	**±21.4%**	

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7. RF Output Power Measurement

7.1 Manufacturing Tolerance

GSM

GSM 850			
Channel	Channel 251	Channel 189	Channel 128
Tolerance (dBm)	31.0~33.0	31.0~33.0	31.0~33.0
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Tolerance (dBm)	28.0~30.0	28.0~30.0	28.0~30.0

GSM 850 GPRS				
Channel		251	189	128
1 Txslot	Tolerance (dBm)	31.0~33.0	31.0~33.0	31.0~33.0
2 Txslot	Tolerance (dBm)	30.0~32.0	30.0~32.0	30.0~32.0
3 Txslot	Tolerance (dBm)	28.0~30.0	28.0~30.0	28.0~30.0
4 Txslot	Tolerance (dBm)	26.0~28.0	26.0~28.0	26.0~28.0

GSM 1900 GPRS				
Channel		810	661	512
1 Txslot	Tolerance (dBm)	28.0~30.0	28.0~30.0	28.0~30.0
2 Txslot	Tolerance (dBm)	27.0~29.0	27.0~29.0	27.0~29.0
3 Txslot	Tolerance (dBm)	25.0~27.0	25.0~27.0	25.0~27.0
4 Txslot	Tolerance (dBm)	22.0~24.0	22.0~24.0	22.0~24.0

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7.2 GSM Measurement result

Conducted Power

Mode	GSM850(Head) Duty cycle: 1:8(12.5%)			GSM1900(Head) Duty cycle: 1:8(12.5%)		
Channel	128	189	251	512	661	810
Frequency(MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
Measured Power(dBm)	32.69	32.78	32.76	29.50	29.39	29.44

GPRS Measured Power

Mode	GPRS850			GPRS1900		
Channel	128	189	251	512	661	810
Frequency(MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
4Downlink1uplinkPower(dBm)	32.71	32.75	32.74	29.57	29.46	29.47
3Downlink2uplinkPower(dBm)	30.58	30.65	30.67	28.01	27.79	27.67
2Downlink3uplinkPower(dBm)	28.62	28.66	28.67	25.31	25.04	24.92
1Downlink4uplinkPower(dBm)	26.46	26.54	26.59	23.11	22.88	22.78

GPRS Averaged Power

Mode	GPRS850			GPRS1900		
Channel	128	189	251	512	661	810
Frequency(MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
4Downlink1uplinkPower(dBm)	23.68	23.72	23.71	20.54	20.43	20.44
3Downlink2uplinkPower(dBm)	**24.56**	**24.63**	**24.65**	**21.99**	**21.77**	**21.65**
2Downlink3uplinkPower(dBm)	24.36	24.40	24.41	21.05	20.78	20.66
1Downlink4uplinkPower(dBm)	23.45	23.53	23.58	20.10	19.87	19.77

Division Factors (for Measured Power and Averaged Power):

To average the power, the division factor is as follows:

1TX-slot (4Downlink1uplink)= 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots(3Downlink2uplink) = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots (2Downlink3uplink)= 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots (1Downlink4uplink)= 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 2Txslots (3Downlink2uplink) for GPRS.

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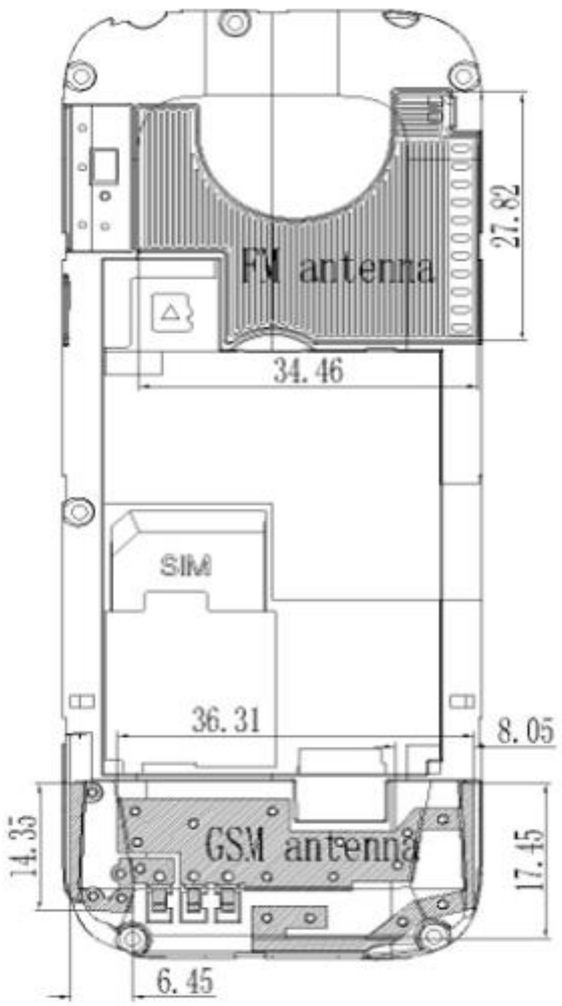
8. RF Exposure Conditions

Refer to the follow picture"Antenna Locations & Separation Distances" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.



8.1 Head Exposure Conditions

For WWAN,

Test Configurations	SAR Required	Note
Left Touch	yes	/
Left Tilt (15°)	yes	/
Right Touch	yes	/
Right Tilt (15°)	yes	/

8.2 Body-worn Accessory Exposure conditions

For WWAN

Test Configurations	SAR Required	Note
Rear	yes	/
Front	yes	/

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9. SAR Test result

In order to determine the largest value of the peak spatial-average SAR of a handset, all device positions, configurations, and operational modes should be tested for each frequency band according to Steps 1 to 3 below.

Step 1: The tests should be performed at the channel that is closest to the center of the transmit frequency band.
a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom),
b) all configurations for each device position in a), e.g., antenna extended and retracted, and
c) All operational modes for each device position in item a) and configuration in item b) in each frequency band, e.g., analog and digital, If more than three frequencies need to be tested (i.e., Nc > 3), then all frequencies, configurations and modes shall be tested for all of the above test conditions.
Step 2: For the condition providing the highest peak spatial-average SAR determined in Step 1 for each frequency, perform all tests at all other test frequency channels, e.g., lowest and highest frequencies. In addition, for all other conditions (device position, configuration, and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies should be tested as well.
Step 3: Examine all data to determine the largest value of the peak.
Note:
1. Per KDB 447498 D01v05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
Reported SAR(W/kg)= Measured SAR(W/kg)* Scaling Factor
2. Per KDB 447498 D01v05, for each exposure position, if the highest output channel reported SAR ≤0.8W/kg, other channels SAR testing are not necessary.
3. In the report the test position “Mobile phone screen Towards Ground” abbreviated as “TG”,and “Mobile phone screen Towards Phantom” abbreviated as “TP”.

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The measured and reported Head/body SAR values for the test device are tabulated below:

Mode: GSM 850

fL(MHz)=824.2MHz fM(MHz)=836.4MHz fH(MHz)= 848.8MHz

SAR Values（Head，850MHz Band）

Limit of SAR (W/kg) : <1.6W/kg (1g Average)

Test Case		Ch	Measure Conducted Power (dBm)	Tune-up limit (dBm)	Scaling Factor	Measure Results (W/kg)	Reported Results (W/kg)
position	mode					1g Average	1g Average
Left cheek	GSM	L	32.69	33.00	----	----	----
		M	32.78	33.00	1.05	0.654	0.688
		H	32.76	33.00	----	----	----
Left Tilted		L	32.69	33.00	----	----	----
		M	32.78	33.00	1.05	0.320	0.337
		H	32.76	33.00	----	----	----
Right cheek		L	32.69	33.00	----	----	----
		M	32.78	33.00	1.05	0.573	0.603
		H	32.76	33.00	----	----	----
Right Tilted		L	32.69	33.00	----	----	----
		M	32.78	33.00	1.05	0.319	0.336
		H	32.76	33.00	----	----	----

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Mode: GSM850 (GSM/GPRS)

fL(MHz)=824.2MHz fM(MHz)=836.4MHz fH(MHz)= 848.8MHz

SAR Values（body，850MHz Band

Limit of SAR (W/kg) : <1.6W/kg (1g Average)

Test Case		Ch	Measure Conducted Power (dBm)	Tune-up limit (dBm)	Scaling Factor	Measure Results (W/kg)	Reported Results (W/kg)
position	mode					1 g Average	1g Average
TG	GSM With headset	L	32.69	33.00	----	----	----
		M	32.78	33.00	1.05	0.355	0.373
		H	32.76	33.00	----	----	----
	GPRS	L	30.58	32.00	1.39	0.756	1.048
		M	30.65	32.00	1.36	**0.816**	**1.113**
		M（repeat）	30.65	32.00	1.36	0.805	1.098
		H	30.67	32.00	1.36	0.613	0.833
TP	GSM With headset	L	32.69	33.00	----	----	----
		M	32.78	33.00	1.05	0.307	0.323
		H	32.76	33.00	----	----	----
	GPRS	L	30.58	32.00	----	----	----
		M	30.65	32.00	1.36	0.396	0.540
		H	30.67	32.00	----	----	----

Note: The distance between the EUT and the phantom bottom is 10mm.

Mode: GSM1900

fL(MHz)=1850.2MHz fM(MHz)=1880.0MHz fH(MHz)=1909.8MHz

SAR Values（Head，1900MHz Band）

Limit of SAR (W/kg) : <1.6W/kg(1g Average)

Test Case		CH	Measure Conducted Power (dBm)	Tune-up limit (dBm)	Scaling Factor	Measure Results (W/kg)	Reported Results (W/kg)
position	mode					1g Average	1g Average
Left cheek	GSM	L	29.50	30	----	----	----
		M	29.39	30	1.15	0.217	0.250
		H	29.44	30	----	----	----
Left Tilted		L	29.50	30	----	----	----
		M	29.39	30	1.15	0.131	0.151
		H	29.44	30	----	----	----
Right cheek		L	29.50	30	----	----	----
		M	29.39	30	1.15	**0.242**	**0.278**
		H	29.44	30	----	----	----
Right Tilted		L	29.50	30	----	----	----
		M	29.39	30	1.15	0.138	0.159
		H	29.44	30	----	----	----

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Mode: GSM1900 (GSM/GPRS)

fL(MHz)=1850.2MHz fM(MHz)=1880.0MHz fH(MHz)=1909.8MHz

SAR Values（body，1900MHz Band）

Limit of SAR (W/kg) :<1.6W/kg(1g Average)

Test Case		CH	Measure Conducted Power (dBm)	Tune-up limit (dBm)	Scaling Factor	Measure Results (W/kg)	Reported Results (W/kg)
position	mode					1 g Average	1g Average
TG	GSM With headset	L	29.50	30	----	----	----
		M	29.39	30	1.15	0.438	0.504
		H	29.44	30	----	----	----
	GPRS	L	28.01	29	----	----	----
		M	27.79	29	1.32	**0.461**	**0.609**
		H	27.67	29	----	----	----
TP	GSM With headset	L	29.50	30	----	----	----
		M	29.39	30	1.15	0.252	0.290
		H	29.44	30	----	----	----
	GPRS	L	28.01	29	----	----	----
		M	27.79	29	1.32	0.450	0.595
		H	27.67	29	----	----	----

Note: The distance between the EUT and the phantom bottom is 10mm.

9.1 SAR Measurement Variability

SAR measurement variability must be 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.
The following procedures are applied to determine if repeated measurements are required.
1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only 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 (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

9.1.1 The Highest Measured SAR configuration in Each Frequency Band

Frequency band(MHz)	Air interface	Head(w/kg)	Body(w/kg)
850	GSM 850	<0.8 W/kg	>0.8 W/kg
1900	GSM 1900	<0.8 W/kg	<0.8 W/kg

9.1.2 Repeated Measurement Results

SAR Measurement Variability

Frequency		Test Position	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR(W/kg)
MHz	Ch.					
836.4	189	TG	0.816	0.805	1.014	/

APPENDIX A: SYSTEM CHECKING SCANS

SYSTEM CHECKING SCANS	835MHz Head

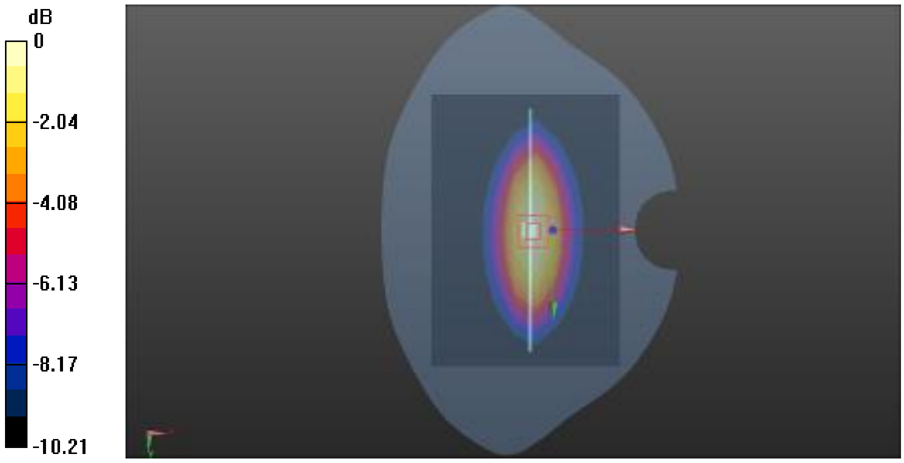
Communication System: UID 0, CW (0); Frequency: 835 MHz
Medium parameters used (extrapolated): f = 835 MHz; σ = 0.909 S/m; ε_r = 42.108; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(8.85, 8.85, 8.85); Calibrated: 10/17/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1559; Type: SAM; Serial: 1559
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies 835MHz Head/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (10x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.02 W/kg

System Performance Check at Frequencies 835MHz Head/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.668 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.55 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.62 W/kg
Maximum value of SAR (measured) = 3.06 W/kg



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

SYSTEM CHECKING SCANS	835MHz Flat

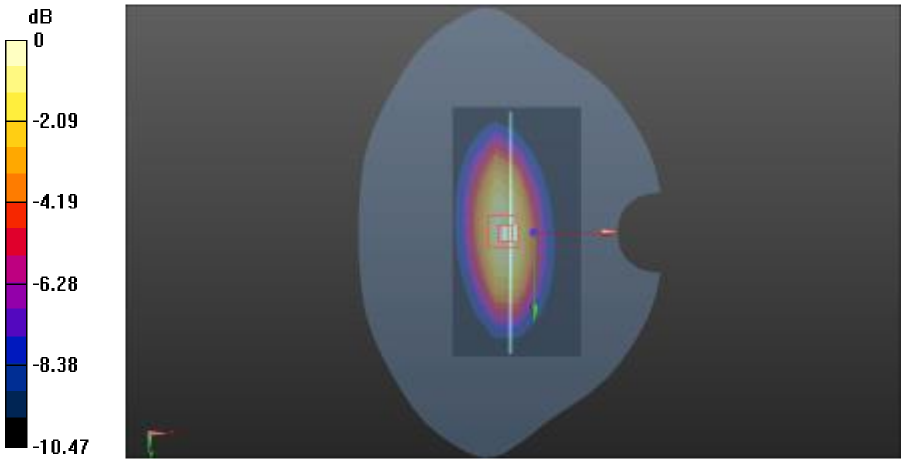
Communication System: UID 0, CW (0); Frequency: 835 MHz
Medium parameters used (extrapolated): f = 835 MHz; σ = 0.978 S/m; ε_r = 53.846; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 3mm (Mechanical Surface Detection), z = -3.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies 835MHz Flat/d=15mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.35 W/kg

System Performance Check at Frequencies 835MHz Flat/d=15mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.940 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.34 W/kg
SAR(1 g) = 2.28 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.66 W/kg



0 dB = 2.66 W/kg = 4.25 dBW/kg

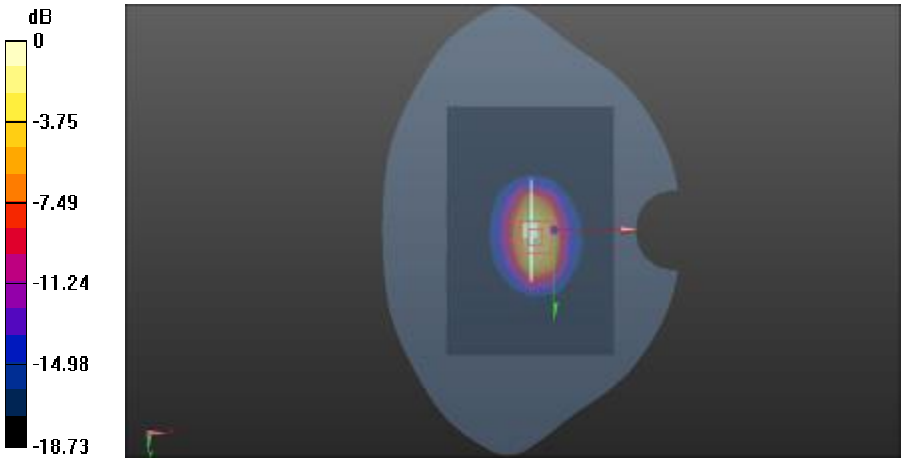
SYSTEM CHECKING SCANS	1900MHz Head

Communication System: UID 0, CW (0); Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.41 S/m; ε_r = 40.84; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(7.87, 7.87, 7.87); Calibrated: 10/17/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1560; Type: SAM; Serial: 1560
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies 1900MHz Head/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Area Scan (9x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 13.9 W/kg
System Performance Check at Frequencies 1900MHz Head/d=10mm, Pin=250mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.723 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 20.8 W/kg
SAR(1 g) = 10.8 W/kg; SAR(10 g) = 5.46 W/kg
Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

SYSTEM CHECKING SCANS	1900MHz Flat

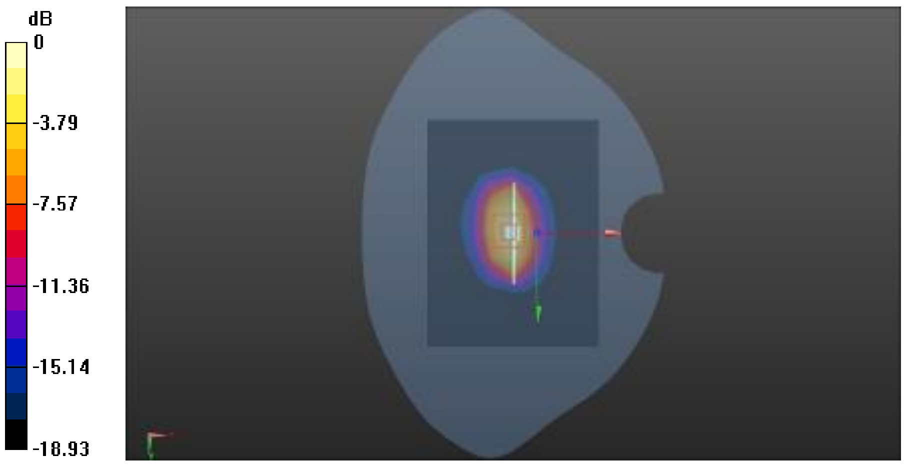
Communication System: UID 0, CW (0); Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.53 S/m; ε_r = 52.184; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(7.59, 7.59, 7.59); Calibrated: 2014/10/17;
- Sensor-Surface: 3mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1660; Type: QD000P40CD; Serial: TP:1660
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies 1900MHz Flat/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (9x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.7 W/kg

System Performance Check at Frequencies 1900MHz Flat/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.714 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 19.2 W/kg
SAR(1 g) = 9.67 W/kg; SAR(10 g) = 4.9 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



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

APPENDIX B: MEASUREMENT SCANS

GSM (850MHz/Head)

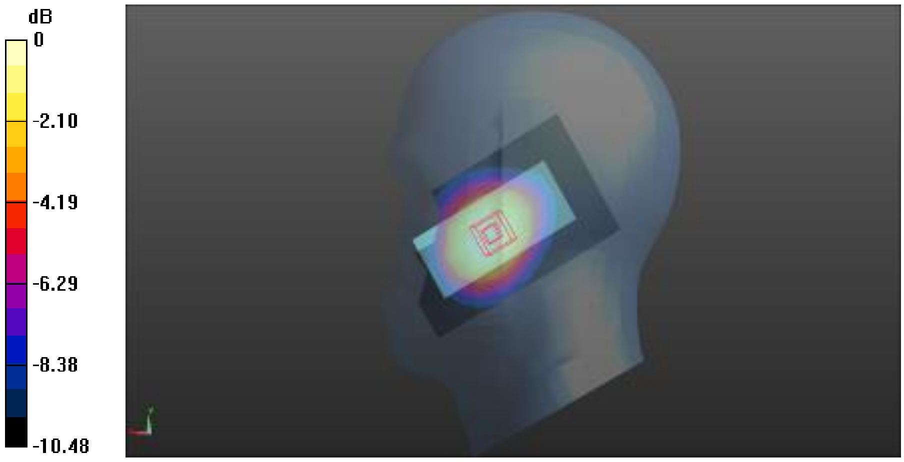
Left Side	Cheek	**836.4 MHz**

Communication System: UID 10021 - DAA, GSM-FDD (TDMA, GMSK); Frequency: 836.6 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.98 S/m; ε_r = 42.097; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(8.85, 8.85, 8.85); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1559; Type: SAM; Serial: 1559
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Left HSL 850/850GSM Hsl touch M/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.689 W/kg
Head-Section Left HSL 850/850GSM Hsl touch M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.712 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.858 W/kg
SAR(1 g) = 0.654 W/kg; SAR(10 g) = 0.467 W/kg
Maximum value of SAR (measured) = 0.692 W/kg



0 dB = 0.692 W/kg = -1.60 dBW/kg

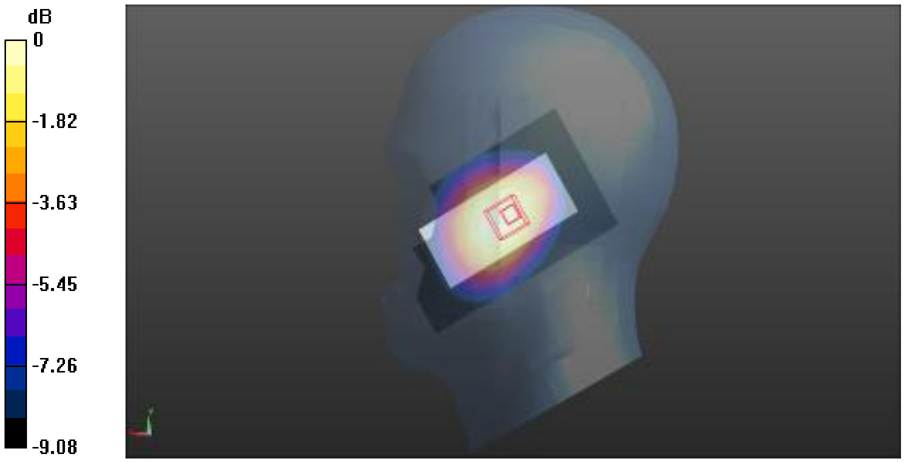
Left Side	Tilt	**836.4 MHz**

Communication System: UID 10021 - DAA, GSM-FDD (TDMA, GMSK); Frequency: 836.6 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.98 S/m; ε_r = 42.097; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(8.85, 8.85, 8.85); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1559; Type: SAM; Serial: 1559
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Left HSL 850/850GSM Hsl tilt M/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.331 W/kg
Head-Section Left HSL 850/850GSM Hsl tilt M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.034 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.424 W/kg
SAR(1 g) = 0.320 W/kg; SAR(10 g) = 0.233 W/kg
Maximum value of SAR (measured) = 0.340 W/kg



0 dB = 0.340 W/kg = -4.69 dBW/kg

Right Side	Cheek	**836.4 MHz**

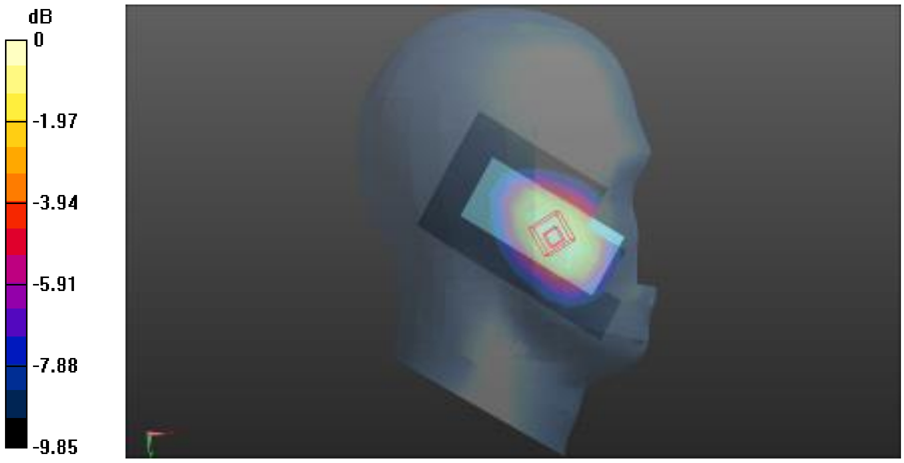
Communication System: UID 10021 - DAA, GSM-FDD (TDMA, GMSK); Frequency: 836.6 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.98 S/m; ε_r = 42.097; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(8.85, 8.85, 8.85); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1559; Type: SAM; Serial: 1559
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Right HSL 850/850GSM HSL touch M/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.615 W/kg

Head-Section Right HSL 850/850GSM HSL touch M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.500 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 0.769 W/kg
SAR(1 g) = 0.573 W/kg; SAR(10 g) = 0.403 W/kg
Maximum value of SAR (measured) = 0.610 W/kg



0 dB = 0.610 W/kg = -2.15 dBW/kg

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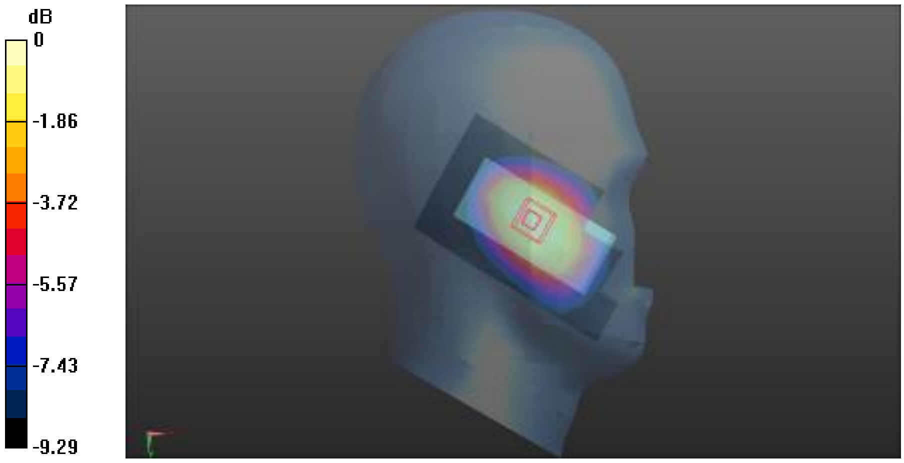
Right Side	Tilt	**836.4 MHz**

Communication System: UID 10021 - DAA, GSM-FDD (TDMA, GMSK); Frequency: 836.6 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.98 S/m; ε_r = 42.097; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(8.85, 8.85, 8.85); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1559; Type: SAM; Serial: 1559
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Right HSL 850/850GSM HSL tilt M/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.330 W/kg
Head-Section Right HSL 850/850GSM HSL tilt M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.600 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.420 W/kg
SAR(1 g) = 0.319 W/kg; SAR(10 g) = 0.230 W/kg
Maximum value of SAR (measured) = 0.343 W/kg



0 dB = 0.343 W/kg = -4.65 dBW/kg

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GSM with headset (850MHz/Flat)

FLAT	TP	**836.4 MHz**

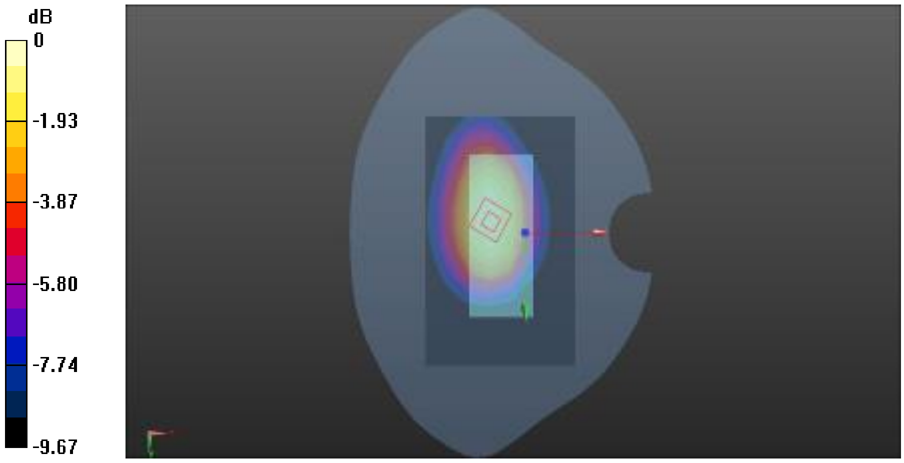
Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.979 S/m; ε_r = 53.843; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TP/850GSM TP M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.290 W/kg

Flat-Section MSL 850 TP/850GSM TP M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.206 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.408 W/kg
SAR(1 g) = 0.307 W/kg; SAR(10 g) = 0.218 W/kg
Maximum value of SAR (measured) = 0.326 W/kg



0 dB = 0.326 W/kg = -4.87 dBW/kg

FLAT	TG	**836.4 MHz**

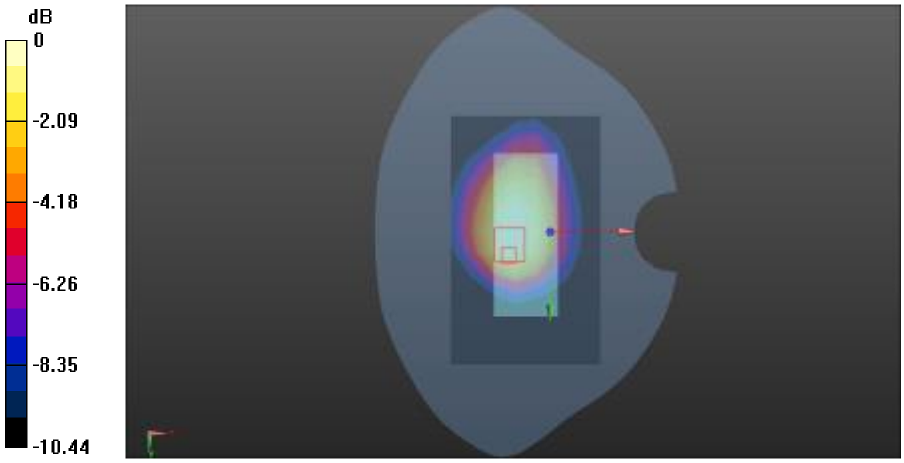
Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.979 S/m; ε_r = 53.843; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TG/850GSM TG M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.395 W/kg

Flat-Section MSL 850 TG/850GSM TG M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.427 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.505 W/kg
SAR(1 g) = 0.355 W/kg; SAR(10 g) = 0.251 W/kg
Maximum value of SAR (measured) = 0.385 W/kg



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

GSM (850MHz with GPRS/Flat)

FLAT	TP	**836.4 MHz**

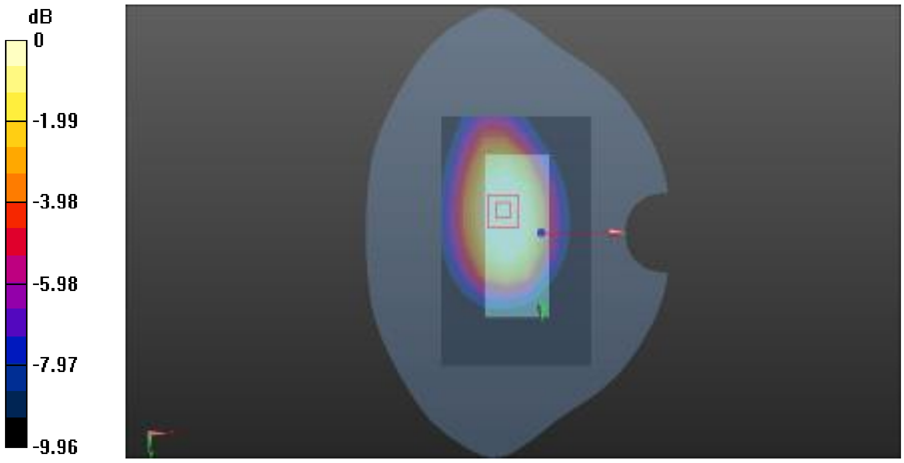
Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.979 S/m; ε_r = 53.843; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TP/850GPRS TP M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.509 W/kg

Flat-Section MSL 850 TP/850GPRS TP M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.062 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.547 W/kg
SAR(1 g) = 0.396 W/kg; SAR(10 g) = 0.273 W/kg
Maximum value of SAR (measured) = 0.420 W/kg



0 dB = 0.420 W/kg = -3.77 dBW/kg

FLAT	TG	**824.2 MHz**

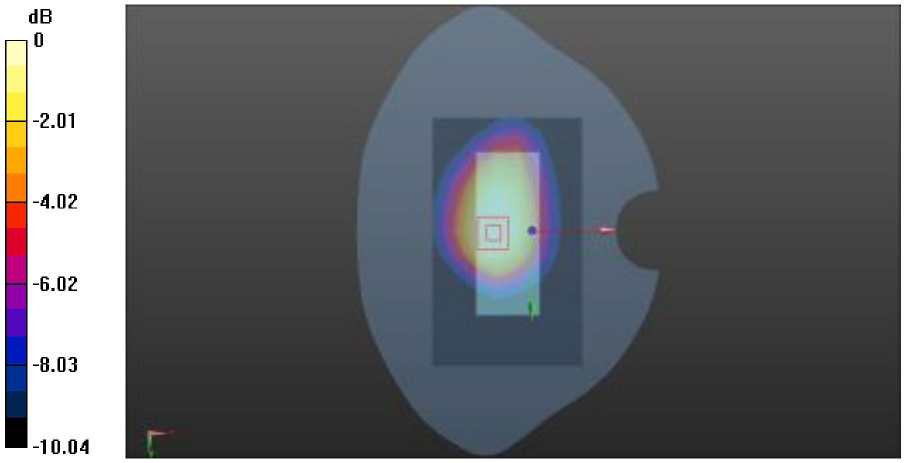
Communication System: UID 0, Generic GSM (0); Frequency: 824.2 MHz
Medium parameters used (extrapolated): f = 824.2 MHz; σ = 0.967 S/m; ε_r = 53.87; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TG/850GPRS TG L/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.882 W/kg

Flat-Section MSL 850 TG/850GPRS TG L/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.495 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.00 W/kg
SAR(1 g) = 0.756 W/kg; SAR(10 g) = 0.541 W/kg
Maximum value of SAR (measured) = 0.810 W/kg



0 dB = 0.810 W/kg = -0.92 dBW/kg

FLAT	TG	**836.4 MHz**

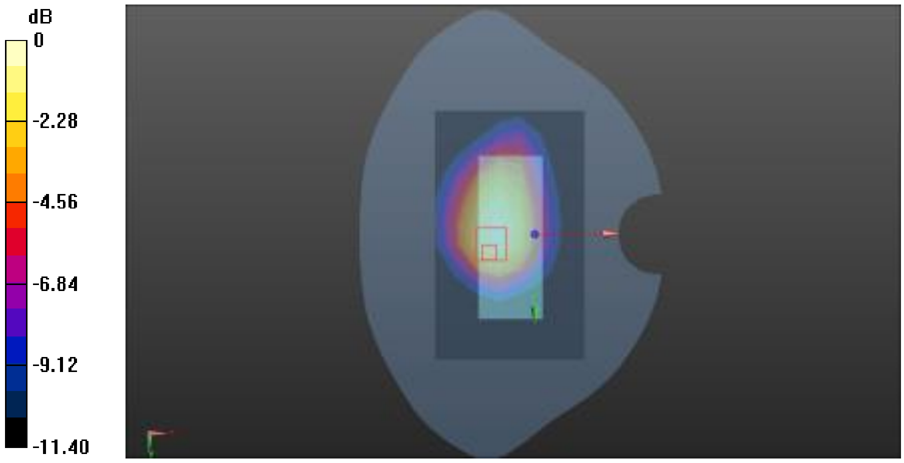
Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.979 S/m; ε_r = 53.843; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

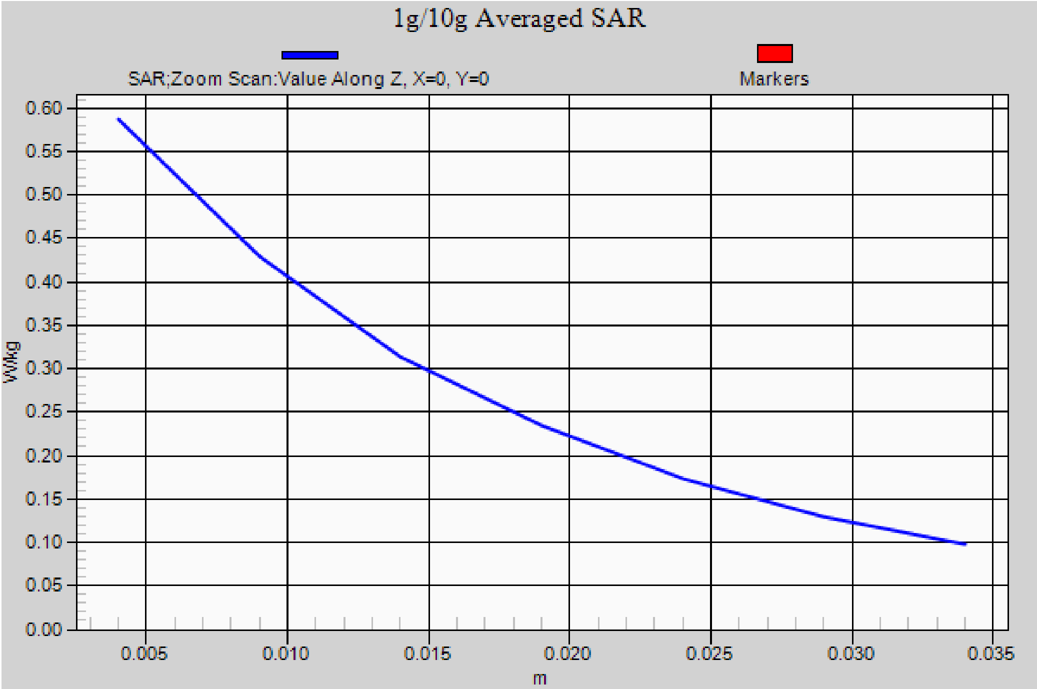
- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TG/850GPRS TG M 2/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.857 W/kg

Flat-Section MSL 850 TG/850GPRS TG M 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.327 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 0.816 W/kg; SAR(10 g) = 0.552 W/kg
Maximum value of SAR (measured) = 0.932 W/kg



0 dB = 0.932 W/kg = -0.31 dBW/kg



Z-Scan at power reference point

Tel: 86-10-68009202 68009203
Fax: 86-10-68009195 68009205

FLAT	TG	**836.4 MHz**

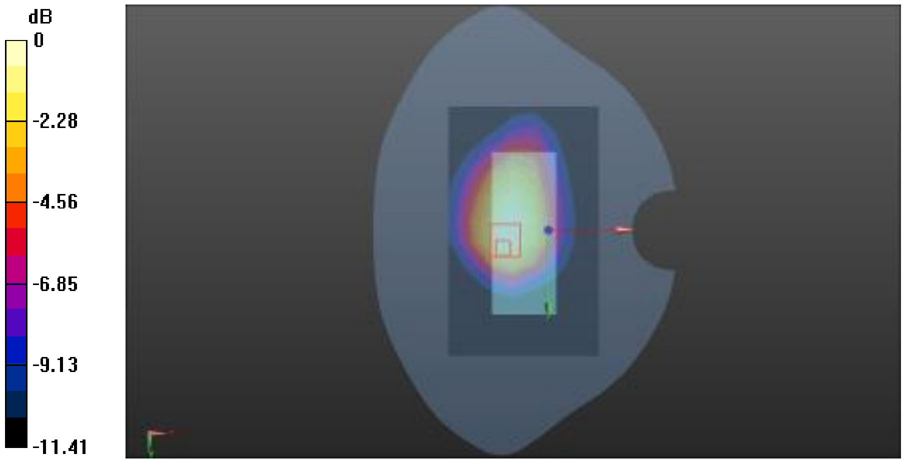
Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz
Medium parameters used (extrapolated): f = 836.6 MHz; σ = 0.979 S/m; ε_r = 53.843; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TG/850GPRS TG M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.860 W/kg

Flat-Section MSL 850 TG/850GPRS TG M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.742 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.805 W/kg; SAR(10 g) = 0.543 W/kg
Maximum value of SAR (measured) = 0.911 W/kg



0 dB = 0.911 W/kg = -0.40 dBW/kg

FLAT	TG	**848.6 MHz**

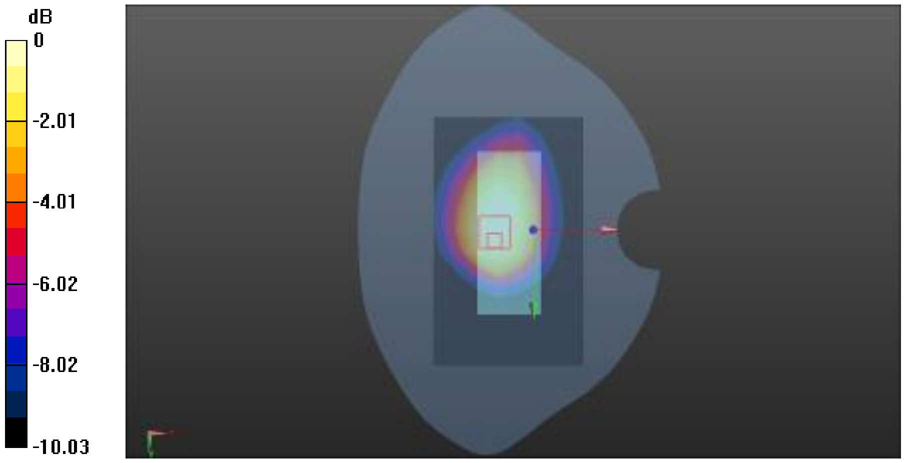
Communication System: UID 0, Generic GSM (0); Frequency: 848.6 MHz
Medium parameters used (extrapolated): f = 848.6 MHz; σ = 0.991 S/m; ε_r = 53.817; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(5.79, 5.79, 5.79); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1659; Type: QD000P40CD; Serial: TP:1659
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 850 TG/850GPRS TG H/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.718 W/kg

Flat-Section MSL 850 TG/850GPRS TG H/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.457 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.827 W/kg
SAR(1 g) = 0.613 W/kg; SAR(10 g) = 0.434 W/kg
Maximum value of SAR (measured) = 0.653 W/kg



0 dB = 0.653 W/kg = -1.85 dBW/kg

Tel: 86-10-68009202 68009203
Fax: 86-10-68009195 68009205

GSM (1900MHz/Head)

Left Side	Cheek	**1880.0 MHz**

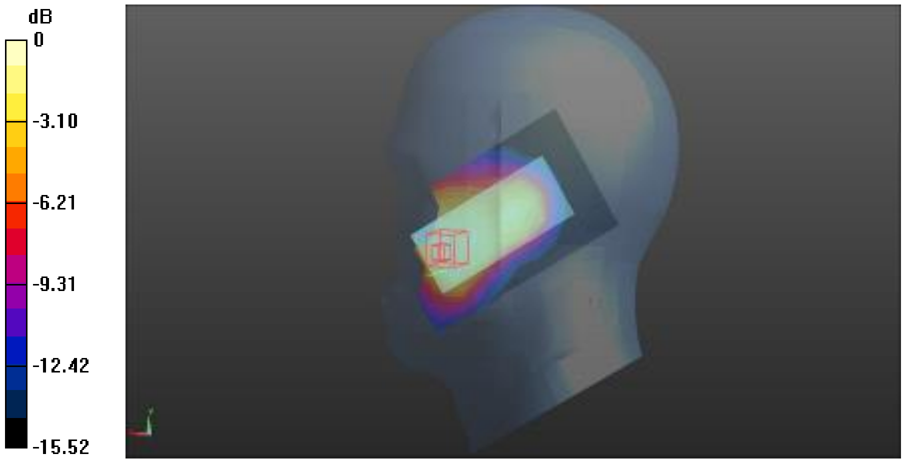
Communication System: UID 10021 - DAA, GSM-FDD (TDMA, GMSK); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.526 S/m; ε_r = 40.934; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(7.87, 7.87, 7.87); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1560; Type: SAM; Serial: 1560
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Left HSL 1900/1900GSM touch M/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.235 W/kg

Head-Section Left HSL 1900/1900GSM touch M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.424 V/m; Power Drift = 0.21 dB
Peak SAR (extrapolated) = 0.341 W/kg
SAR(1 g) = 0.217 W/kg; SAR(10 g) = 0.132 W/kg
Maximum value of SAR (measured) = 0.236 W/kg



0 dB = 0.236 W/kg = -6.27 dBW/kg

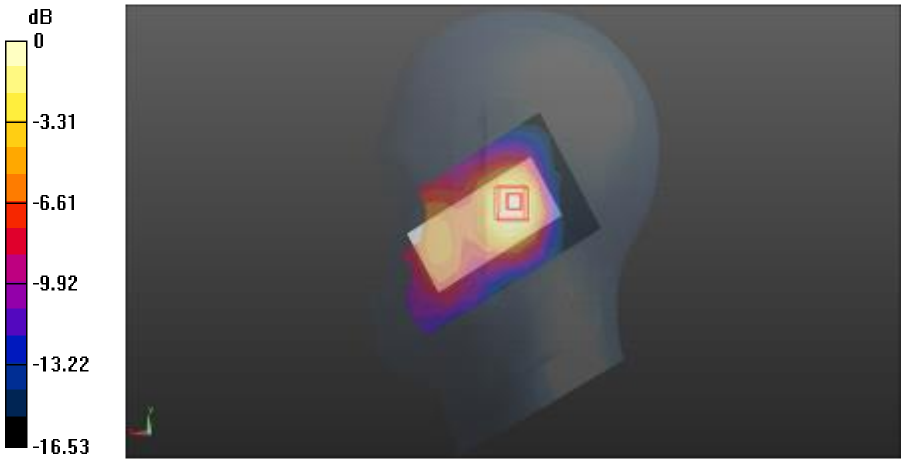
Left Side	tilt	**1880 MHz**

Communication System: UID 10021 - DAA, GSM-FDD (TDMA, GMSK); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.526 S/m; ε_r = 40.934; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(7.87, 7.87, 7.87); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1560; Type: SAM; Serial: 1560
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Left HSL 1900/1900GSM tilt M/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.137 W/kg
Head-Section Left HSL 1900/1900GSM tilt M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.705 V/m; Power Drift = 0.21 dB
Peak SAR (extrapolated) = 0.207 W/kg
SAR(1 g) = 0.131 W/kg; SAR(10 g) = 0.078 W/kg
Maximum value of SAR (measured) = 0.144 W/kg



0 dB = 0.144 W/kg = -8.42 dBW/kg

Tel: 86-10-68009202 68009203
Fax: 86-10-68009195 68009205

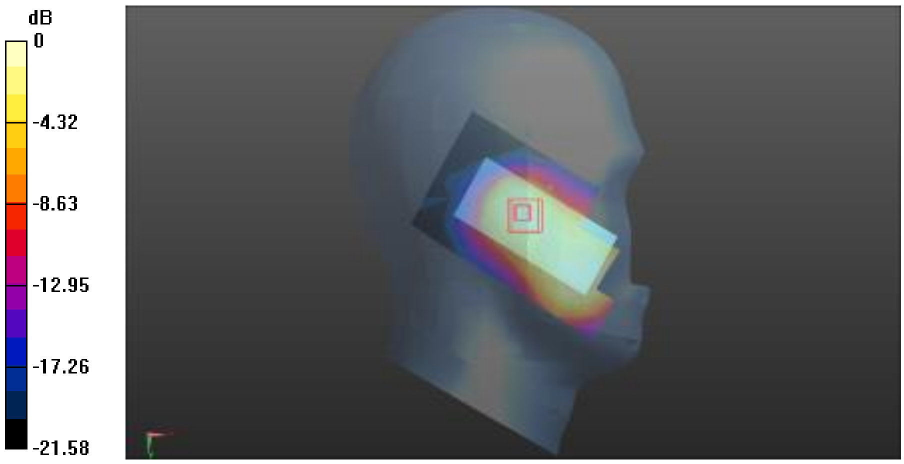
Right Side	Cheek	**1880.0 MHz**

Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.526 S/m; ε_r = 40.934; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(7.87, 7.87, 7.87); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1560; Type: SAM; Serial: 1560
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Right HSL 1900/1900GSM touch M/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.236 W/kg
Head-Section Right HSL 1900/1900GSM touch M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.867 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.367 W/kg
SAR(1 g) = 0.242 W/kg; SAR(10 g) = 0.146 W/kg
Maximum value of SAR (measured) = 0.262 W/kg



0 dB = 0.262 W/kg = -5.82 dBW/kg

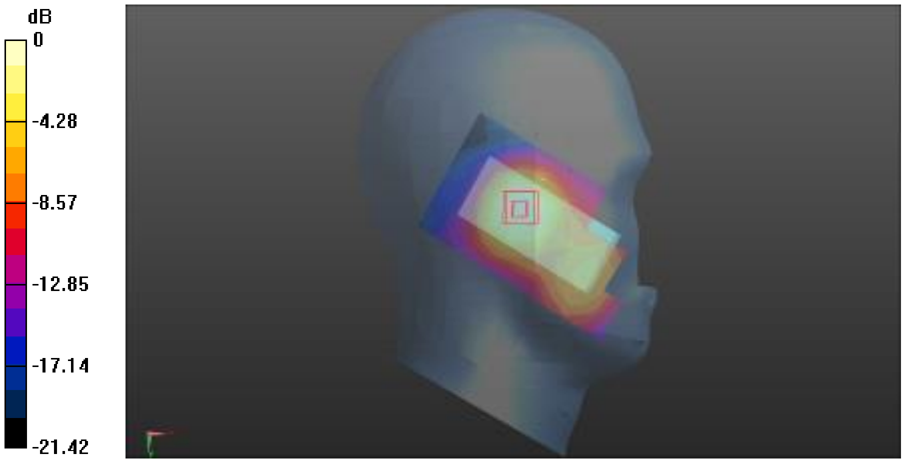
Right Side	tilt	**1880.0 MHz**

Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.526 S/m; ε_r = 40.934; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: EX3DV4 - SN3708; ConvF(7.87, 7.87, 7.87); Calibrated: 10/17/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn546; Calibrated: 8/13/2014
- Phantom: SAM 1560; Type: SAM; Serial: 1560
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Head-Section Right HSL 1900/1900GSM tilt M/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.145 W/kg
Head-Section Right HSL 1900/1900GSM tilt M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.157 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.217 W/kg
SAR(1 g) = 0.138 W/kg; SAR(10 g) = 0.082 W/kg
Maximum value of SAR (measured) = 0.149 W/kg



0 dB = 0.149 W/kg = -8.27 dBW/kg

GSM with headset (1900MHz/Flat)

FLAT	TP	**1880 MHz**

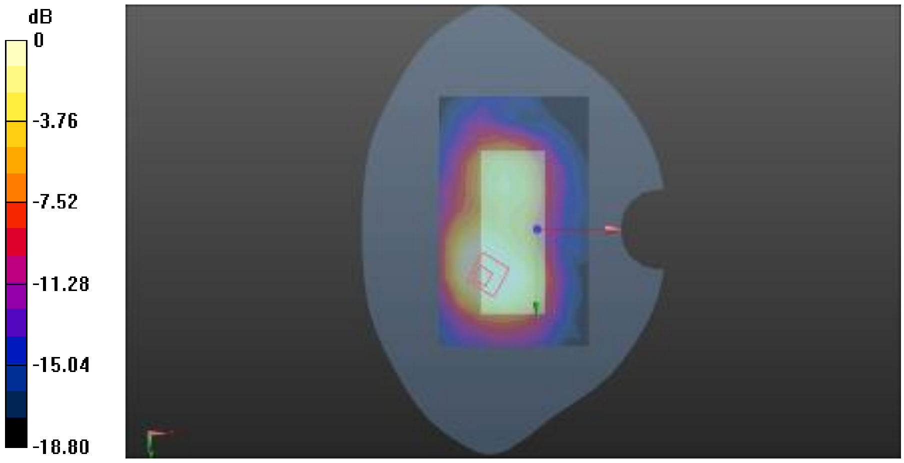
Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.611 S/m; ε_r = 52.016; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = -3.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1660; Type: QD000P40CD; Serial: TP:1660
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 1900 TP/1900GSM TP M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.444 W/kg

Flat-Section MSL 1900 TP/1900GSM TP M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.679 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.445 W/kg
SAR(1 g) = 0.252 W/kg; SAR(10 g) = 0.147 W/kg
Maximum value of SAR (measured) = 0.280 W/kg



0 dB = 0.280 W/kg = -5.53 dBW/kg

FLAT	TG	**1880 MHz**

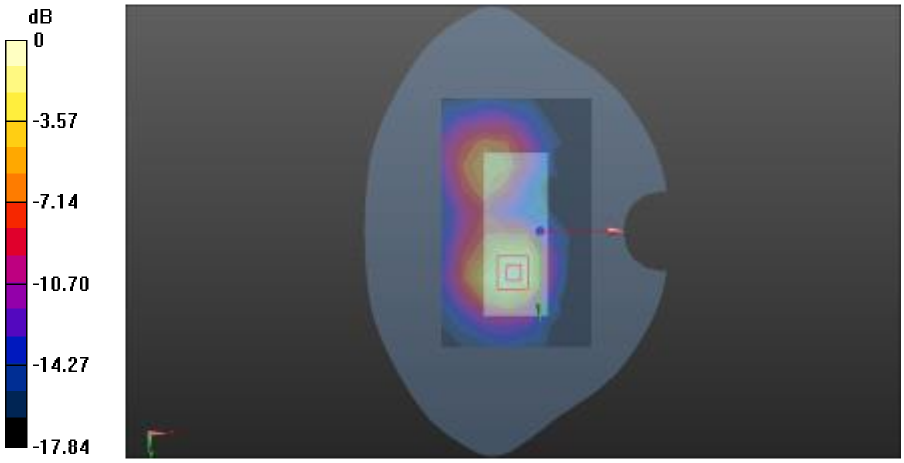
Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.611 S/m; ε_r = 52.016; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1660; Type: QD000P40CD; Serial: TP:1660
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 1900 TG/1900GSM TG M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.429 W/kg

Flat-Section MSL 1900 TG/1900GSM TG M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.514 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.778 W/kg
SAR(1 g) = 0.438 W/kg; SAR(10 g) = 0.236 W/kg
Maximum value of SAR (measured) = 0.482 W/kg



0 dB = 0.482 W/kg = -3.17 dBW/kg

GSM (1900MHz with GPRS/Flat)

FLAT	TP	**1880 MHz**

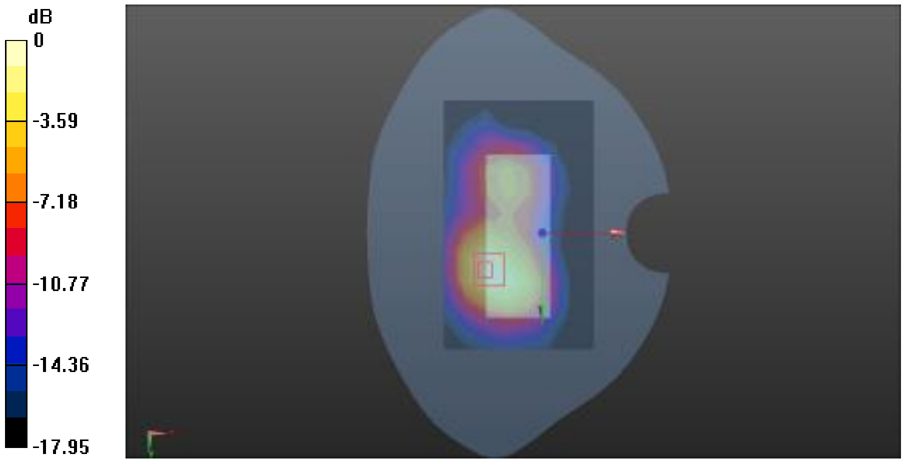
Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.611 S/m; ε_r = 52.016; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard:DASY5 (IEEE 1528-2003)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1660; Type: QD000P40CD; Serial: TP:1660
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 1900 TP/1900GPRS TP M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.436 W/kg

Flat-Section MSL 1900 TP/1900GPRS TP M/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.159 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.878 W/kg
SAR(1 g) = 0.450 W/kg; SAR(10 g) = 0.238 W/kg
Maximum value of SAR (measured) = 0.490 W/kg



0 dB = 0.490 W/kg = -3.10 dBW/kg

FLAT	TG	**1880 MHz**

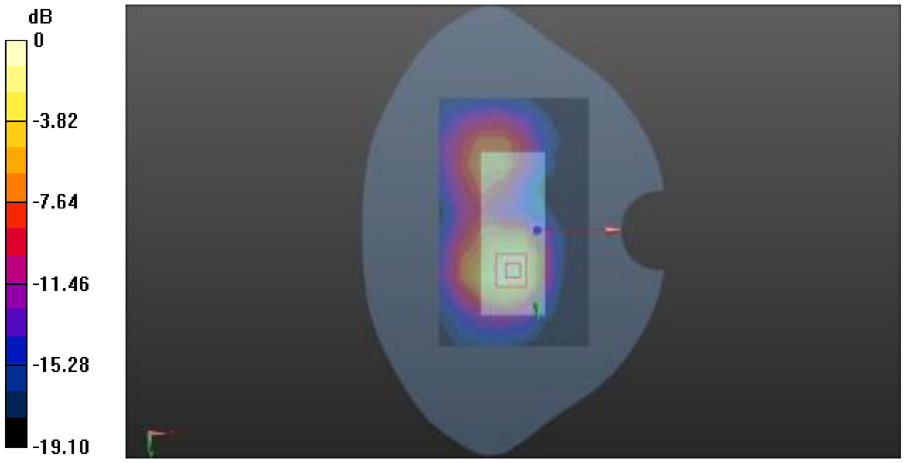
Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz
Medium parameters used: f = 1880 MHz; σ = 1.611 S/m; ε_r = 52.016; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: ES3DV3 - SN3127; ConvF(4.6, 4.6, 4.6); Calibrated: 2014/8/19;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 2.0, 32.0
- Electronics: DAE4 Sn725; Calibrated: 2014/10/24
- Phantom: SAM 1660; Type: QD000P40CD; Serial: TP:1660
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Flat-Section MSL 1900 TG/1900GPRS TG M/Area Scan (8x12x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.418 W/kg

Flat-Section MSL 1900 TG/1900GPRS TG M/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.428 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.871 W/kg
SAR(1 g) = 0.461 W/kg; SAR(10 g) = 0.238 W/kg
Maximum value of SAR (measured) = 0.516 W/kg



0 dB = 0.516 W/kg = -2.87 dBW/kg

APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)

ES3DV3 – SN:3127

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
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: **SRTC (PTT)**

Certificate No: **ES3-3127_Aug14**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3127

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: August 19, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: August 20, 2014

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

Certificate No: ES3-3127_Aug14 Page 1 of 11

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Certificate No: ES3-3127_Aug14 Page 2 of 11

Probe ES3DV3

SN:3127

Manufactured: July 11, 2006
Calibrated: August 19, 2014

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

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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3127

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.30	1.27	1.22	± 10.1 %
DCP (mV)[B]	101.8	100.7	102.2	

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	215.4	±3.3 %
		Y	0.0	0.0	1.0		213.6	
		Z	0.0	0.0	1.0		213.3	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.38	71.4	20.0	1.87	149.5	±0.7 %
		Y	3.52	72.6	21.0		128.8	
		Z	3.86	74.3	21.4		147.1	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	98.41	99.7	19.2	1.16	129.2	±2.7 %
		Y	29.27	99.8	21.8		130.9	
		Z	80.96	99.7	19.2		127.4	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.56	67.9	20.0	5.67	140.1	±1.4 %
		Y	6.76	68.9	20.7		144.6	
		Z	6.60	68.2	20.1		139.3	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.49	67.7	20.0	5.80	138.2	±1.4 %
		Y	6.66	68.5	20.7		143.6	
		Z	6.48	67.7	20.1		137.3	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.16	67.0	19.7	5.75	134.7	±1.2 %
		Y	6.31	67.9	20.4		140.6	
		Z	6.15	67.2	19.8		133.0	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.19	67.2	20.0	5.73	139.0	±1.2 %
		Y	5.33	68.2	20.9		144.9	
		Z	5.19	67.5	20.2		137.4	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.19	67.2	20.0	5.72	137.3	±1.2 %
		Y	5.28	68.0	20.8		144.0	
		Z	5.16	67.5	20.2		135.5	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.46	67.5	19.9	5.81	135.6	±1.4 %
		Y	6.66	68.5	20.7		144.0	
		Z	6.49	67.8	20.1		134.8	

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.

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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3127

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
450	43.5	0.87	6.48	6.48	6.48	0.19	2.30	± 13.3 %
750	41.9	0.89	6.31	6.31	6.31	0.80	1.09	± 12.0 %
900	41.5	0.97	5.95	5.95	5.95	0.37	1.67	± 12.0 %
1810	40.0	1.40	4.89	4.89	4.89	0.57	1.39	± 12.0 %
2000	40.0	1.40	4.84	4.84	4.84	0.80	1.17	± 12.0 %
2450	39.2	1.80	4.27	4.27	4.27	0.66	1.38	± 12.0 %
2600	39.0	1.96	4.20	4.20	4.20	0.79	1.33	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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ES3DV3– SN:3127 August 19, 2014

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3127

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
450	56.7	0.94	6.80	6.80	6.80	0.12	1.60	± 13.3 %
750	55.5	0.96	5.93	5.93	5.93	0.27	2.05	± 12.0 %
900	55.0	1.05	5.79	5.79	5.79	0.62	1.30	± 12.0 %
1810	53.3	1.52	4.60	4.60	4.60	0.33	1.99	± 12.0 %
2000	53.3	1.52	4.58	4.58	4.58	0.42	1.91	± 12.0 %
2450	52.7	1.95	4.08	4.08	4.08	0.80	1.15	± 12.0 %
2600	52.5	2.16	3.92	3.92	3.92	0.63	0.94	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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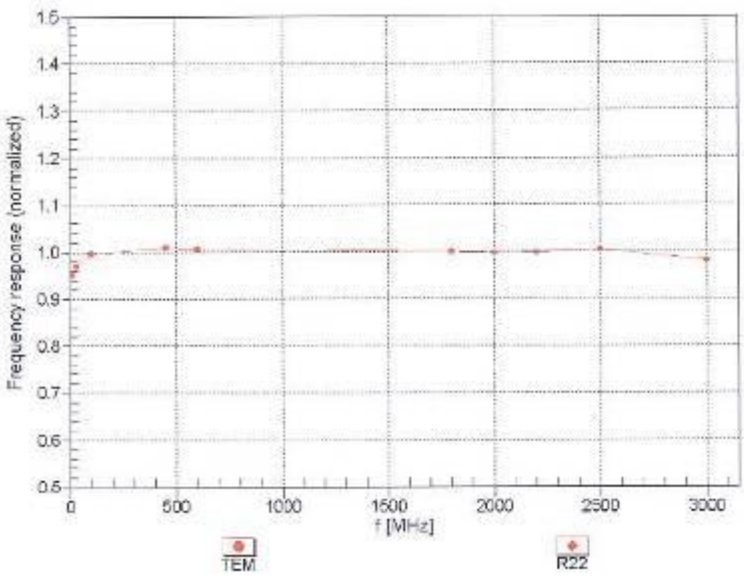
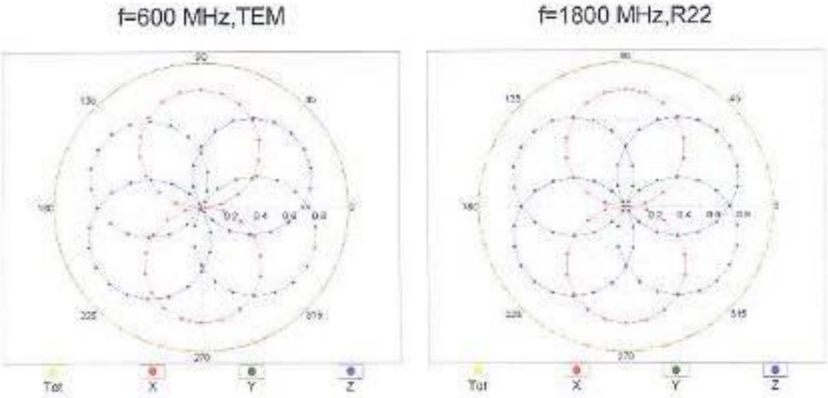
Frequency Response of E-Field

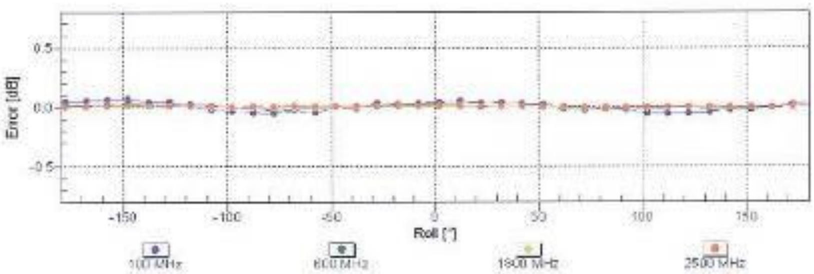
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (ϕ), ϑ = 0°





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

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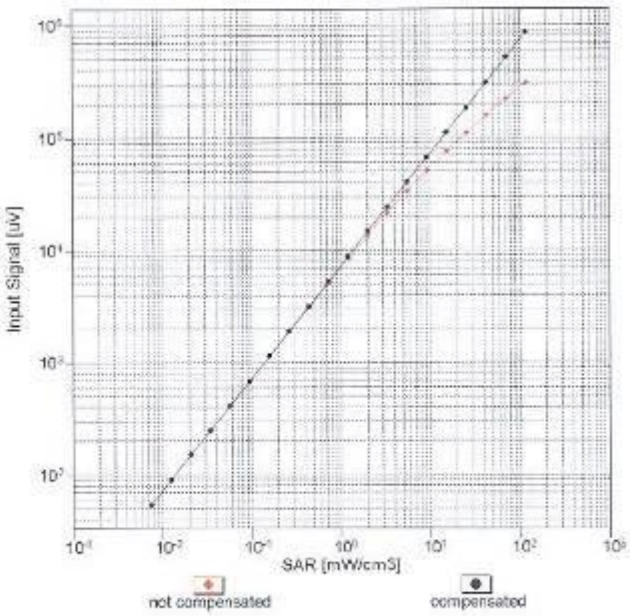
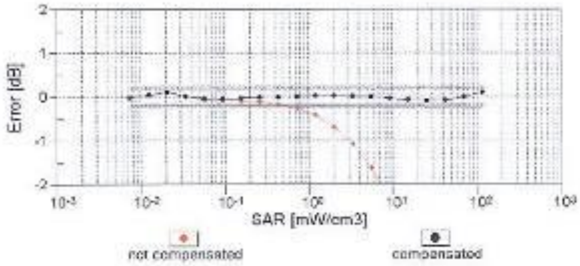
ES3DV3– SN:3127 August 19, 2014

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





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

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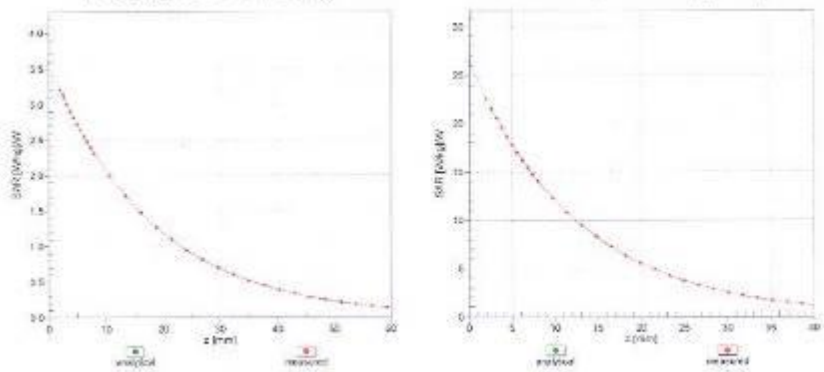
ES3DV3– SN:3127

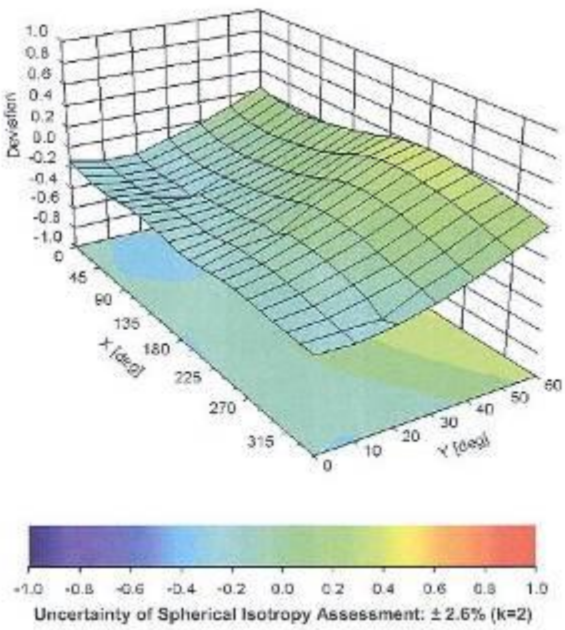
August 19, 2014

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3127

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-17.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	2 mm

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EX3DV4 – SN:3708

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Client **SRTC (Vitec)**

Certificate No: **EX3-3708_Oct14**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3708
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	October 17, 2014

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

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Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
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Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: October 20, 2014

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Accreditation No.: **SCS 108**

Glossary:

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Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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EX3DV4 – SN:3708 October 17, 2014

Probe EX3DV4

SN:3708

Manufactured: July 21, 2009
Calibrated: October 17, 2014

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

Certificate No: EX3-3708_Oct14 Page 3 of 11

Tel: 86-10-68009202 68009203
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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3708

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.19	0.35	0.44	± 10.1 %
DCP (mV)[B]	99.4	101.7	101.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	136.9	±2.7 %
		Y	0.0	0.0	1.0		146.6	
		Z	0.0	0.0	1.0		143.9	
10011-CAB	UMTS-FDD (WCDMA)	X	3.75	69.6	20.6	2.91	146.5	±0.9 %
		Y	3.63	68.6	19.6		144.1	
		Z	4.24	71.8	21.4		134.0	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	13.41	99.7	27.7	9.39	62.7	±2.7 %
		Y	6.46	84.3	22.3		73.1	
		Z	3.06	71.9	18.1		110.9	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	3.31	100.0	31.4	3.55	138.7	±2.5 %
		Y	13.39	99.5	24.7		135.4	
		Z	8.64	98.7	26.6		131.6	
10058-DAB	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.35	75.0	24.7	6.52	140.1	±2.2 %
		Y	4.69	74.7	23.6		130.6	
		Z	5.50	78.2	25.6		132.7	
10062-CAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.32	68.6	21.6	8.68	139.6	±2.7 %
		Y	10.09	68.4	21.4		127.5	
		Z	10.16	68.8	21.8		126.7	
10097-CAB	UMTS-FDD (HSDPA)	X	4.89	67.8	19.7	3.98	132.4	±0.7 %
		Y	4.98	67.8	19.3		148.3	
		Z	5.23	69.3	20.2		145.4	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.89	67.8	19.7	3.98	132.6	±0.7 %
		Y	4.94	68.1	19.5		146.5	
		Z	5.21	69.2	20.2		146.8	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	4.24	70.6	21.4	3.46	135.6	±1.2 %
		Y	3.87	68.1	19.6		128.3	
		Z	4.40	70.8	21.2		131.9	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	4.18	70.7	21.4	3.39	132.3	±0.9 %
		Y	3.89	69.7	19.9		140.5	
		Z	4.42	71.2	21.3		130.4	

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

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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3708

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
900	41.5	0.97	8.85	8.85	8.85	0.25	1.10	± 12.0 %
1810	40.0	1.40	7.87	7.87	7.87	0.57	0.68	± 12.0 %
2000	40.0	1.40	7.81	7.81	7.81	0.56	0.69	± 12.0 %
5200	36.0	4.66	5.41	5.41	5.41	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.18	5.18	5.18	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.85	4.85	4.85	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.67	4.67	4.67	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.85	4.85	4.85	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3708

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
900	55.0	1.05	8.90	8.90	8.90	0.80	0.60	± 12.0 %
1810	53.3	1.52	7.59	7.59	7.59	0.64	0.68	± 12.0 %
2000	53.3	1.52	7.66	7.66	7.66	0.73	0.62	± 12.0 %
5200	49.0	5.30	4.49	4.49	4.49	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.31	4.31	4.31	0.45	1.90	± 13.1 %
5500	48.6	5.65	3.93	3.93	3.93	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.78	3.78	3.78	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.14	4.14	4.14	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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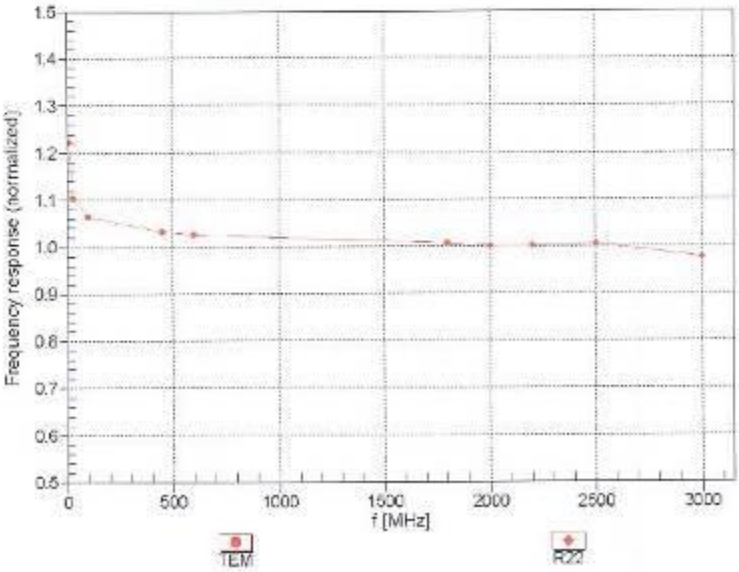
EX3DV4– SN:3708 October 17, 2014

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



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

Certificate No: EX3-3708_Oct14 Page 7 of 11

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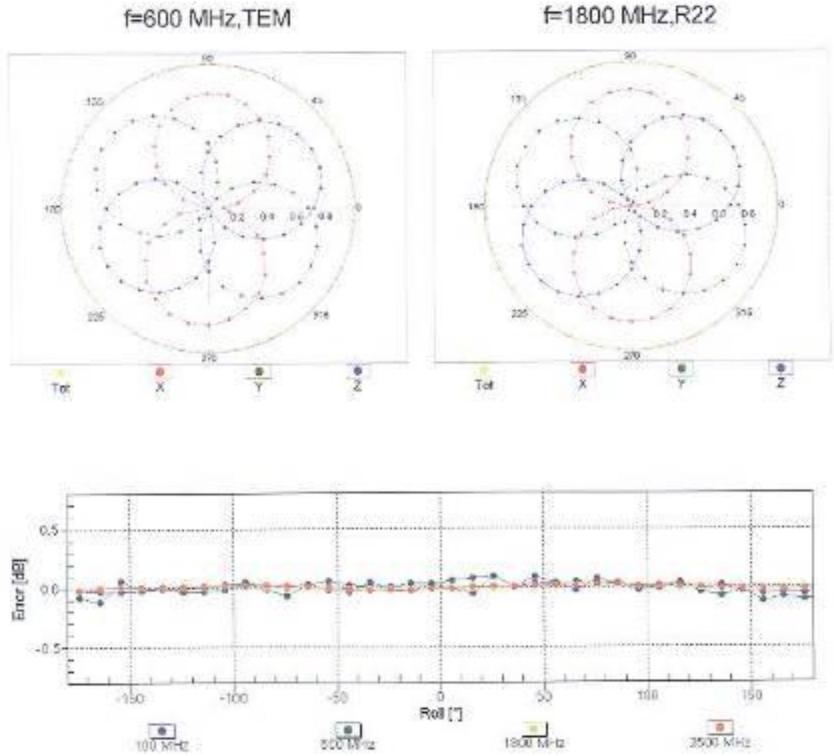
EX3DV4– SN:3708 October 17, 2014

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



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

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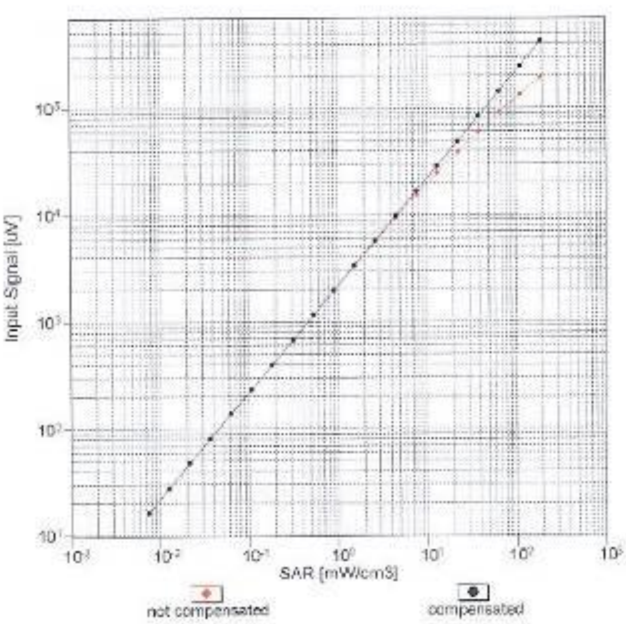
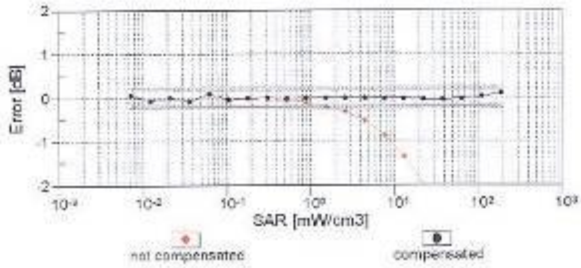
Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)





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

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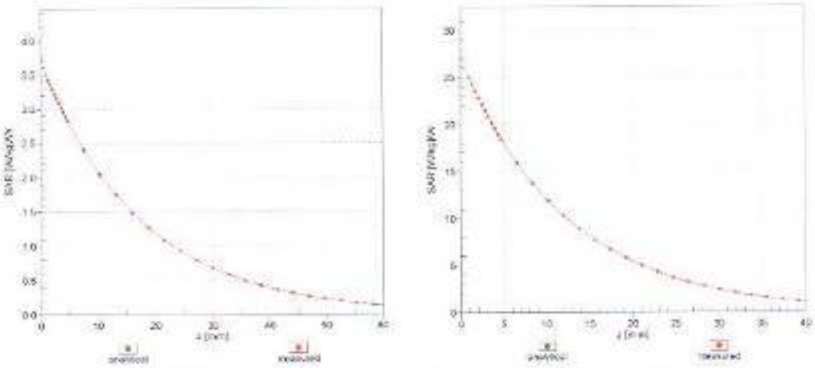
EX3DV4– SN:3708 October 17, 2014

Conversion Factor Assessment

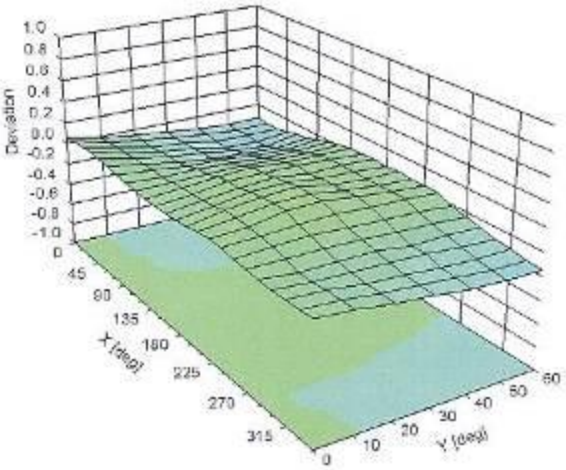
f = 900 MHz,WGLS R9 (H_convF)

f = 1810 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)

Certificate No: EX3-3708_Oct14 Page 10 of 11

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3708

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-4.1
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	1.4 mm

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APPENDIX D: RELEVANT PAGES FROM DAE REPORT(S)

DAE4 – SN:546

Schmid & Partner Engineering AG

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IMPORTANT NOTICE

USAGE OF THE DAE 4

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

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

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

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

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

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

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

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

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

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TN_BR040315AD DAE4.doc 11.12.2009

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **SRTC (PTT)**

Certificate No: **DAE4-546_Aug14**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 546
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	August 13, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: August 13, 2014

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

Certificate No: DAE4-546_Aug14 Page 1 of 5

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

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

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

Calibration Factors	X	Y	Z
High Range	405.342 ± 0.02% (k=2)	404.095 ± 0.02% (k=2)	404.193 ± 0.02% (k=2)
Low Range	3.98645 ± 1.50% (k=2)	3.95797 ± 1.50% (k=2)	3.97811 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	240.0 ° ± 1 °

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Appendix (Additional assessments outside the scope of SCS108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199996.94	0.31	0.00
Channel X	+ Input	20001.92	0.69	0.00
Channel X	- Input	-19994.55	6.01	-0.03
Channel Y	+ Input	199997.25	0.46	0.00
Channel Y	+ Input	20000.06	-1.05	-0.01
Channel Y	- Input	-20001.71	-1.01	0.01
Channel Z	+ Input	199987.80	-9.06	-0.00
Channel Z	+ Input	19997.61	-3.49	-0.02
Channel Z	- Input	-19999.94	0.93	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.02	-0.06	-0.00
Channel X	+ Input	202.01	0.59	0.29
Channel X	- Input	-197.99	0.45	-0.23
Channel Y	+ Input	2002.62	1.58	0.08
Channel Y	+ Input	200.93	-0.44	-0.22
Channel Y	- Input	-199.54	0.99	0.50
Channel Z	+ Input	2000.69	-0.15	-0.01
Channel Z	+ Input	201.05	-0.26	-0.13
Channel Z	- Input	-199.61	0.87	0.44

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	0.75	-0.68
	- 200	1.81	0.57
Channel Y	200	-0.62	-0.84
	- 200	-1.71	-2.16
Channel Z	200	1.95	2.10
	- 200	-3.24	-3.81

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.06	-2.70
Channel Y	200	10.17	-	-0.86
Channel Z	200	5.29	6.74	-

Certificate No: DAE4-546_Aug14 Page 4 of 5

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15837	15567
Channel Y	16153	14673
Channel Z	15909	16637

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	1.05	0.19	1.92	0.35
Channel Y	-0.61	-1.74	1.08	0.46
Channel Z	-0.52	-1.45	0.55	0.35

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

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DAE4 – SN:725

Schmid & Partner Engineering AG **s p e a g**

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IMPORTANT NOTICE

USAGE OF THE DAE 4

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

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

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

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

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

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

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

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

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

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TN_BR040315AD DAE4.doc 11.12.2009

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Accreditation No.: **SCS 108**

Client **SRTC (Vitec)**

Certificate No: **DAE4-725_Oct14**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 725
Calibration procedure(s)	QA CAL-06.v28 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	October 24, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	F. Bomholt

Issued: October 24, 2014

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Certificate No: DAE4-725_Oct14 Page 1 of 5

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Accreditation No.: SCS 108

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

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

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

Calibration Factors	X	Y	Z
High Range	404.101 ± 0.02% (k=2)	404.861 ± 0.02% (k=2)	404.423 ± 0.02% (k=2)
Low Range	3.93490 ± 1.50% (k=2)	3.98924 ± 1.50% (k=2)	3.96578 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	233.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199993.41	-2.75	-0.00
Channel X	+ Input	20003.77	2.92	0.01
Channel X	- Input	-19997.52	3.28	-0.02
Channel Y	+ Input	199993.22	-3.14	-0.00
Channel Y	+ Input	20004.18	3.24	0.02
Channel Y	- Input	-19997.69	3.10	-0.02
Channel Z	+ Input	199994.75	-2.02	-0.00
Channel Z	+ Input	20002.42	1.40	0.01
Channel Z	- Input	-20001.12	-0.37	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.97	-0.01	-0.00
Channel X	+ Input	201.54	0.13	0.06
Channel X	- Input	-198.28	0.27	-0.14
Channel Y	+ Input	2000.56	-0.45	-0.02
Channel Y	+ Input	201.04	-0.38	-0.19
Channel Y	- Input	-199.32	-0.75	0.38
Channel Z	+ Input	2001.31	0.40	0.02
Channel Z	+ Input	200.87	-0.76	-0.38
Channel Z	- Input	-199.45	-0.89	0.45

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	11.31	8.06
	- 200	-7.01	-9.50
Channel Y	200	-9.69	-9.97
	- 200	10.11	9.43
Channel Z	200	-3.52	-4.05
	- 200	2.43	2.17

3. Channel separation

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

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	-1.55	-3.07
Channel Y	200	8.75	-	-0.57
Channel Z	200	4.75	6.31	-

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4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	16151	13758
Channel Y	16212	16763
Channel Z	16108	15252

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.69	-0.41	1.57	0.45
Channel Y	-0.29	-1.88	0.96	0.50
Channel Z	-0.52	-1.97	0.94	0.51

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

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APPENDIX E: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)

D835V2 – SN:4d023

Tel: 86-10-68009202 68009203
Fax: 86-10-68009195 68009205

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

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S Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **SRTC (Vitec)**

Certificate No: **D835V2-4d023_Oct14**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d023
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	October 09, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: October 9, 2014

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Certificate No: D835V2-4d023_Oct14 Page 1 of 8

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	41.9 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.23 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.01 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	54.9 ± 6 %	0.99 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	2.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.52 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.28 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.4 Ω - 0.5 jΩ
Return Loss	- 27.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω - 2.2 jΩ
Return Loss	- 32.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 17, 2004

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DASY5 Validation Report for Head TSL

Date: 09.10.2014

Test Laboratory: SPEAG, Zurich, Switzerland

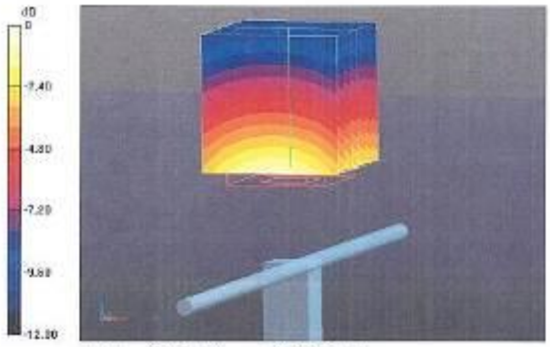
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 41.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

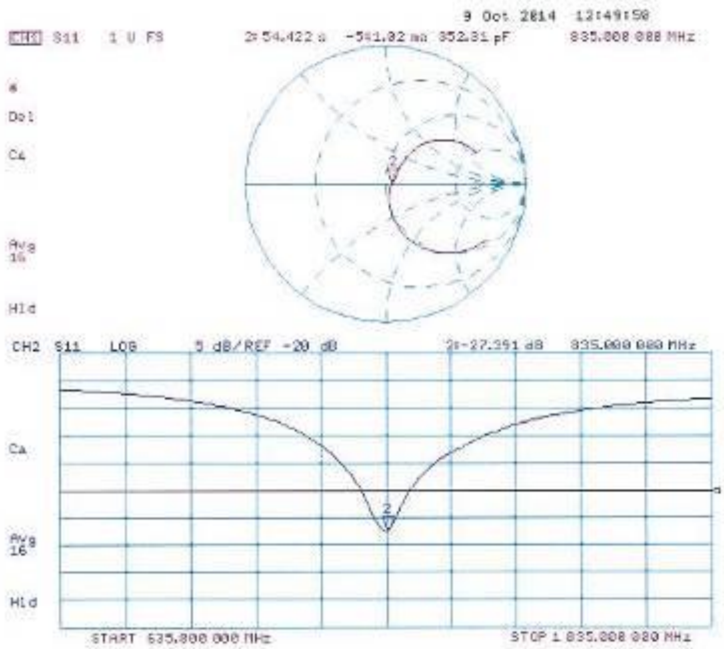
- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.39 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.48 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.52 W/kg
Maximum value of SAR (measured) = 2.73 W/kg



0 dB = 2.73 W/kg = 4.36 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d023_Oct14 Page 6 of 8

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DASY5 Validation Report for Body TSL

Date: 09.10.2014

Test Laboratory: SPEAG, Zurich, Switzerland

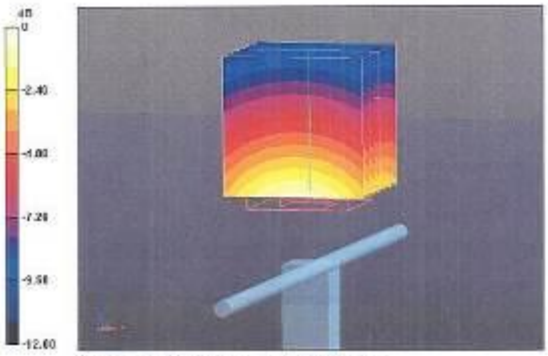
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.09 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.83 W/kg



0 dB = 2.83 W/kg = 4.52 dBW/kg

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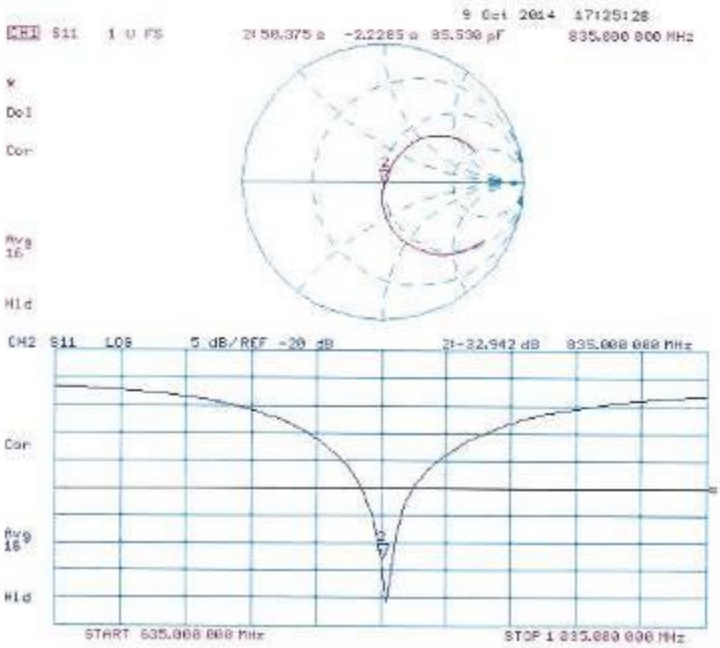
Impedance Measurement Plot for Body TSL



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D1900V2 – SN:5d113

Calibration Laboratory of Schmid & Partner Engineering AG
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Accreditation No.: **SCS 108**

Client **SRTC (Vitec)**

Certificate No: **D1900V2-5d113_Oct14**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d113
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	October 13, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M. Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 13, 2014

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Certificate No: D1900V2-5d113_Oct14 Page 1 of 8

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.7 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.1 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	53.1 ± 6 %	1.51 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 W/kg ± 16.5 % (k=2)**

The State Radio_monitoring_center Testing Center (SRTC)
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Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1 Ω + 7.4 jΩ
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω + 7.4 jΩ
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.200 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 24, 2009

Tel: 86-10-68009202 68009203
Fax: 86-10-68009195 68009205

DASY5 Validation Report for Head TSL

Date: 13.10.2014

Test Laboratory: SPEAG, Zurich, Switzerland

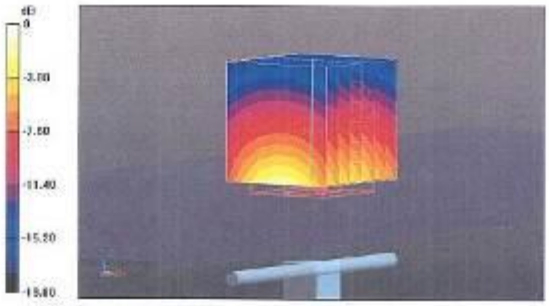
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d113

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.4 S/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.58 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.29 W/kg
Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.07 dBW/kg

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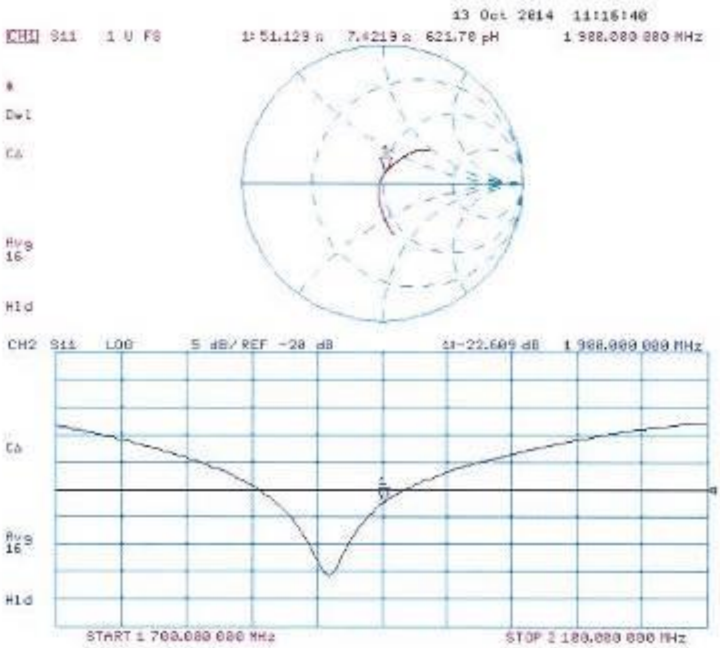
Fax: 86-10-68009195 68009205

Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 13.10.2014

Test Laboratory: SPEAG, Zurich, Switzerland

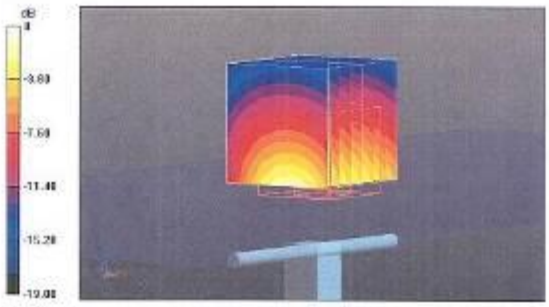
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d113

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.51 S/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

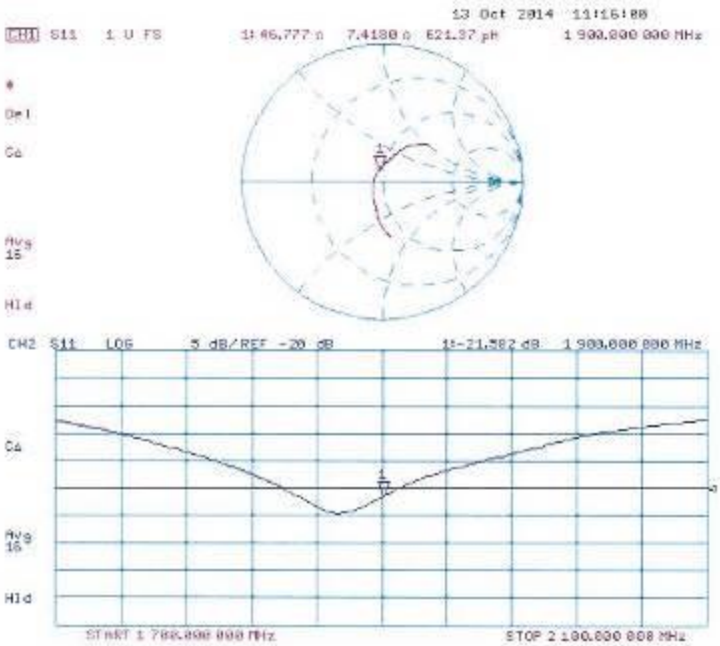
- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.88 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.34 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



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

Impedance Measurement Plot for Body TSL



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APPENDIX F: Test Setup

Appendix Test Setup

The State Radio_monitoring_center Testing Center (SRTC)
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