



FCC SAR EVALUATION REPORT

For

GUANGDONG GUANTONG HOLDING CO., Ltd

Product Name: Mobile Phone

Model No. : M182

Date of Receipt: 12nd Dec. 2014

Date of Test: 15th Dec. 2014

Issued Date: 16th Dec. 2014

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Issue By

Shenzhen Sunway Communication CO.,LTD Testing Center
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**SAR Evaluation compliance**

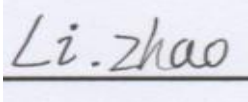
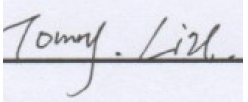
Product Name:	Mobile Phone
Brand Name:	Ole!
Model Name:	M182
Applicant:	GUANGDONG GUANTONG HOLDING CO., Ltd
Address:	NO.2,BEIAO AVENUE,DAWENBA,AOTOU,DAYABAY,HUIZHOU
Manufacturer:	GUANGDONG GUANTONG HOLDING CO., Ltd
Address:	NO.2,BEIAO AVENUE,DAWENBA,AOTOU,DAYABAY,HUIZHOU
Applicable Standard:	FCC 47 CFR Part 2(2.1093) ANSI/IEEE C95.1-1992 IEEE Std. 1528-2013 KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 KDB 447498 D01 General RF Exposure Guidance v05r02 KDB 648474 D04 Handset SAR v01: SAR Evaluation Considerations for Wireless Handsets.
Test Result:	Max. SAR Report: Body (1g): 0.390W/kg Head(1g): 1.346W/kg
Performed Date:	12 nd ~16 th Dec . 2014
Test Engineer:	 16 th Dec. 2014
Reviewed By	 16 th Dec. 2014
Performed Location:	Shenzhen Sunway Communication CO.,LTD Testing Center 1/F,BuildingA, SDG Info Port, KefengRoad, Hi-Tech Park, Nanshan District,Shenzhen , Guangdong, China 518104 Tel: +86-755- 36615880 Fax: +86-755- 86525532



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**1. General Information:****1.1 EUT Description:**

EUT Information	
Product Name	Mobile Phone
Brand Name	Ole!
Model Name	M182
Device Category	MobilePhone
State of Sample	Product units
Antenna Type	Integral Antenna
Headset	/
Battery	Type: Rechargeable lithium-ion battery 3.7V
Dimensions (L*W*H):	108mm (L)× 47mm (W)× 13mm (H)
Weight:	-
Power Source:	Rechargeable lithium-ion battery 3.7V
Normal Operation:	Head & Body
EUT and External Photos are the same product, they are just different colors	
GSM-2G	
Support Band	GSM850/PCS1900
GPRS Type	GPRS850/GPRS1900
GPRS Class	12
Frequency Bands:	GSM 850: UL: 824-850 MHz DL: 869-894 MHz PCS 1900: UL: 1850-1910 MHz DL: 1930-1990 MHz
Release Version	R99
Type of modulation	GMSK for GSM/GPRS,
Antenna locations	GSM antenna is located on the top of the mobile phone (page 22)
Antenna Gain	-2.0 dBi



Bluetooth	
Frequency	2402-2408 MHz
Type of modulation	FHSS
Data Rate	1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps(8DPSK)
Antenna Gain	-2.0 dBi
Max. Output Power (Conducted)	
GSM850:	32.53dBm
GPRS 850:	32.63 dBm
PCS1900:	29.28dBm
GPRS 1900:	29.29 dBm
Bluetooth	5.88dBm



1.2 Test Environment:

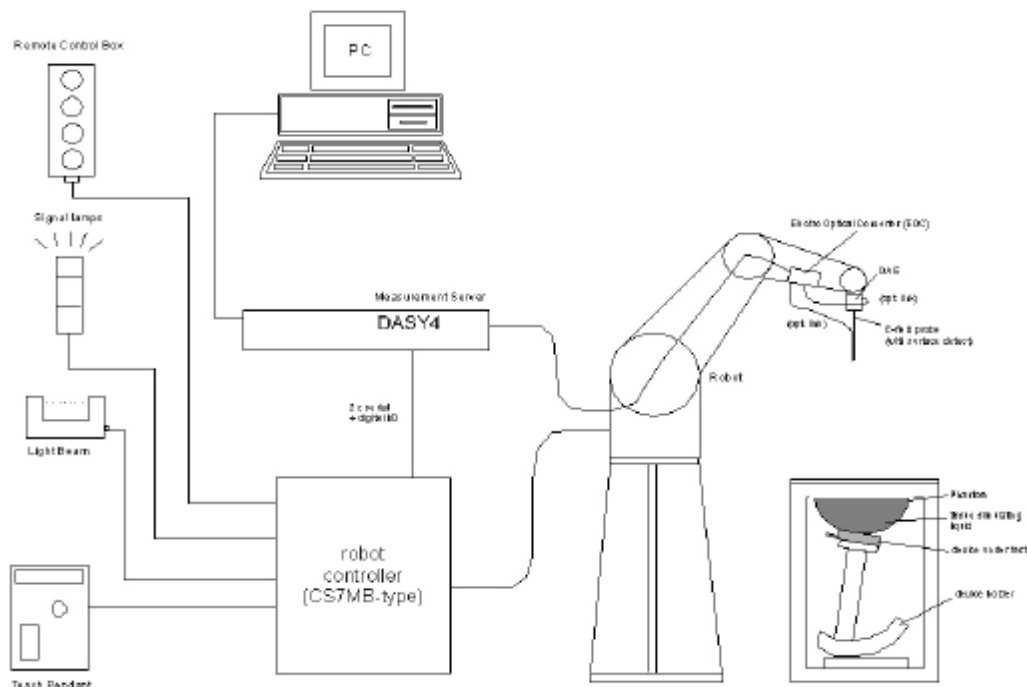
Ambient conditions in the SAR laboratory:

Items	Required	Actual
Temperature (°C)	18-25	21~23
Humidity (%RH)	30-70	50~65



2. SAR Measurement System:

2.1 Dasy4 System Description:



The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validate the proper functioning of the system.



3. System Components:

➤ DAsY4 Measurement Server:



Calibration: No calibration required.

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power pentium, 32MB chipdisk and 64MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

➤ DATA Acquisition Electronics (DAE):



Calibration: Recommended once a year

The data acquisition electronics consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

➤ Dosimetric Probes:



Calibration: Recommended once a year

Model: ES3DV3,
Frequency: 10MHz to 6G, Linearity: ± 0.2 dB,
Dynamic Range: 10 μ W/g to 100 mW/g
Directivity:
 ± 0.3 dB in HSL (rotation around probe axis)
 ± 0.5 dB in tissue material (rotation normal to probe axis)

These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (± 2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.



➤ Light Beam unit:



Calibration: No calibration required.

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm.

➤ SAM Twin Phantom:



The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left hand
- Right hand
- Flat phantom

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

➤ Device Holder for SAM Twin Phantom:



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

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



4. Tissue Simulating Liquid

4.1 The composition of the tissue simulating liquid:

INGREDIENT (% Weight)	835MHz Head	835MHz Body	1900MHz Head	1900MHz Body
Water	40.45	52.4	54.9	40.4
Salt	1.525	1.52	0.18	0.5
Sugar	57.6	45.0	0.00	58.0
HEC	0.40	1.0	0.00	1.0
Preventol	0.10	0.1	0.00	0.1
DGBE	0.00	0	44.92	0

4.2 Tissue Calibration Result:

Dielectric Probe Kit: Speag DAK 3.5mm probe -S/N:1038

Head Tissue Simulate Measurement:

Frequency (MHz)	Description	Dielectric Parameters		Tissue Temp. (°C)	Date
		ϵ_r	σ [s/m]		
835MHz	Reference	$41.50 \pm 5\%$ (39.425~43.574)	$0.90 \pm 5\%$ (0.855~0.945)	N/A	2014.12.15
	Measurement	42.27	0.91	22.1	
1900MHz	Reference	$40 \pm 5\%$ (38~42)	$1.40 \pm 5\%$ (1.33~1.47)	N/A	2014.12.16
	Measurement	39.27	1.42	21.8	

Body Tissue Simulate Measurement:

Frequency (MHz)	Description	Dielectric Parameters		Tissue Temp. (°C)	Date
		ϵ_r	σ [s/m]		
835MHz	Reference	$55.2 \pm 5\%$ (52.45~57.96)	$0.97 \pm 5\%$ (0.93~1.01)	N/A	2015.01.10
	Measurement	54.73	0.98	22.5	
1900MHz	Reference	$53.3 \pm 5\%$ (50.64~55.96)	$1.52 \pm 5\%$ (1.45~1.59)	N/A	2015.01.10
	Measurement	52.45	1.54	22.5	



4.3 Tissue Dielectric Parameters for Head and Body Phantoms:

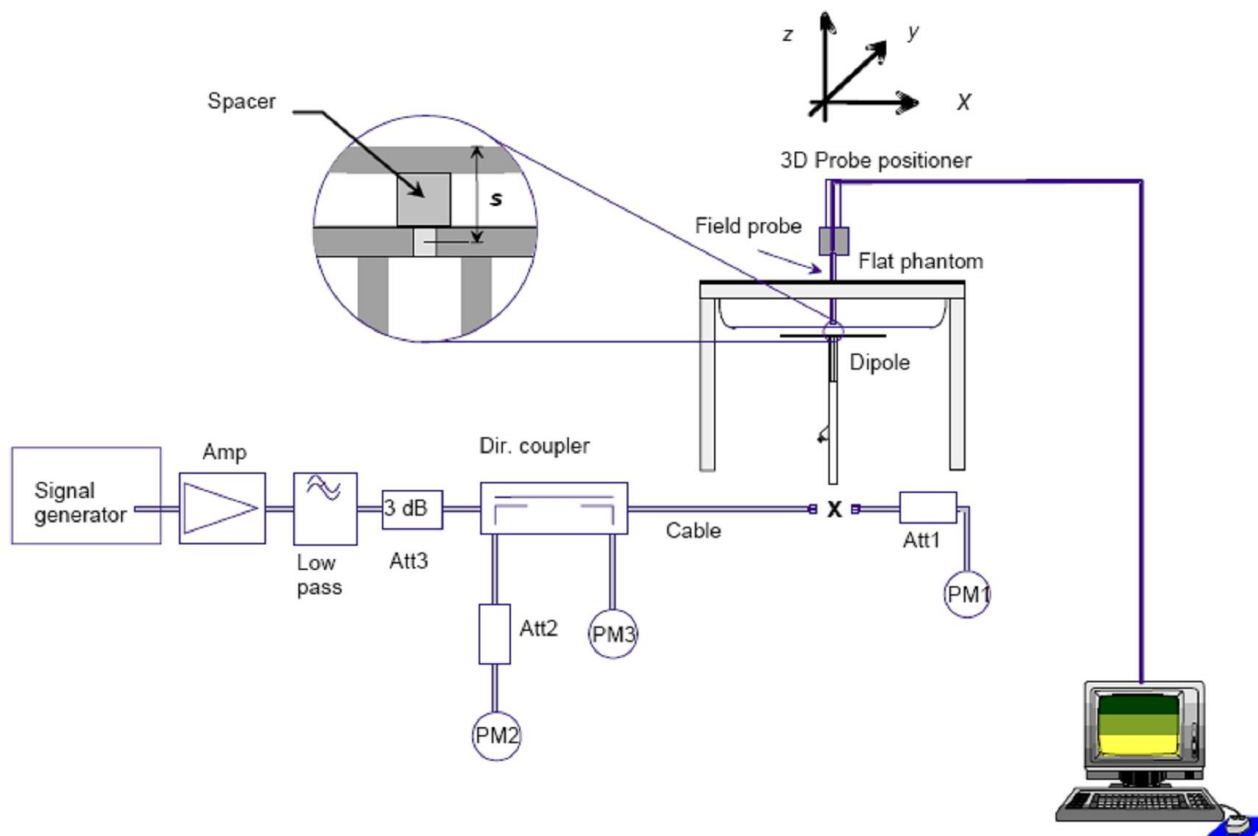
The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ [s/m]	ϵ_r	σ [s/m]
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00



5. SAR System Validation

5.1 Validation System:



5.2 Validation Dipoles:

The dipoles used is based on the IEEE-1528/EN62209-1 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE-1528/EN62209-1 and FCC Supplement C. the table below provides details for the mechanical and electrical specifications for the dipoles

Frequency	L(mm)	H(mm)	D(mm)
835MHz	161	89.8	3.6
1900MHz	68	39.5	3.6

**5.3 Validation Result:**

System performance check for Head at 835MHz,1900MHz

Validation Dipole: D835V2-SN:4d120

Frequency (MHz)	Description	SAR(1g) W/Kg	SAR(10g) W/Kg	Tissue Temp. (°C)	Date
835MHz	Reference	$9.29 \pm 10\%$ (8.36~10.22)	$6.0 \pm 10\%$ (5.40~6.60)	N/A	2014.12.15
	Validation	10.04	6.56	22.5	

Validation Dipole: D1900V2-SN:5d142

1900MHz	Reference	$40.5 \pm 10\%$ (36.45~44.55)	$21.2 \pm 10\%$ (19.08~23.32)	N/A	2014.12.16
	Validation	42.0	21.44	22.5	

System performance check for Body at 835MHz,1900MHz

Validation Dipole: D835V2-SN:4d120

Frequency (MHz)	Description	SAR(1g) W/Kg	SAR(10g) W/Kg	Tissue Temp. (°C)	Date
835MHz	Reference	$9.47 \pm 10\%$ (8.52~10.41)	$6.23 \pm 10\%$ (5.61~6.85)	N/A	2015.01.10
	Validation	9.68	6.24	22.5	

Validation Dipole: D1900V2-SN:5d142

1900MHz	Reference	$40.4 \pm 10\%$ (36.36~44.44)	$21.3 \pm 10\%$ (19.17~23.43)	N/A	2015.01.10
	Validation	42.40	21.60	22.5	

Note: Note: All system validation SAR values are measured at 24dBm and normalized to 1W forward power.



6. SAR Evaluation Procedures:

The procedure for assessing the average SAR value consists of the following steps:

➤ Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

➤ Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. The scanning area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the Area Scan's property sheet is brought-up, grid settings can be edited by a user.

➤ Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 7 x 7 x 7 points (5mmx5mmx5mm) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure.

➤ Power Drift Measurement

The Power Drift Measurement job measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement.

**7. SAR Exposure Limits**

SAR assessments have been made in line with the requirements of IEEE-1528,FCC Supplement C ,and comply with ANSI/IEEE C95.1-1992"Uncontrolled Environments" limits.

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

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60W/kg
Spatial Peak SAR (whole body)	0.08W/kg
Spatial Peak SAR (10g for hands,feet,ankles and wrist)	4.00W/kg

Note: Occupational/Uncontrolled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure,(i.e. as a result of employment or occupation)



8. Measurement Uncertainty:

8.1 Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram / 10 gram.

NO	Source	Uncert. ai (%)	Prob. Dist.	Div. k	ci (1g)	ci (10g)	Stand. Uncert. ui (1g)	Stand. Uncert. ui (10g)	V_{eff}
1	Repeat	0.04	N	1	1	1	0.04	0.04	9
Instrument									
2	Probe calibration	7	N	2	1	1	3.5	3.5	∞
3	Axial isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
4	Hemispherical isotropy	9.6	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
5	Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
7	Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
8	Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
9	Response time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
10	Integration time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
11	Ambient noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	Ambient reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Probe positioner mech. restrictions	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
14	Probe positioning with respect to phantom shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
15	Max.SAR evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞



Test sample related									
16	Device positioning	3.8	N	1	1	1	3.8	3.8	99
17	Device holder	5.1	N	1	1	1	5.1	5.1	5
18	Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up									
19	Phantom uncertainty	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Liquid conductivity (target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas)	2.5	N	1	0.64	0.43	1.6	1.2	∞
22	Liquid Permittivity (target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.5	∞
23	Liquid Permittivity (meas)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined standard			RSS	$U_c = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$			12.2%	11.9%	236
Expanded uncertainty (P=95%)		$U = k U_c$,k=2					24.4%	23.8%	



8.2 Measurement uncertainty for System Validation

NO	Source	Uncert. ai (%)	Prob. Dist.	Div. k	ci (1g)	ci (10g)	Stand. Uncert. ui (1g)	Stand. Uncert. ui (10g)	Veff
Measurement system									
1	Probe calibration	7	N	2	1	1	3.5	3.5	∞
2	Axial isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Hemispherical isotropy	9.6	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
4	Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
5	Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
6	System detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
7	Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
8	Response time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
9	Integration time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
10	Ambient noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Ambient reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	Probe positioner mech. restrictions	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
13	Probe positioning with respect to phantom shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
14	Max.SAR evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Dipole									
16	Dipole axis to liquid distance	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞



17	Input power and SAR drift measurement	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and tissue parameters									
18	Phantom uncertainty	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas)	2.5	N	1	0.64	0.43	1.6	1.2	∞
21	Liquid Permittivity (target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.5	∞
22	Liquid Permittivity (meas)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined standard			RSS	$U_c = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$			8.75%	8.50%	236
Expanded uncertainty (P=95%)		$U = k U_c$,k=2					17.50%	17.00%	

**9. Conducted Power Measurement:**

Band	Channel	Frequency (MHz)	Avg.Burst Power(dBm)	Duty Cycle Factor(dB)	Frame Power (dBm)
Maximum Power <SIM 1>					
GSM850	CH128	824.20	32.53	-9.03	23.50
	CH190	836.60	32.38	-9.03	23.35
	CH251	848.80	32.35	-9.03	23.32
PCS1900	Ch512	1850.20	29.28	-9.03	20.25
	CH661	1880.00	29.04	-9.03	20.01
	CH810	1909.80	28.94	-9.03	19.91
Maximum Power <SIM 2>					
GSM850	CH128	824.20	32.53	-9.03	23.50
	CH190	836.60	32.38	-9.03	23.35
	CH251	848.80	32.35	-9.03	23.32
PCS1900	Ch512	1850.20	29.28	-9.03	20.25
	CH661	1880.00	29.04	-9.03	20.01
	CH810	1909.80	28.94	-9.03	19.91



Band	Channel	Frequency (MHz)	Avg.Burst Power(dBm)	Duty Cycle Factor(dB)	Frame Power (dBm)
Maximum Power					
GPRS850 Slot1	CH128	824.20	32.63	-9.03	23.6
	CH190	836.60	32.41	-9.03	23.38
	CH251	848.80	32.37	-9.03	23.34
GPRS850 Slot2	CH128	824.20	31.84	-6.02	25.82
	CH190	836.60	31.63	-6.02	25.61
	CH251	848.80	31.56	-6.02	25.54
GPRS850 Slot3	CH128	824.20	30.16	-4.35	25.81
	CH190	836.60	29.88	-4.35	25.53
	CH251	848.80	29.75	-4.35	25.4
GPRS850 Slot4	CH128	824.20	29.06	-3	26.06
	CH190	836.60	28.73	-3	25.73
	CH251	848.80	28.51	-3	25.51
GPRS1900 Slot1	CH512	1850.20	29.29	-9.03	20.26
	CH661	1880.00	29.08	-9.03	20.05
	CH810	1909.80	29.02	-9.03	19.99
GPRS1900 Slot2	CH512	1850.20	28.52	-6.02	22.5
	CH661	1880.00	28.39	-6.02	22.37
	CH810	1909.80	28.34	-6.02	22.32
GPRS1900 Slot3	CH512	1850.20	26.83	-4.35	22.48
	CH661	1880.00	26.81	-4.35	22.46
	CH810	1909.80	26.87	-4.35	22.52
GPRS1900 Slot4	CH512	1850.20	25.72	-3	22.72
	CH661	1880.00	25.75	-3	22.75
	CH810	1909.80	25.92	-3	22.92



Test Mode	Channel	Frequency (MHz)	Avg. Power (dBm)
Bluetooth Output Power			
1Mbps (GFSK)	00	2402	5.12
	39	2441	5.80
	78	2480	5.88
2Mbps (Pi/4 DQPSK)	00	2402	4.61
	39	2441	5.25
	78	2480	5.34
3Mbps (8DPSK)	00	2402	4.44
	39	2441	5.21
	78	2480	5.14

Note : According to KDB 648474,Bluetooth output power is $\leq 10\text{dBm}$,standalone SAR for Bluetooth is not required.



10. Test photos and results:

10.1 DUT photos:



Front side



Back side



Antenna Location



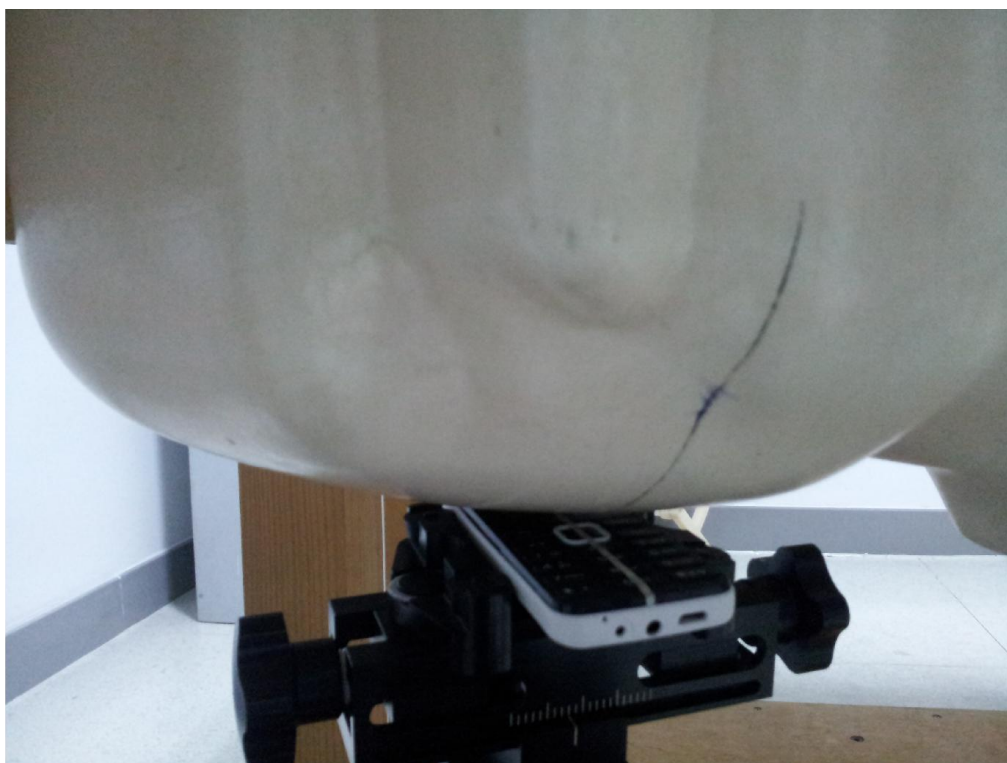
10.2 Setup photos:



Left Touch Cheek



Left Tilt(15°)



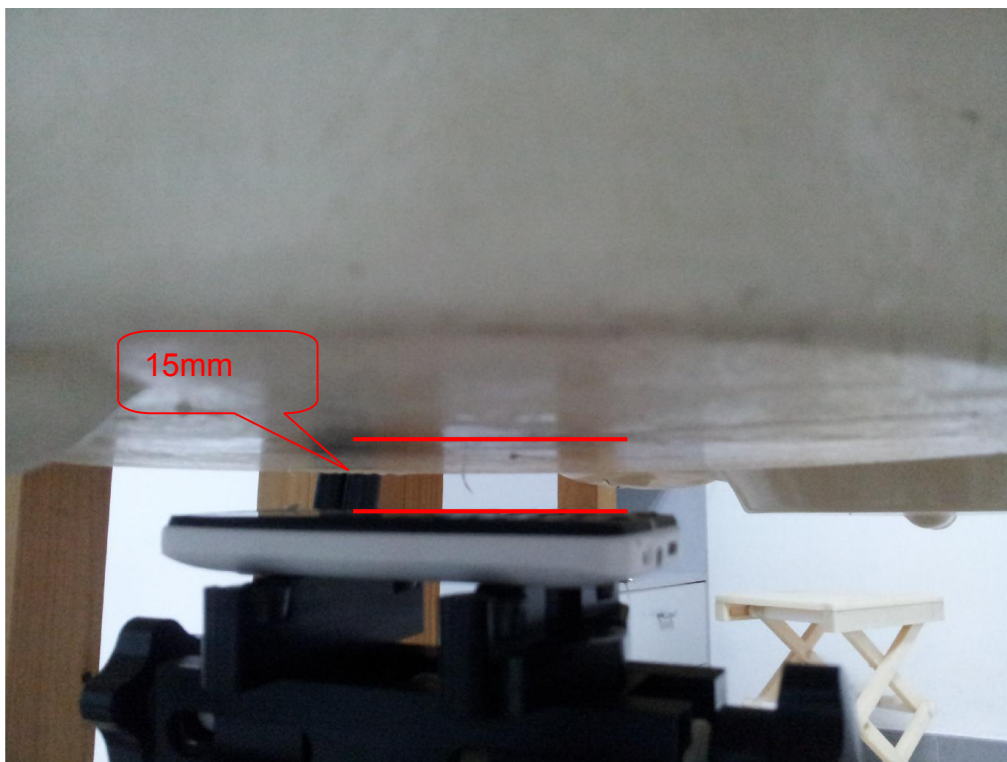
Right Touch Cheek



Right Tilt(15°)



Body:

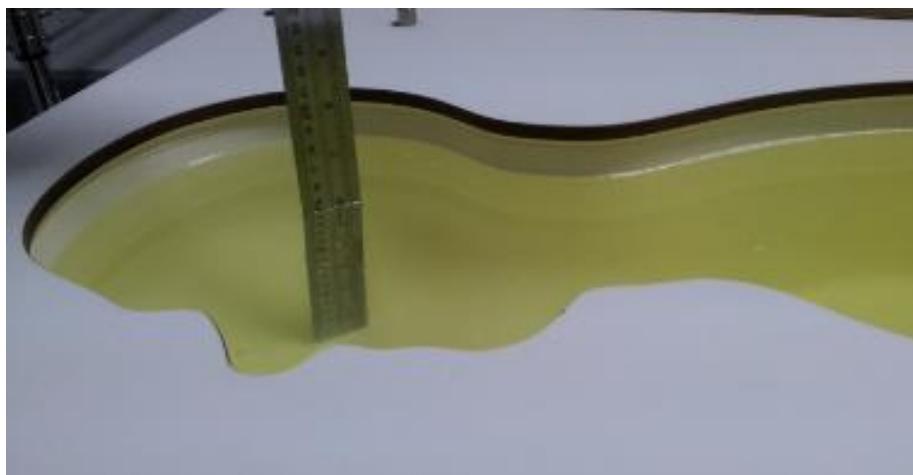


Body Front

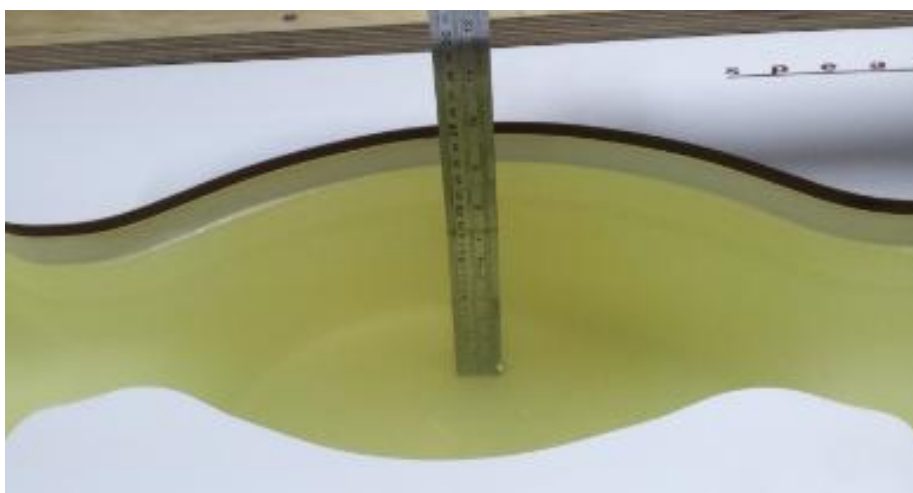


Body Worn

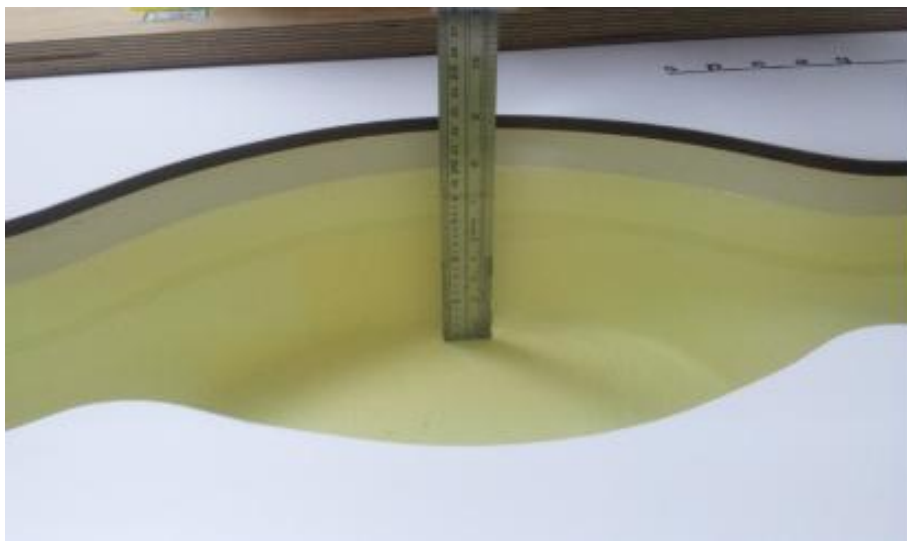
Body worn with headset



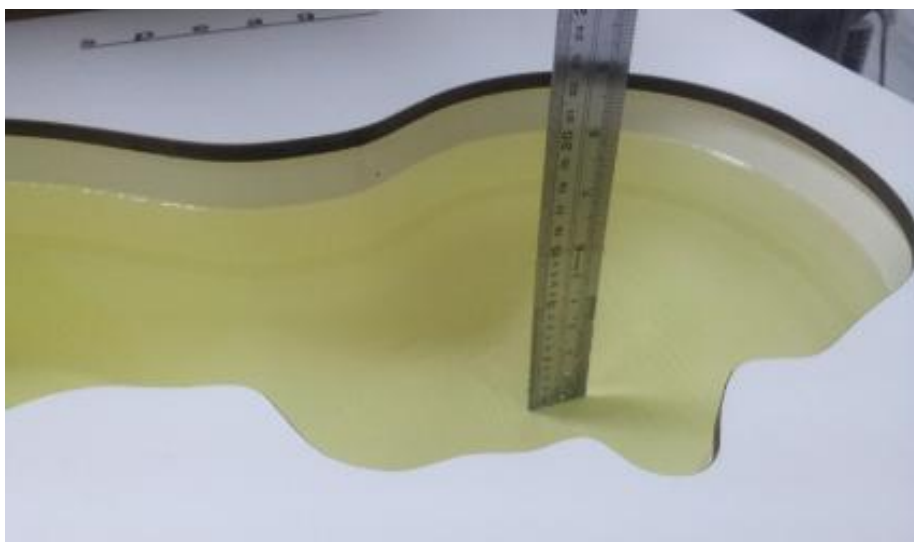
Liquid depth in the Head Phantom (835 MHz) (depth=15cm)



Liquid depth in the Flat Phantom (835 MHz) (depth=15cm)



Liquid depth in the Flat Phantom (1900MHz) (depth=15cm)



Liquid depth in the Head Phantom (1900MHz) (depth=15cm)



10.3 SAR result summary:

Scale Factor=Target Power/Measurement Power

Scale SAR=Measurement SAR*Scale Factor

Head

Test Case of Head			Meas. Power (dBm)	Target Power (dBm)	Factor	Meas. SAR (W/kg) 1g Avg.	Scale SAR (W/kg)	Power Drift <±0.2 dB	Data Slot
Band	Test Position	CH							
SIM1,Liquid: Head									
GSM 850	Right Cheek	CH190	32.38	33	1.15	0.863	0.992	0.142	Plot 1
	Right Cheek	CH128	32.53	33	1.11	0.733	0.814	-0.082	Plot 2
	Right Cheek	CH251	32.35	33	1.16	1.070	1.241	-0.028	Plot 3
	Right Tilt	CH190	32.38	33	1.15	0.448	0.515	-0.113	Plot 4
	Left Cheek	CH190	32.38	33	1.15	1.010	1.162	-0.040	Plot5
	Left Cheek	CH128	32.53	33	1.11	0.811	0.900	-0.035	Plot6
	Left Cheek	CH251	32.35	33	1.16	1.130	1.311	-0.056	Plot 7
	Left Cheek-rep1	CH251	32.35	33	1.16	1.08	1.253	-0.166	Plot 8
	Left Cheek-rep2	CH251	32.35	33	1.16	1.08	1.253	-0.166	Plot 8
	Left Tilt	CH190	32.38	33	1.15	0.504	0.580	-0.064	Plot10
SIM2,Liquid: Head									
GSM 850	Left Cheek	CH251	32.35	33	1.16	1.000	1.160	-0.073	Plot11
SIM1,Liquid: Head									
GSM 1900	Right Cheek	CH661	29.04	30	1.25	0.417	0.521	-0.0571	Plot 12
	Right Tilt	CH661	29.04	30	1.25	0.279	0.349	-0.001	Plot 13
	Left Cheek	CH661	29.04	30	1.25	0.562	0.701	0.0754	Plot 14
	Left Tilt	CH661	29.04	30	1.25	0.319	0.399	-0.017	Plot15
SIM2,Liquid: Head									
GSM 1900	Left Cheek	CH661	29.04	30	1.25	0.630	0.786	-0.119	Plot 16



Body

Test Case of Head			Meas. Power (dBm)	Target Power (dBm)	Factor	Meas. SAR (W/kg) 1g Avg.	Scale SAR (W/kg)	Power Drift <±0.2 dB	Data Slot
Band	Test Position	CH							
Liquid: Body, Separator: 15mm									
GSM 850	Worn	CH190	32.38	33	1.15	0.339	0.390	0.089	Plot 17
	Front	CH190	32.38	33	1.15	0.138	0.159	0.009	Plot 18
GSM 1900	Worn	CH661	29.04	30	1.25	0.134	0.168	0.061	Plot19
	Front	CH661	29.04	30	1.25	0.088	0.110	0.037	Plot 20

Note:

- When the 1g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional.



10.4 Co-located SAR

According to KDB 648474, Bluetooth output power is $\leq 10\text{dBm}$, standalone SAR for Bluetooth is not required

Simultaneous transmission SAR for BT:

$$\text{SAR} = (\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f_{\text{GHz}}/X}]$$

$$\text{Max Power} = 6\text{dBm} = 3.98\text{mW}$$

$$\text{Min Test separation distance} = 5\text{mm}$$

$$X = 7.5$$

$$F = 2.480\text{ GHz.}$$

$$\text{Head Estimated SAR} = 3.98/5 \cdot (1.57/7.5) = 0.166\text{ W/Kg.}$$

$$\text{Body Estimated SAR} = (3.98/5 \cdot (1.57/7.5)) = 0.166\text{ W/Kg}$$

The simultaneous transmission between BT and GSM

Head SAR value and the sum of the 1-g SAR for WLAN&GMS

Max 1-g SAR(W/kg)			Σ 1-g SAR(W/kg)
Position	BT	GSM	
Head-Left	0.166	1.346	1.512

The simultaneous transmission between BT and GSM

Body SAR value and the sum of the 1-g SAR for WLAN&GMS

Max 1-g SAR(W/kg)			Σ 1-g SAR(W/kg)
Position	BT	GSM	
Body-Worn	0.166	0.390	0.556

Note: 1.This device just supports simultaneous transmission between BT and GSM

Conclusion:

1. Simultaneous Transmission: **BT&GSM**

2. Require for simultaneous Transmission SAR with Volume Scans:

NO (Σ 1-g SAR < 1.6W/Kg)

**11. Equipment List:**

NO.	Instrument	Manufacture	Model	S/N	Cal. Date	Cal. Due Date
1	Communication	Agilent	E5515C	MY50267264	Dec 27th 2013	Dec 26th 2014
2	E-field Probe	Speag	ES3DV3	3028	Oct 22nd 2014	Oct 21st 2015
3	Dielectric Probe	Speag	DAK 3.5mm	1038	N/A	N/A
4	DAE	Speag	DAE4	689	Oct 01st 2014	Sep 30th 2015
5	SAM TWIN	Speag	SAM	1360/1432	N/A	N/A
6	Robot	Stabuli	TX60L	N/A	N/A	N/A
7	Device Holder	Speag	SD000H01HA	N/A	N/A	N/A
8	Vector Network	Agilent	E5071C	MY46107615	Nov 11st 2014	Nov 10th 2015
9	Signal Generator	Agilent	E4438C	MY49072279	Nov 11st 2014	Nov 10th 2015
10	Amplifier	Mini-circuit	ZHL-42W	QA098002	N/A	N/A
11	Power Meter	Agilent	N1419A	MY50001563	Nov 11st 2014	Nov 10th 2015
12	Power Sensor	Agilent	N8481H	MY51020010	Nov 11st 2014	Nov 10th 2015
13	EPM Power Meter	Agilent	E4418B	GB39512692	Apr.20 th 2014	Apr.19 th 2015
14	Power Sensor	Agilent	8481A	MY41090341	Apr.20 th 2014	Apr.19 th 2015
15	Directional	Agilent	772D	MY46151275	Nov 11st 2014	Nov 10th 2015
16	Directional	Agilent	778D	MY48220607	Nov 11st 2014	Nov 10th 2015
17	Dipole 835MHz	Speag	D835V2	4d120	Jun 16 th 2014	Jun 15 th 2015
18	Dipole 1900MHz	Speag	D1900V2	5d142	Jun 18 th 2014	Jun 17 th 2015



Appendix A. System validation plots:

DUT: Dipole 835MHz; Type: D835V2; Serial: D835V2 - SN:4d120

Program Name: System Performance Check Head at 835 MHz

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.91 \text{ mho/m}$; $\epsilon_r = 42.27$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn689; Calibrated: 10/1/2014

- Phantom: SAM with TP1432; Type: SAM

- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 2.59 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

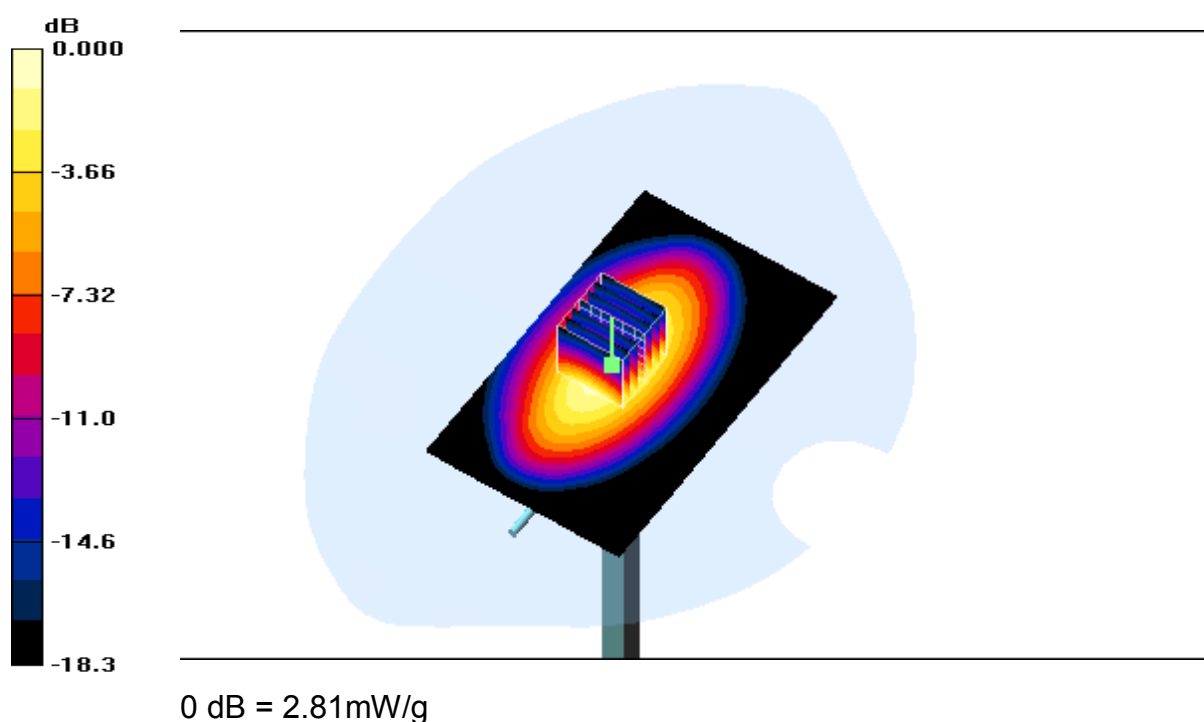
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.38 V/m ; Power Drift = -0.03dB

Peak SAR (extrapolated) = 3.61W/kg

SAR(1 g) = 2.51 mW/g ; SAR(10 g) = 1.64 mW/g

Maximum value of SAR (measured) = 2.81 mW/g





DUT: Dipole 835MHz; Type: D835V2; Serial: D835V2 - SN:4d120

Program Name: System Performance Check Body at 835 MHz

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.98 \text{ mho/m}$; $\epsilon_r = 54.73$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.02, 6.02, 6.02); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 2.49 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

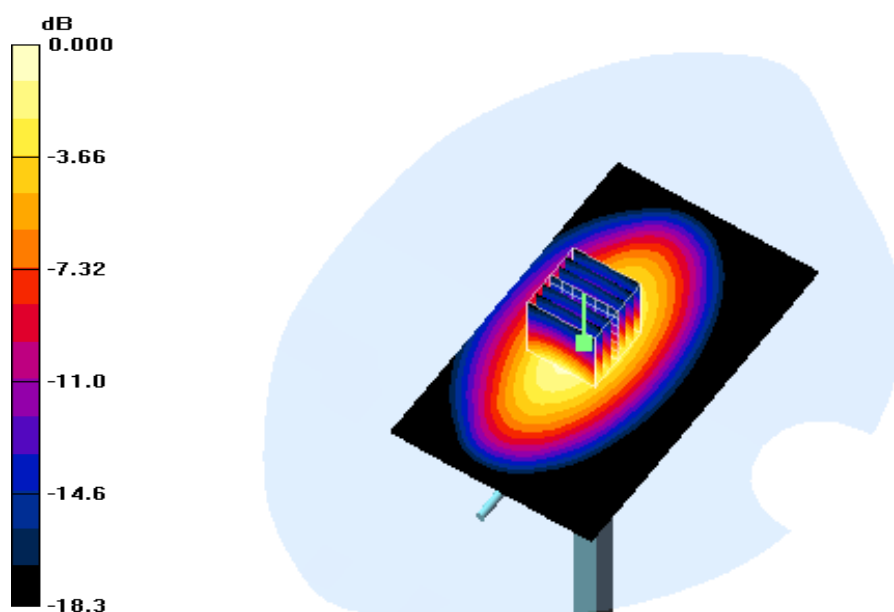
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.04 V/m ; Power Drift = -0.00dB

Peak SAR (extrapolated) = 3.61 W/kg

SAR(1 g) = 2.42 mW/g ; SAR(10 g) = 1.56 mW/g

Maximum value of SAR (measured) = 2.84 mW/g



0 dB = 2.84 mW/g



DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d142

Program Name: System Performance Check Head at 1900 MHz

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.27$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.68, 4.68, 4.68); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

d=15mm, Pin=250mW/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 11.1 mW/g

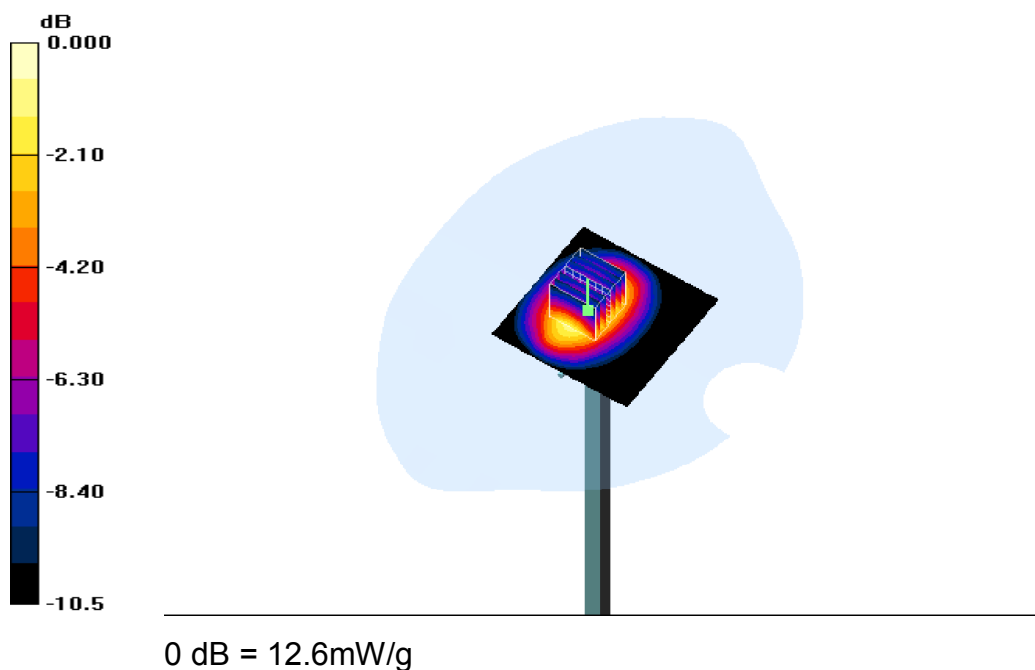
d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.07 V/m; Power Drift = -0.099dB

Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.36 mW/g

Maximum value of SAR (measured) = 12.6 mW/g





DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d142

Program Name: System Performance Check Body at 1900 MHz

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 52.45$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.48,4.48,4.48); Calibrated: 10/22/2014

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn689; Calibrated: 10/1/2014

- Phantom: SAM with TP1432; Type: SAM

- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

d=15mm, Pin=250mW/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12 mW/g

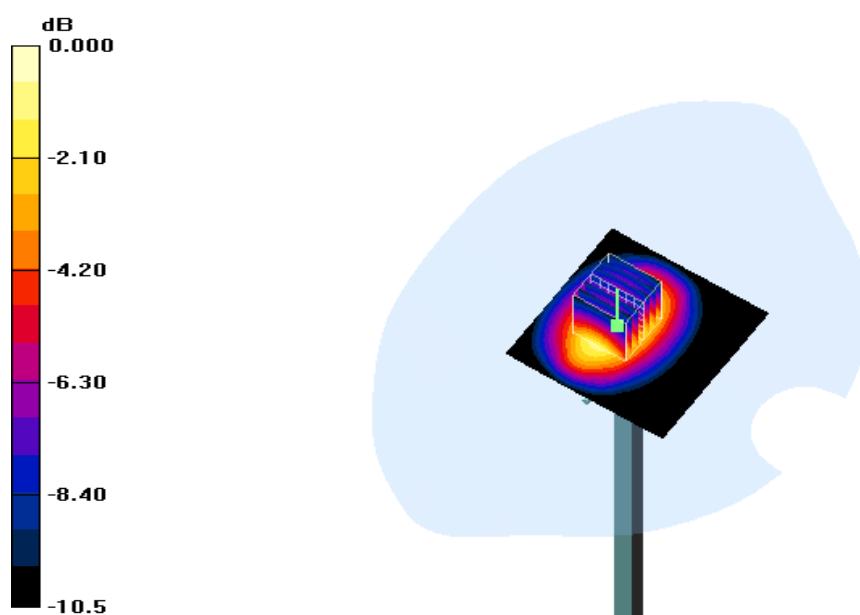
d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =94.36 V/m; Power Drift = 0.05dB

Peak SAR (extrapolated) = 17.3 W/kg

SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.40 mW/g

Maximum value of SAR (measured) = 12.5 mW/g



0 dB = 12mW/g



Appendix B. SAR Test plots:

Plot 1: 12/15/2014 11:03:13 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.957$ mho/m; $\epsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Right touch/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.939 mW/g

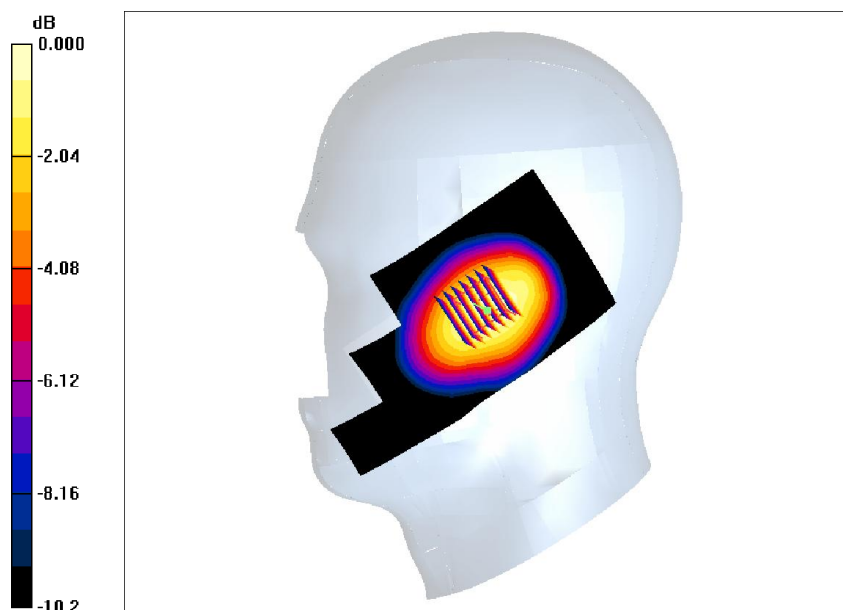
Right touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.7 V/m; Power Drift = 0.142 dB

Peak SAR (extrapolated) = 1.19 W/kg

SAR(1 g) = 0.863 mW/g; SAR(10 g) = 0.596 mW/g

Maximum value of SAR (measured) = 0.915 mW/g



0 dB = 0.915mW/g



Plot 2: 12/15/2014 11:30:35 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.942$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn689; Calibrated: 10/1/2014

- Phantom: SAM with TP1432; Type: SAM;

- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Right touch/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.795 mW/g

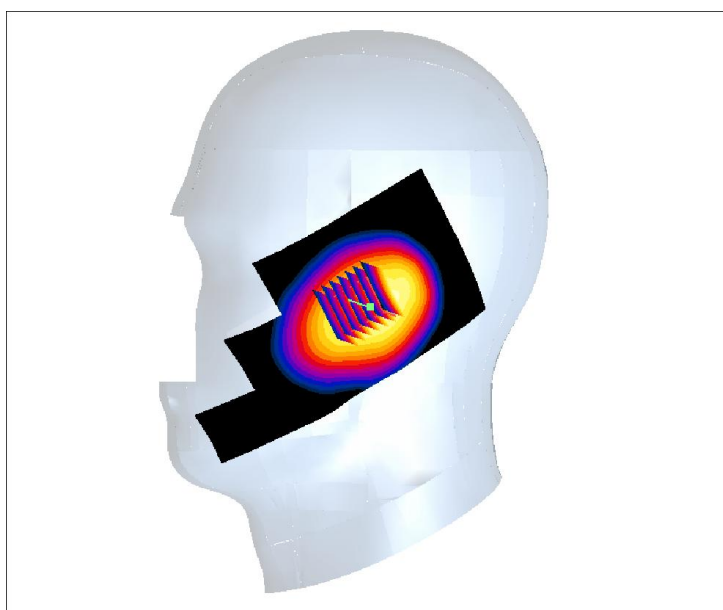
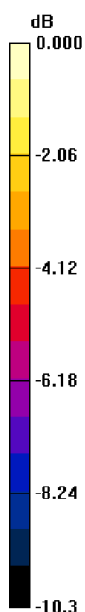
Right touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.4 V/m; Power Drift = -0.082 dB

Peak SAR (extrapolated) = 1.01 W/kg

SAR(1 g) = 0.733 mW/g; SAR(10 g) = 0.509 mW/g.

Maximum value of SAR (measured) = 0.785 mW/g



0 dB = 0.785mW/g



Plot 3:12/15/2014 12:38:14 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.971$ mho/m; $\epsilon_r = 42.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Right touch /Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.18 mW/g

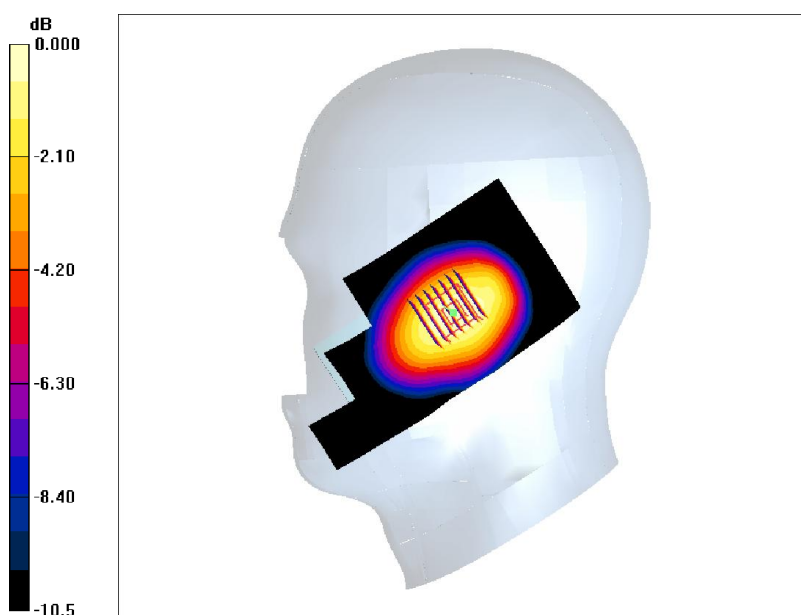
Right touch /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.1 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 1.07 mW/g; SAR(10 g) = 0.746 mW/g

Maximum value of SAR (measured) = 1.15 mW/g



0 dB = 1.15mW/g



Plot 4: 12/15/2014 12:05:18 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.957$ mho/m; $\epsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Right tilt/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.493 mW/g

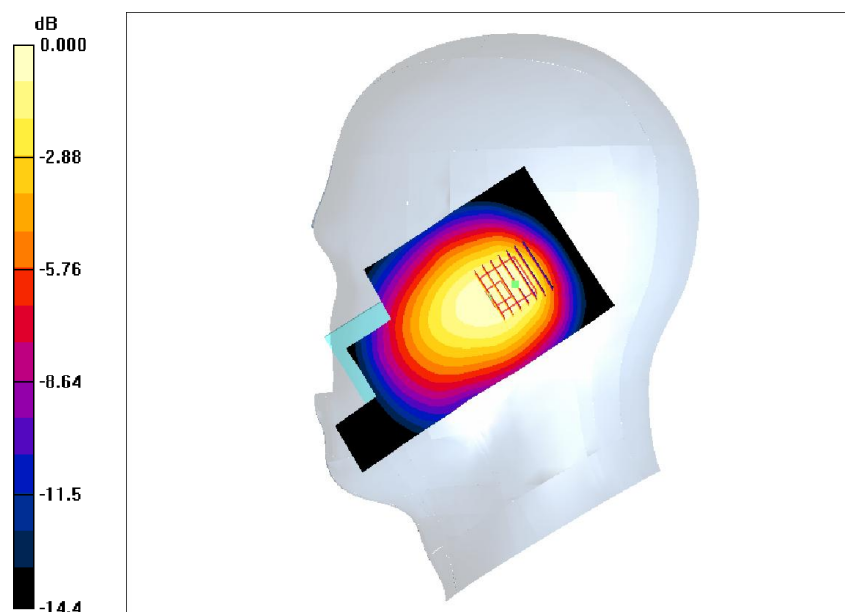
Right tilt/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.2 V/m; Power Drift = -0.113 dB

Peak SAR (extrapolated) = 0.607 W/kg

SAR(1 g) = 0.448 mW/g; SAR(10 g) = 0.296 mW/g

Maximum value of SAR (measured) = 0.481 mW/g



0 dB = 0.481mW/g



Plot 5: 12/15/2014 13:33:59 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.957$ mho/m; $\epsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.11 mW/g

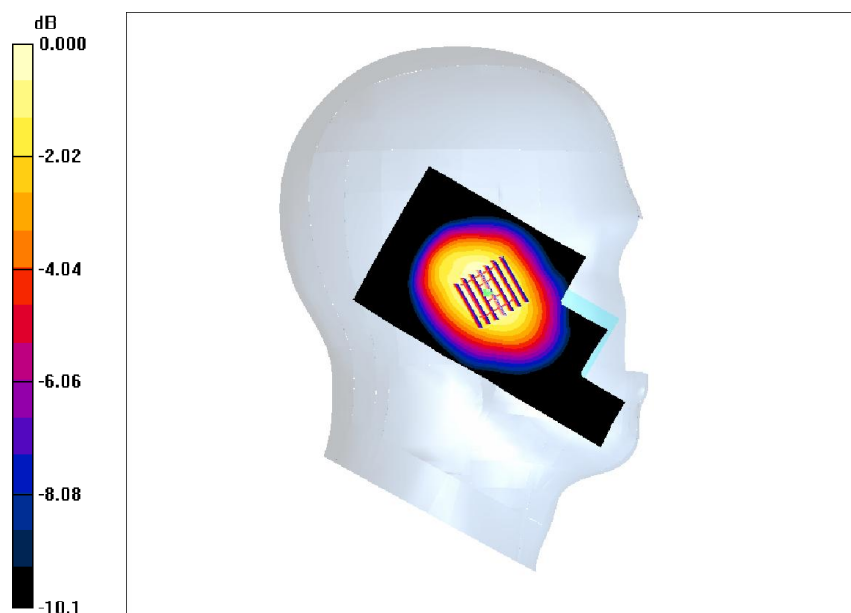
Left touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.4 V/m; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 1.41 W/kg

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.702 mW/g

Maximum value of SAR (measured) = 1.07 mW/g



0 dB = 1.07mW/g



Plot 6: 12/15/2014 14:32:22 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.942$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.872 mW/g

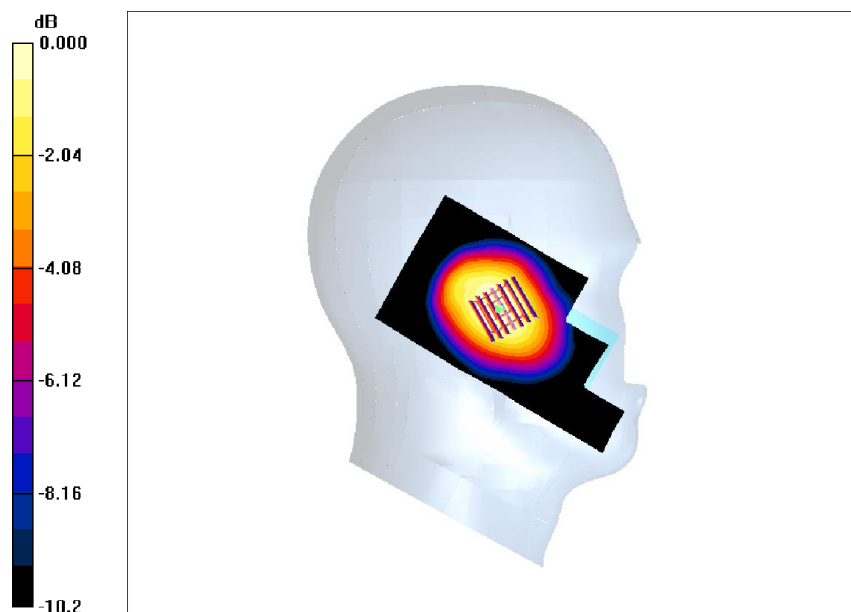
Left touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.4 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.811 mW/g; SAR(10 g) = 0.565 mW/g

Maximum value of SAR (measured) = 0.869 mW/g



0 dB = 0.869mW/g



Plot 7: 12/15/2014 15:05:33 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.971$ mho/m; $\epsilon_r = 42.7$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.22 mW/g

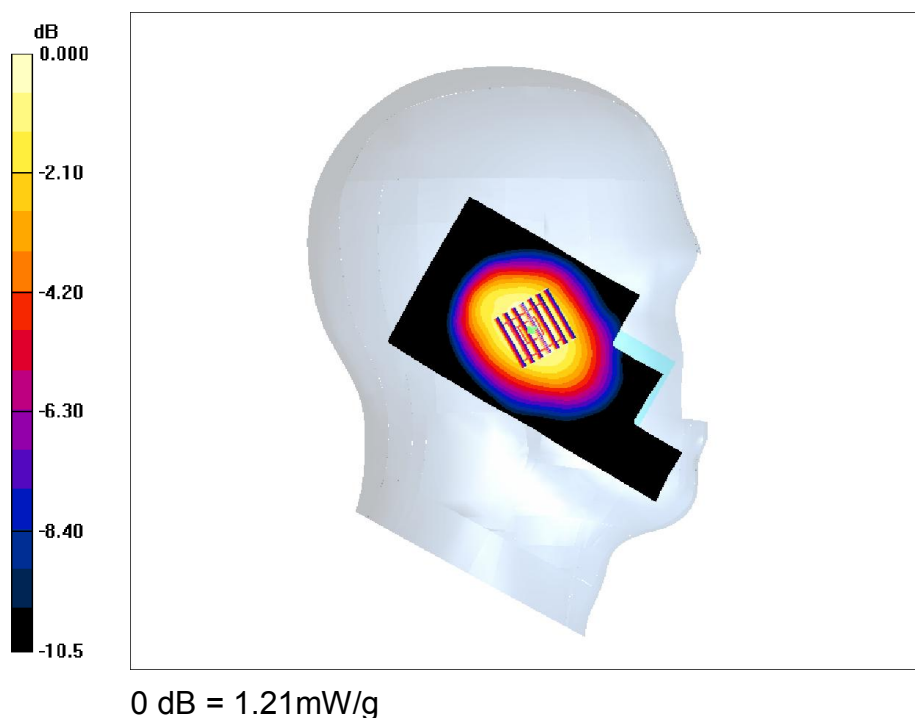
Left touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.9 V/m; Power Drift = -0.056 dB

Peak SAR (extrapolated) = 1.58 W/kg

SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.786 mW/g

Maximum value of SAR (measured) = 1.21 mW/g





Plot 8: 12/15/2014 15:39:53 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.971$ mho/m; $\epsilon_r = 42.7$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch repeat 1/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.16 mW/g

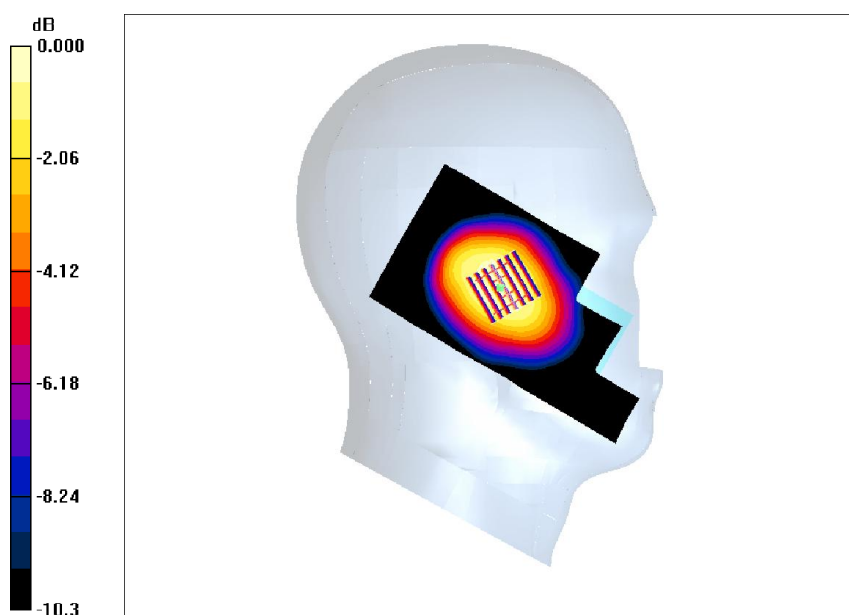
Left touch repeat 1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.5 V/m; Power Drift = -0.166 dB

Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.748 mW/g

Maximum value of SAR (measured) = 1.14 mW/g



0 dB = 1.14mW/g



Plot 09: 12/15/2014 16:10:03 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.971$ mho/m; $\epsilon_r = 42.7$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch repeat 2/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.26 mW/g

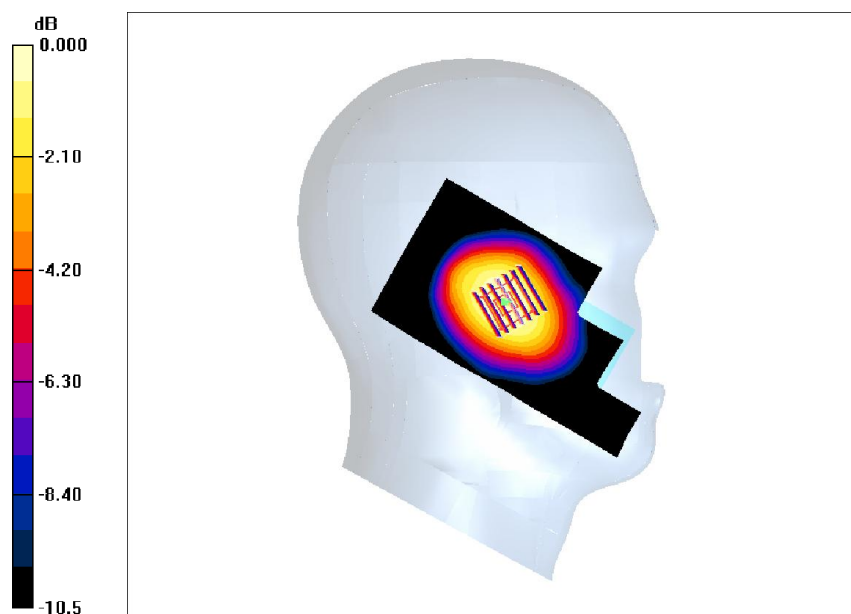
Left touch repeat 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.8 V/m; Power Drift = -0.027 dB

Peak SAR (extrapolated) = 1.63 W/kg

SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.806 mW/g

Maximum value of SAR (measured) = 1.25 mW/g



0 dB = 1.25mW/g



Plot 10: 12/15/2014 14:03:52 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.957$ mho/m; $\epsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn689; Calibrated: 10/1/2014

- Phantom: SAM with TP1432; Type: SAM;

- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left tilt/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.562 mW/g

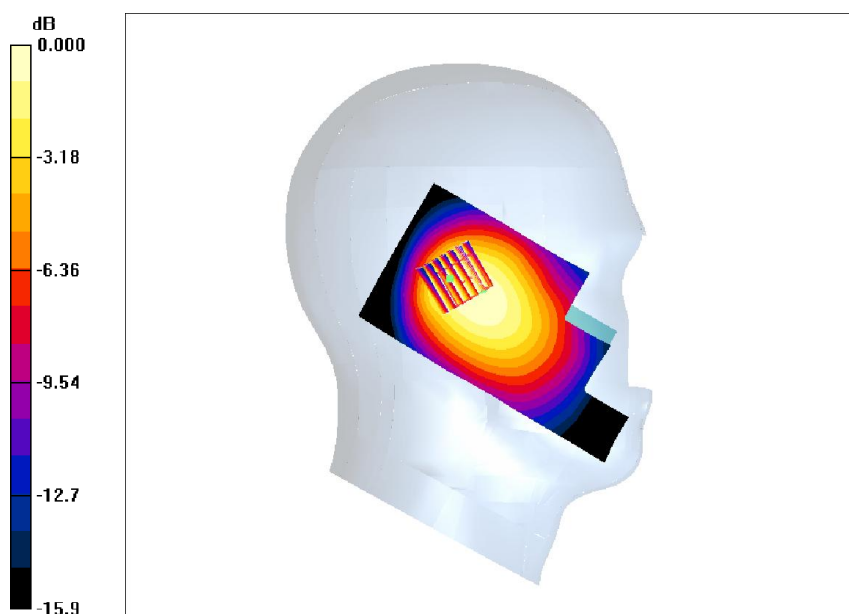
Left tilt/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.8 V/m; Power Drift = -0.063 dB

Peak SAR (extrapolated) = 0.685 W/kg

SAR(1 g) = 0.504 mW/g; SAR(10 g) = 0.329 mW/g

Maximum value of SAR (measured) = 0.545 mW/g



0 dB = 0.545mW/g



Plot 11: 12/15/2014 16:40:23 PM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.971$ mho/m; $\epsilon_r = 42.7$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.19, 6.19, 6.19); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch SIM2/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.974 mW/g

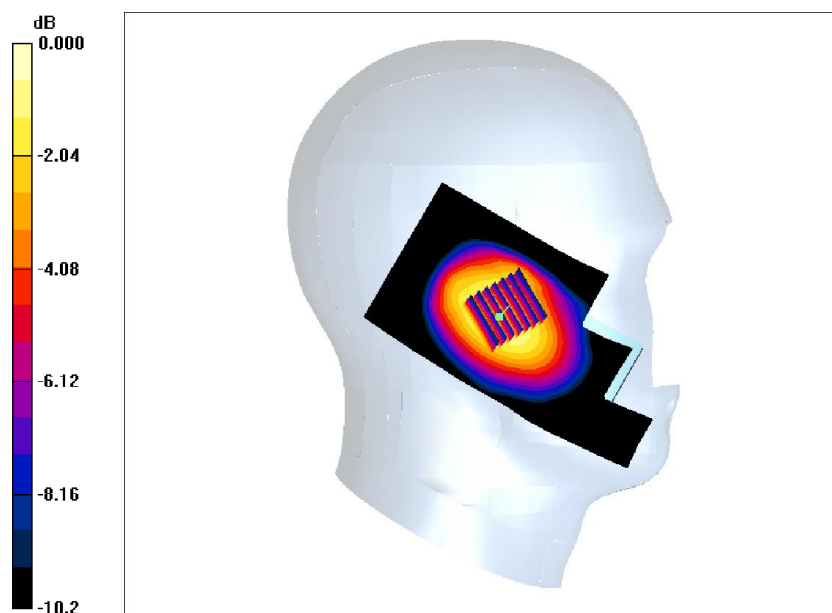
Left touch SIM2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.3 V/m; Power Drift = -0.073 dB

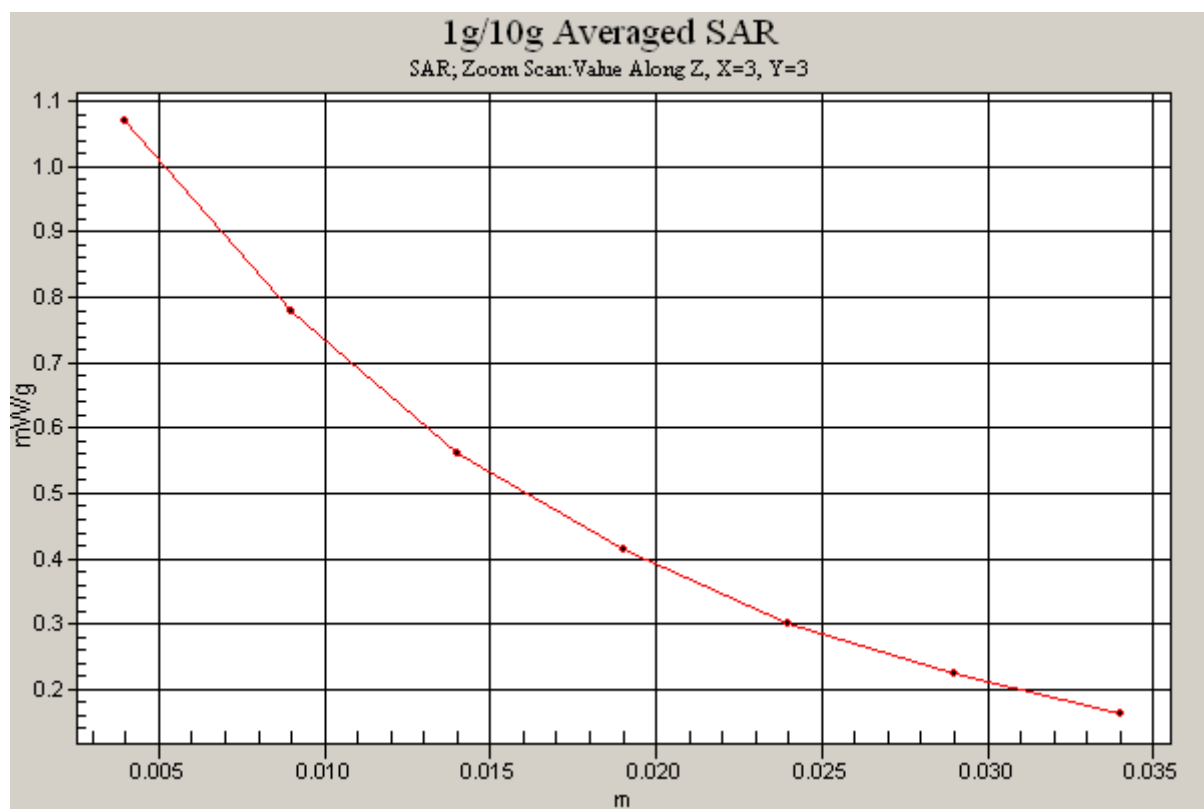
Peak SAR (extrapolated) = 1.39 W/kg

SAR(1 g) = 1 mW/g; SAR(10 g) = 0.695 mW/g

Maximum value of SAR (measured) = 1.07 mW/g



0 dB = 1.07mW/g





Plot 12: 12/16/2014 08:08:16 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 40.5$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.68, 4.68, 4.68); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Right touch/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.487 mW/g

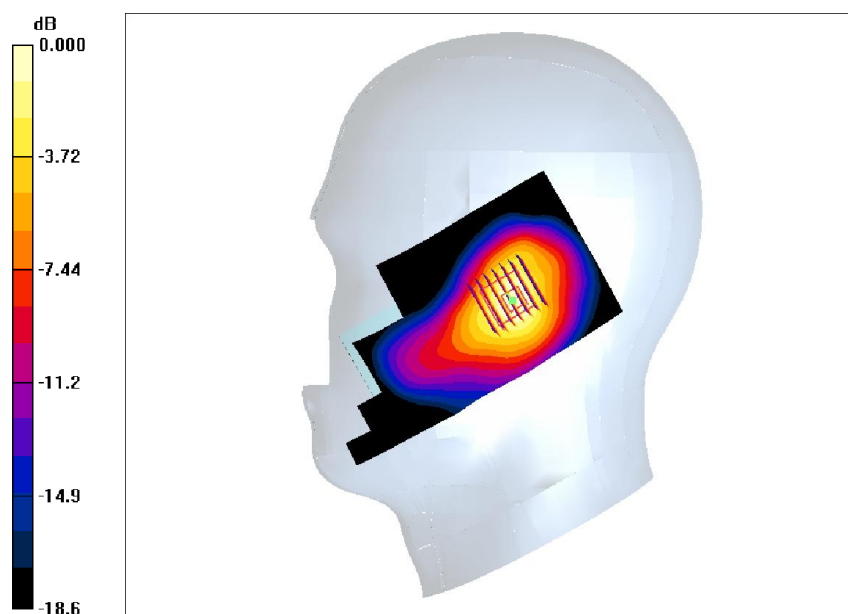
Right touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.2 V/m; Power Drift = -0.0571 dB

Peak SAR (extrapolated) = 0.719 W/kg

SAR(1 g) = 0.417 mW/g; SAR(10 g) = 0.229 mW/g

Maximum value of SAR (measured) = 0.462 mW/g



0 dB = 0.462mW/g



Plot 13: 12/16/2014 08:35:57 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.45 \text{ mho/m}$; $\epsilon_r = 40.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.68, 4.68, 4.68); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Right tilt/Area Scan (61x111x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.313 mW/g

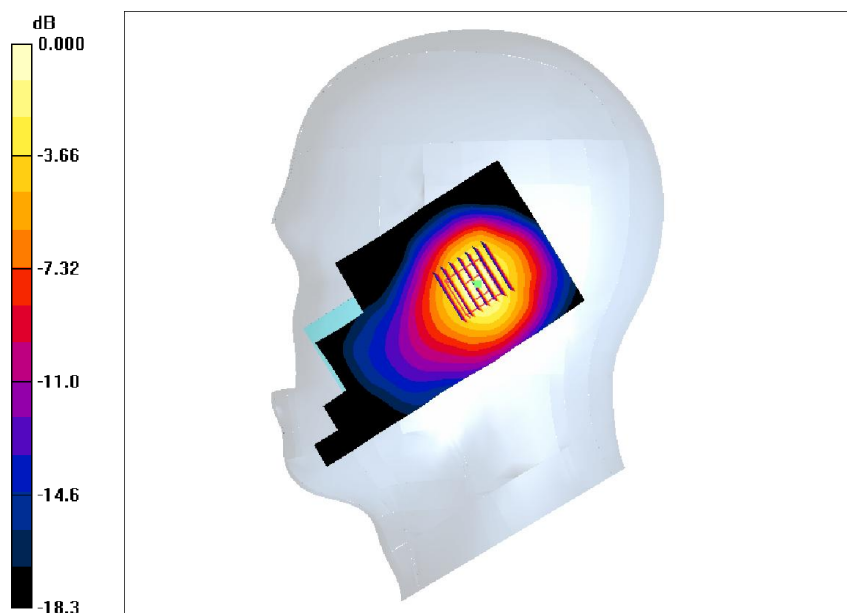
Right tilt/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 11.1 V/m; Power Drift = -0.001 dB

Peak SAR (extrapolated) = 0.505 W/kg

SAR(1 g) = 0.279 mW/g; SAR(10 g) = 0.151 mW/g

Maximum value of SAR (measured) = 0.308 mW/g



0 dB = 0.308mW/g



Plot 14 12/16/2014 08:05:57AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.45 \text{ mho/m}$; $\epsilon_r = 40.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.68, 4.68, 4.68); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch/Area Scan (61x111x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.616 mW/g

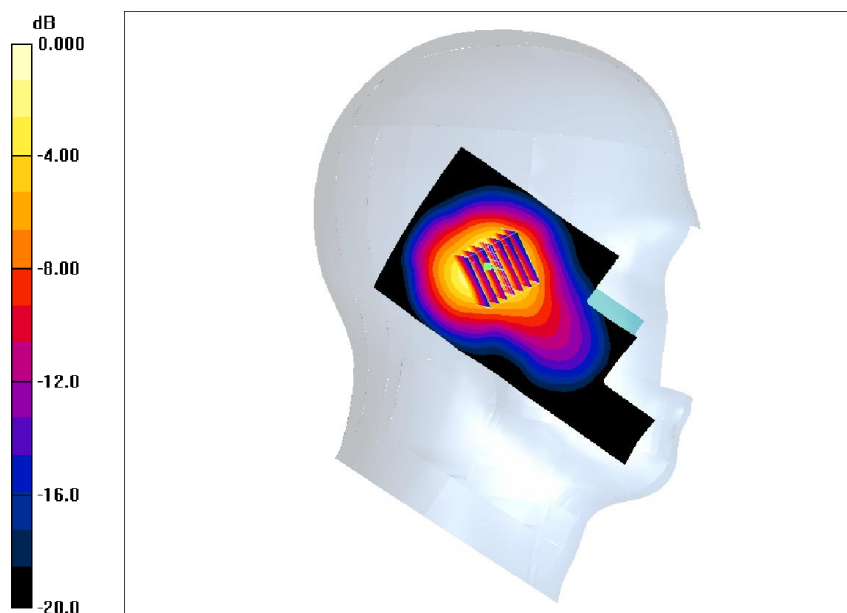
Left touch/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 10.5 V/m ; Power Drift = 0.0754 dB

Peak SAR (extrapolated) = 0.953 W/kg

SAR(1 g) = 0.562 mW/g ; SAR(10 g) = 0.306 mW/g

Maximum value of SAR (measured) = 0.630 mW/g



0 dB = 0.630mW/g



Plot 15 12/16/2014 08:36:22 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 40.5$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.68, 4.68, 4.68); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left tilt/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.387 mW/g

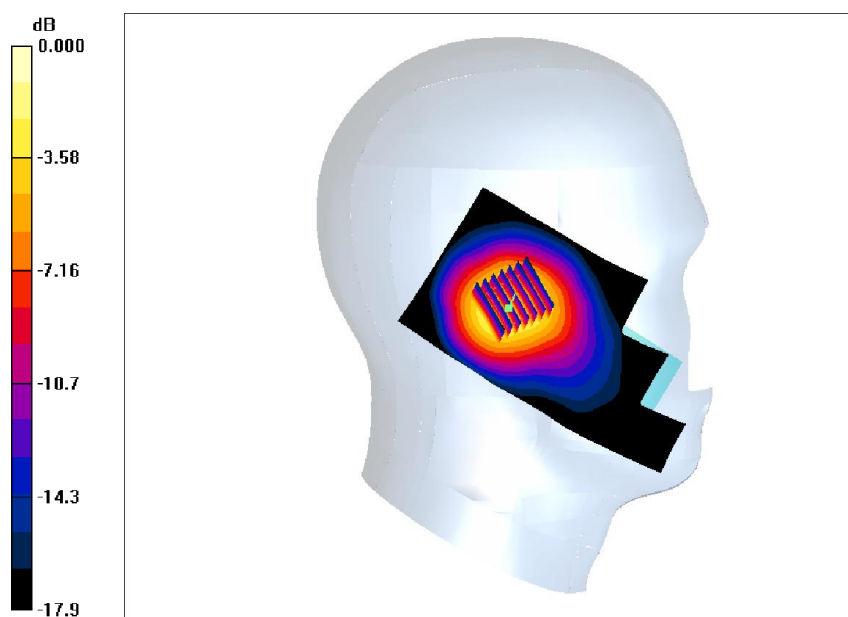
Left tilt/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.3 V/m; Power Drift = -0.017 dB

Peak SAR (extrapolated) = 0.632 W/kg

SAR(1 g) = 0.319mW/g; SAR(10 g) = 0.185 mW/g

Maximum value of SAR (measured) = 0.386 mW/g



0 dB = 0.386mW/g



Plot 16: 12/16/2014 09:07:15 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.45 \text{ mho/m}$; $\epsilon_r = 40.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.68, 4.68, 4.68); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Left touch -SIM2/Area Scan (61x111x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.665 mW/g

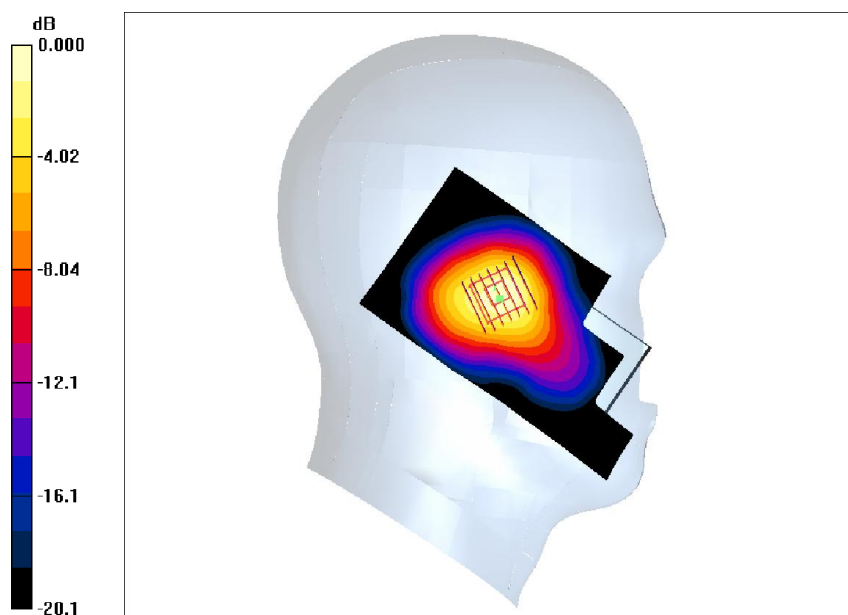
Left touch -SIM2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 9.62 V/m ; Power Drift = -0.119 dB

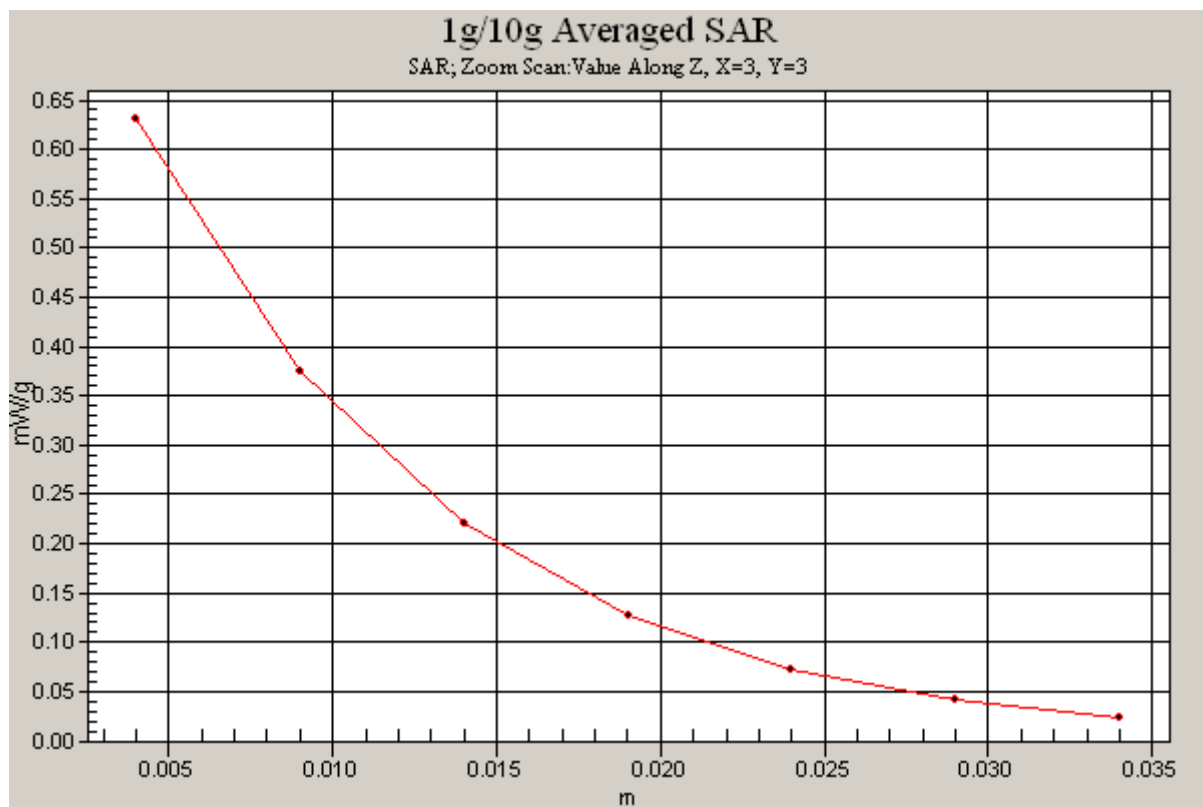
Peak SAR (extrapolated) = 1.10 W/kg

SAR(1 g) = 0.630 mW/g ; SAR(10 g) = 0.342 mW/g

Maximum value of SAR (measured) = 0.689 mW/g



0 dB = 0.689mW/g





Plot 17: 01/10/2015 09:10:23 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.02, 6.02, 6.02); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM; Serial:
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Worn/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.369 mW/g

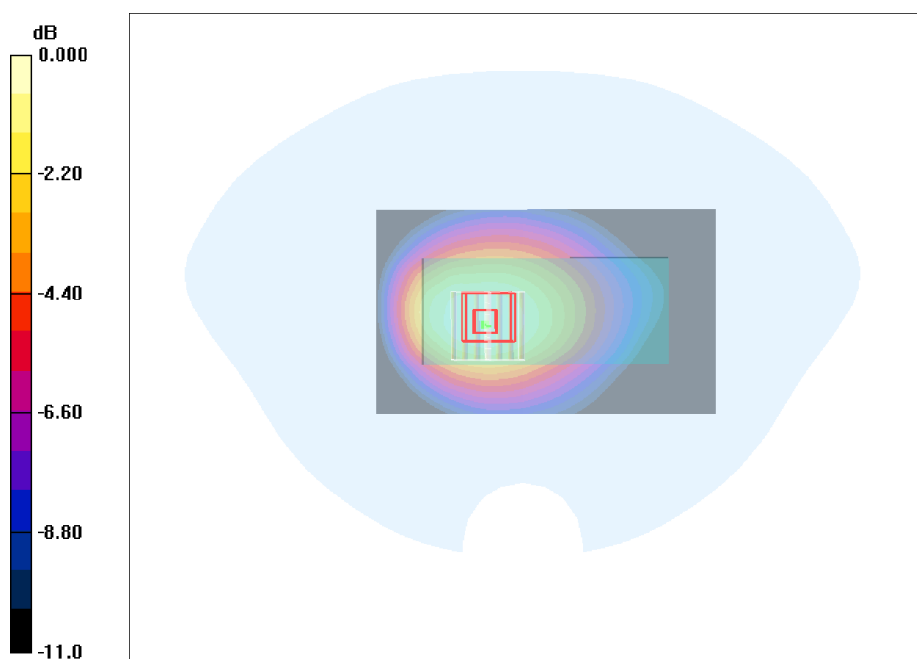
Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.6 V/m; Power Drift = -0.089 dB

Peak SAR (extrapolated) = 0.465 W/kg

SAR(1 g) = 0.339 mW/g; SAR(10 g) = 0.237 mW/g

Maximum value of SAR (measured) = 0.359 mW/g



0 dB = 0.359mW/g



Plot 18: 01/10/2015 09:45:18 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(6.02, 6.02, 6.02); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1432; Type: SAM; Serial:
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Front/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.147 mW/g

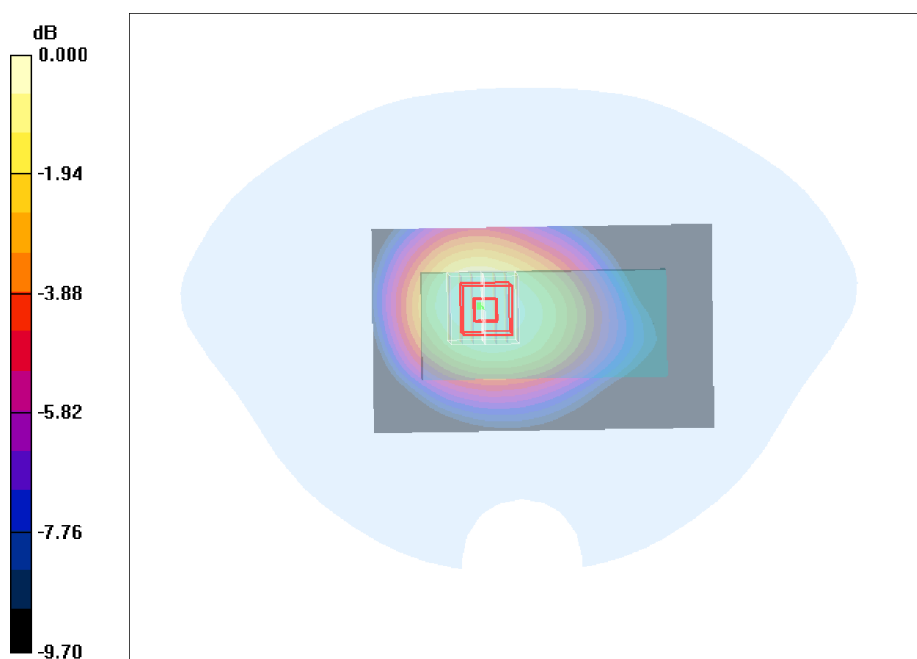
Front/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.3 V/m; Power Drift = 0.009 dB

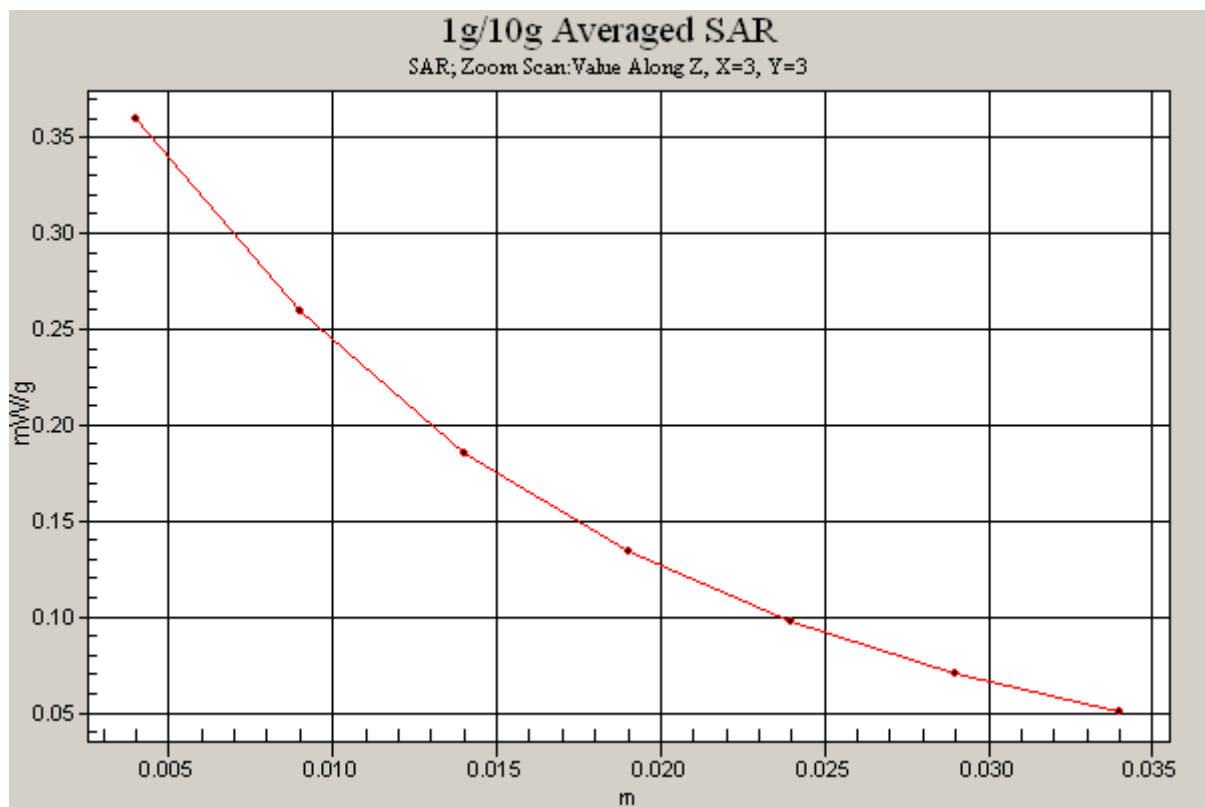
Peak SAR (extrapolated) = 0.186 W/kg

SAR(1 g) = 0.138 mW/g; SAR(10 g) = 0.099 mW/g

Maximum value of SAR (measured) = 0.146 mW/g



0 dB = 0.146mW/g





Plot 19: 01/10/2015 10:04:35 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.58 \text{ mho/m}$; $\epsilon_r = 52.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.48, 4.48, 4.48); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM; Serial:
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Worn/Area Scan (61x101x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.147 mW/g

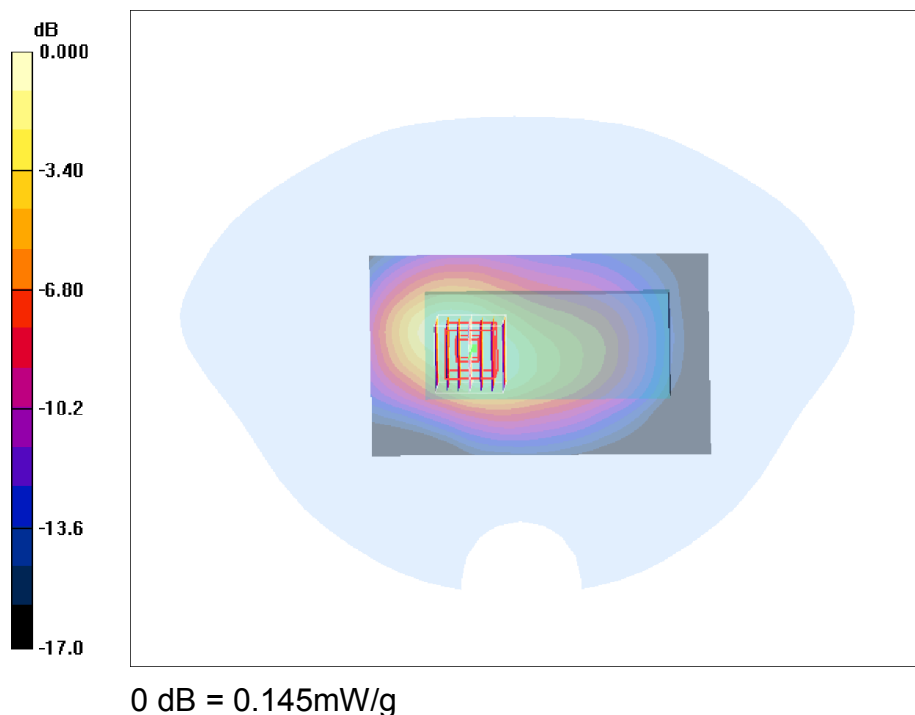
Worn/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 7.64 V/m ; Power Drift = -0.061 dB

Peak SAR (extrapolated) = 0.232 W/kg

SAR(1 g) = 0.134 mW/g ; SAR(10 g) = 0.078 mW/g

Maximum value of SAR (measured) = 0.145 mW/g





Plot 20: 01/10/2015 10:35:15 AM

Test Laboratory: SUNWAY COMMUNICATION CO.,LTD.

DUT: M182; Type: SI PIN; Serial: IMEI Number

Program Name: M182

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.58 \text{ mho/m}$; $\epsilon_r = 52.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3028; ConvF(4.48, 4.48, 4.48); Calibrated: 10/22/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn689; Calibrated: 10/1/2014
- Phantom: SAM with TP1360; Type: SAM; Serial:
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Front/Area Scan (61x101x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.084 mW/g

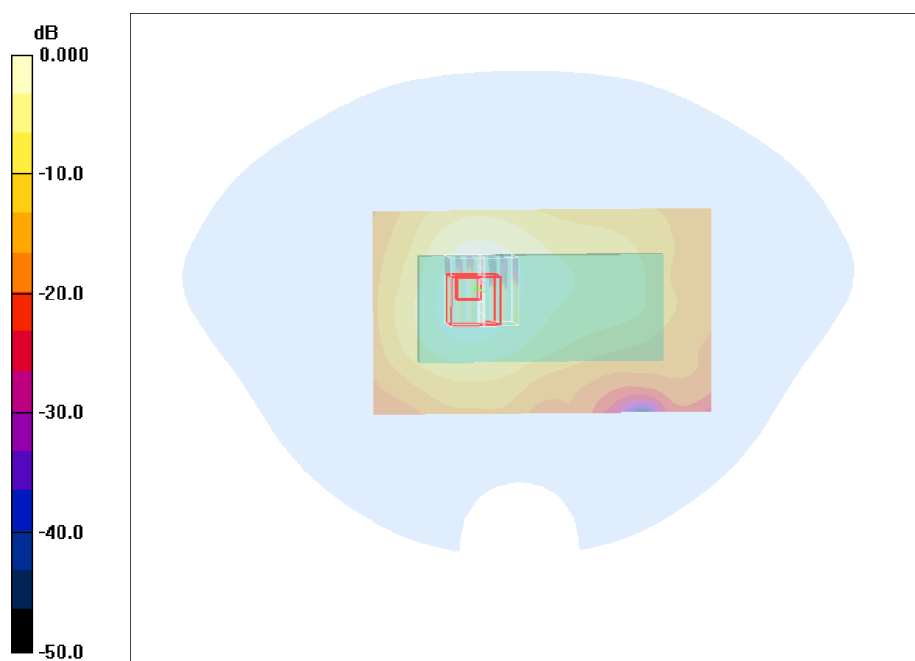
Front/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.88 V/m; Power Drift = -0.037 dB

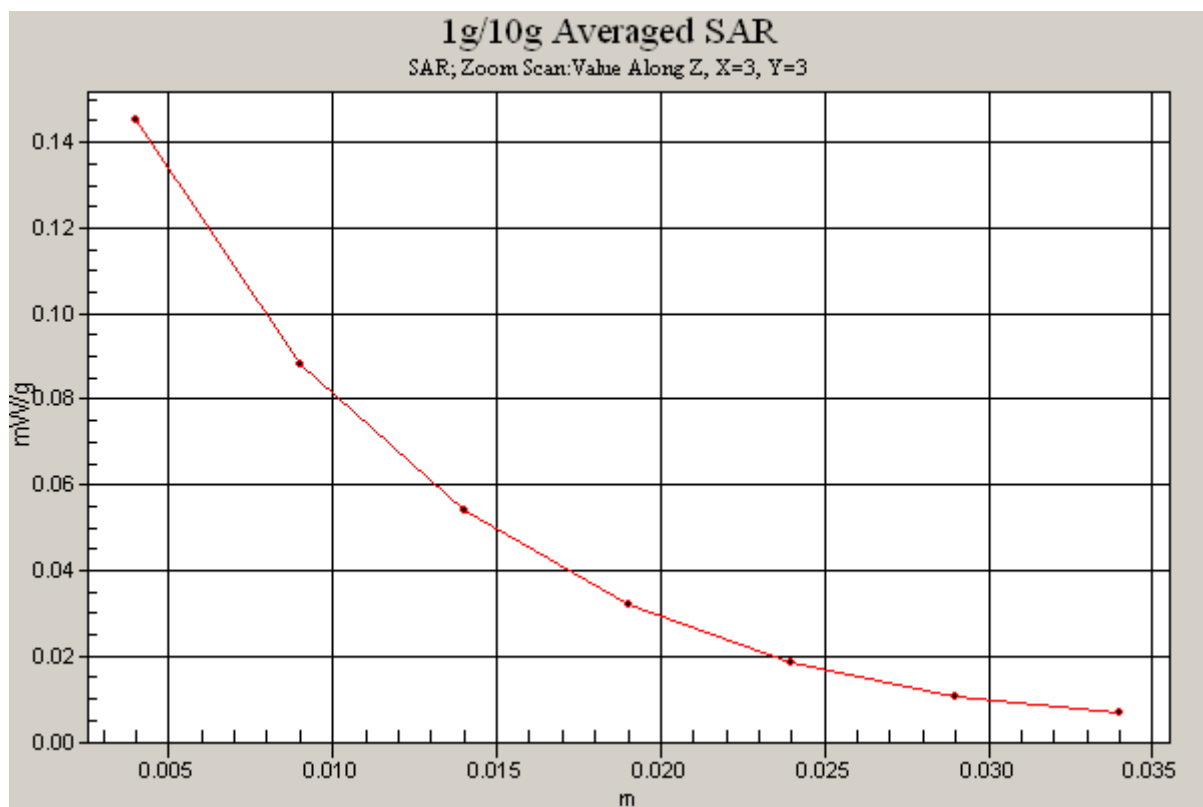
Peak SAR (extrapolated) = 0.185 W/kg

SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.042 mW/g

Maximum value of SAR (measured) = 0.082 mW/g



0 dB = 0.082mW/g





Appendix C.Probe Calibration Data



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctt@chinattl.com <http://www.chinattl.com>



Client **AUDEN**

Certificate No: Z14-97115

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3028**

Calibration Procedure(s) **TMC-OS-E-02-195**
Calibration Procedures for Dosimetric E-field Probes

Calibration date: **October 22, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101547	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101548	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3617	28-Aug-14(SPEAG,No.EX3-3617_Aug14)	Aug-15
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-14 (CTTL, No.J14X02145)	Jun-15
Network Analyzer E5071C	MY46110673	15-Feb-14 (TMC, No.JZ14-781)	Feb-15

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: October 23, 2014

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



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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e. $\theta=0$ 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:

- 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
- 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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}: Assessed for E-field polarization $\theta=0$ (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}; A,B,C 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≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f>800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ±50MHz to ±100MHz.
- 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 NORM_x (no uncertainty required).



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Probe ES3DV3

SN: 3028

Calibrated: October 22, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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E-mail: ctt@chinatl.com [Http://www.chinatl.com](http://www.chinatl.com)

DASY – Parameters of Probe: ES3DV3 - SN: 3028

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$) ^A	1.16	1.27	1.21	±10.8%
DCP(mV) ^B	105.8	103.2	103.8	

Modulation Calibration Parameters

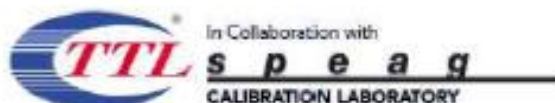
UID	Communication System Name		A dB	B dB/μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	282.9	±2.2%
		Y	0.0	0.0	1.0		292.0	
		Z	0.0	0.0	1.0		290.3	

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 Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 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 – Parameters of Probe: ES3DV3 - SN: 3028

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^g (mm)	Unct. (k=2)
750	41.9	0.89	6.36	6.36	6.36	0.37	1.44	± 12%
835	41.5	0.90	6.19	6.19	6.19	0.39	1.42	± 12%
1750	40.1	1.37	4.97	4.97	4.97	0.55	1.34	± 12%
1900	40.0	1.40	4.68	4.68	4.68	0.70	1.23	± 12%
2300	39.5	1.67	4.52	4.52	4.52	0.80	1.17	± 12%
2450	39.2	1.80	4.21	4.21	4.21	0.98	1.04	± 12%
2600	39.0	1.96	4.06	4.06	4.06	0.86	1.11	± 12%

^c Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^f At frequency 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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DASY – Parameters of Probe: ES3DV3 - SN: 3028

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^g (mm)	Unct. (k=2)
750	55.5	0.96	6.02	6.02	6.02	0.33	1.68	±12%
835	55.2	0.97	6.02	6.02	6.02	0.34	1.79	±12%
1750	53.4	1.49	4.69	4.69	4.69	0.63	1.30	±12%
1900	53.3	1.52	4.48	4.48	4.48	0.60	1.34	±12%
2300	52.9	1.81	4.37	4.37	4.37	0.74	1.25	±12%
2450	52.7	1.95	4.14	4.14	4.14	0.68	1.35	±12%
2600	52.5	2.16	4.02	4.02	4.02	0.84	1.16	±12%

^c Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

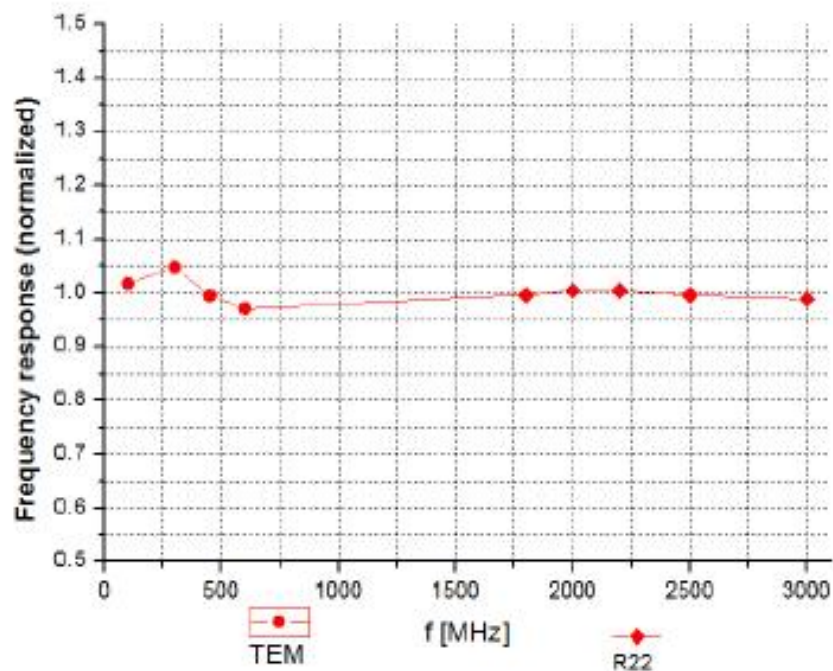
^f At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty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



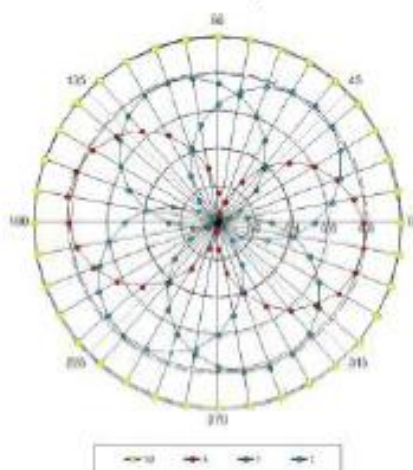
Uncertainty of Frequency Response of E-field: $\pm 7.5\%$ (k=2)



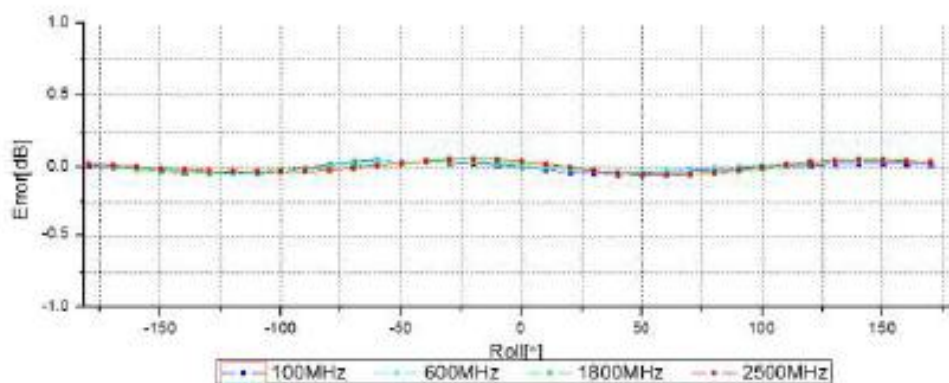
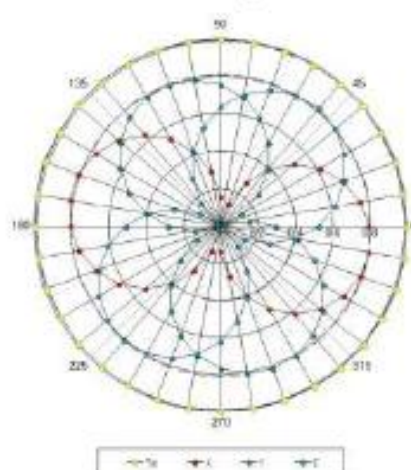
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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM



f=1800 MHz, R22

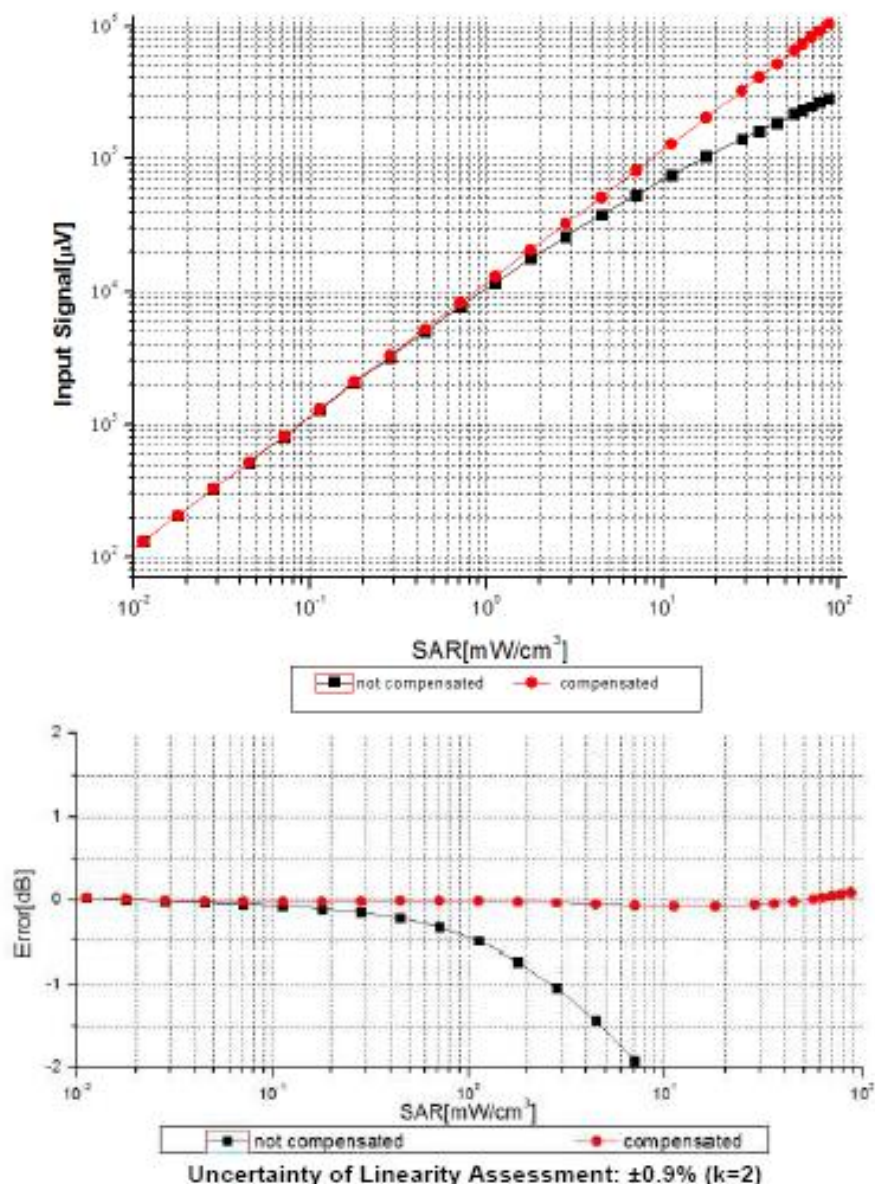


Uncertainty of Axial Isotropy Assessment: $\pm 0.9\%$ ($k=2$)



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



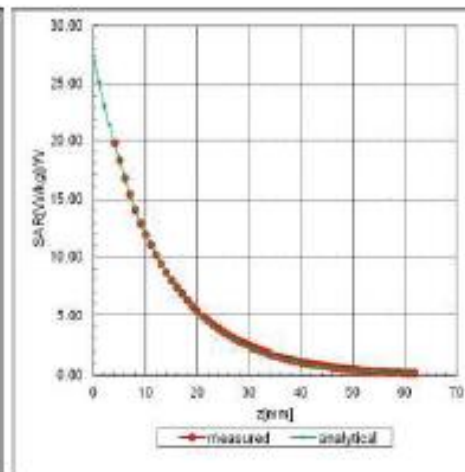
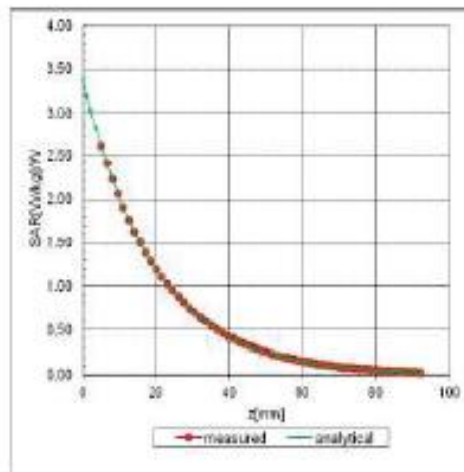


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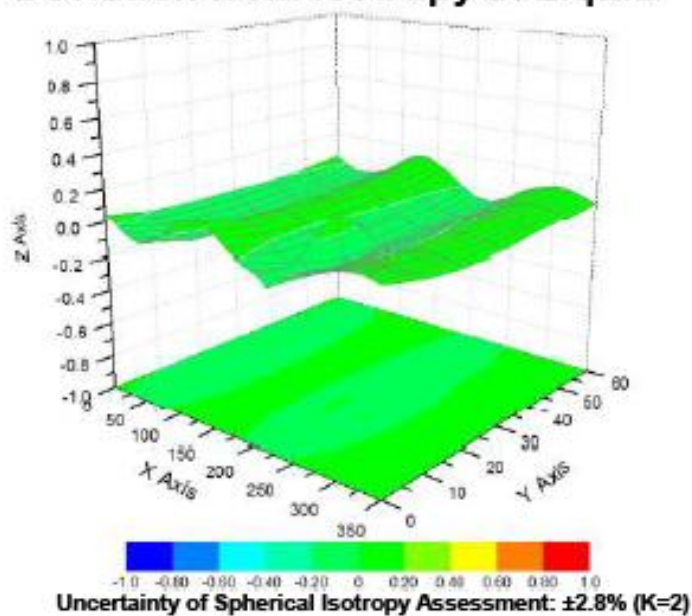
Conversion Factor Assessment

f=835 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid





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DASY - Parameters of Probe: ES3DV3 - SN: 3208**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	54.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm



February 14, 2014

**Acceptable Conditions for SAR Measurements Using Probes and Dipoles
Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to
Support FCC Equipment Certification**

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics or other test signal based probe linearization methods not fully described in SAR standards are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC. Equivalent test equipment and measurement configurations may be considered only when agreed by both SPEAG and the FCC.



February 14, 2014

- f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 systems or higher version systems that satisfy the requirements of this KDB.
- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall apply the required protocols without modification and, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Note: It is expected that TMC (*Telecommunication Metrology Center*) may change its name in 2014. For this KDB to remain valid, it must be updated by TMC before the name change occurs. The SPEAG-TMC Dual-Logo calibration certificate shall also be updated accordingly to reflect the change.



Appendix D. DAE Calibration Data:

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 **Sunway-SZ (Auden)**

Certificate No: **DAE4-689_Oct14**

CALIBRATION CERTIFICATE

Object **DAE4 -SD 000 D04 BM - SN: 689**

Calibration procedure(s) **QA CAL-06.v28
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **October 01, 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 ($22 \pm 3^\circ\text{C}$) and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Kelthley 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

Calibrated by: **Dominique Steffen** **Technician** **Signature**

Approved by: **Fin Bomholt** **Deputy Technical Manager**

F. Bomholt

Issued: October 1, 2014

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



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



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

Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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



DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	404.239 $\pm$ 0.02% (k=2)	404.156 $\pm$ 0.02% (k=2)	404.835 $\pm$ 0.02% (k=2)
Low Range	3.94871 $\pm$ 1.50% (k=2)	3.98364 $\pm$ 1.50% (k=2)	4.00706 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	83.0 $^{\circ}$ $\pm$ 1 $^{\circ}$
---	------------------------------------

**Appendix (Additional assessments outside the scope of SCS108)****1. DC Voltage Linearity**

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200037.45	-2.43	-0.00
Channel X + Input	20004.97	0.89	0.00
Channel X - Input	-20004.37	1.76	-0.01
Channel Y + Input	200038.83	1.40	0.00
Channel Y + Input	20005.93	1.88	0.01
Channel Y - Input	-20004.16	1.95	-0.01
Channel Z + Input	200036.92	-0.75	-0.00
Channel Z + Input	20003.46	-0.50	-0.00
Channel Z - Input	-20002.36	3.79	-0.02

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2000.93	0.43	0.02
Channel X + Input	200.65	0.11	0.05
Channel X - Input	-198.95	0.46	-0.23
Channel Y + Input	2000.28	0.04	0.00
Channel Y + Input	200.24	-0.14	-0.07
Channel Y - Input	-199.08	-0.36	0.18
Channel Z + Input	2000.87	0.60	0.03
Channel Z + Input	199.31	-1.12	-0.56
Channel Z - Input	-200.09	-0.51	0.25

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	22.24	21.85
	-200	-19.90	-22.18
Channel Y	200	1.27	-0.05
	-200	4.06	3.25
Channel Z	200	16.18	15.97
	-200	-18.12	-18.54

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	-	-1.25	-1.10
Channel Y	200	4.48	-	-0.80
Channel Z	200	7.05	3.04	-

**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	15681	16385
Channel Y	16252	16126
Channel Z	16131	16597

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	1.41	0.05	2.73	0.67
Channel Y	0.68	-1.71	2.71	0.60
Channel Z	-0.36	-1.58	0.75	0.46

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <251A

7. Input Resistance (Typical values for information)

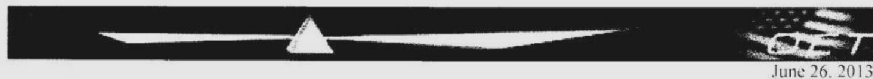
	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

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	+5	+14
Supply (- Vcc)	-0.01	-8	-9



Acceptable Conditions for SAR Measurements Using Probes and Dipoles Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to Support FCC Equipment Certification

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



June 26, 2013

- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

**Appendix E. Dipole Calibration Data:**

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: **Auden**

Certificate No: **D835V2-4d120_Jun14**

CALIBRATION CERTIFICATE

Object: **D835V2 - SN: 4d120**

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

Calibration date: **June 16, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8461A	US37292763	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8461A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4205	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: June 18, 2014

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



Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



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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:

- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

**Measurement Conditions**

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

DASY Version	DASY5	V52.8.8
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 $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.29 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.00 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.2 $\pm$ 6 %	1.01 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.47 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.23 W/kg $\pm$ 16.5 % (k=2)

**Appendix (Additional assessments outside the scope of SCS100)****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	53.0 Ω - 0.1 j Ω
Return Loss	- 30.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.6 Ω - 3.0 j Ω
Return Loss	- 28.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.396 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 29, 2010



DASY5 Validation Report for Head TSL

Date: 16.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d120

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.94 \text{ S/m}$; $\epsilon_r = 41.5$; $\rho = 1000 \text{ kg/m}^3$

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: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

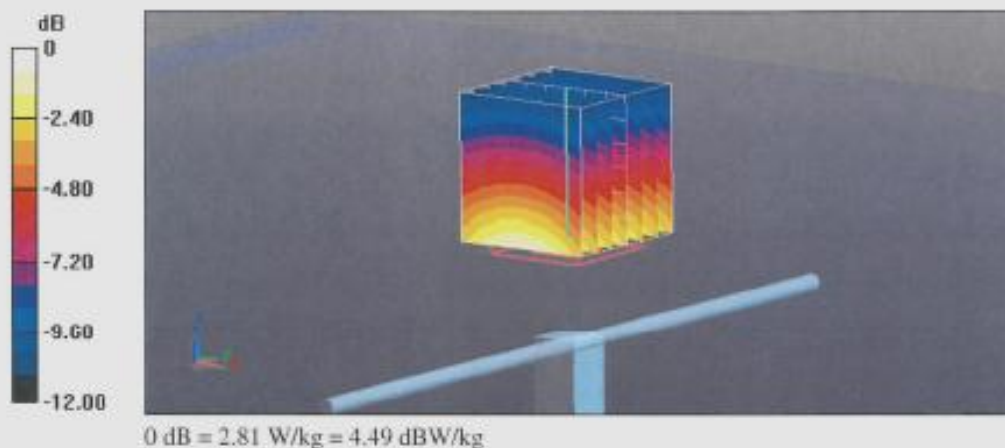
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.38 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.61 W/kg

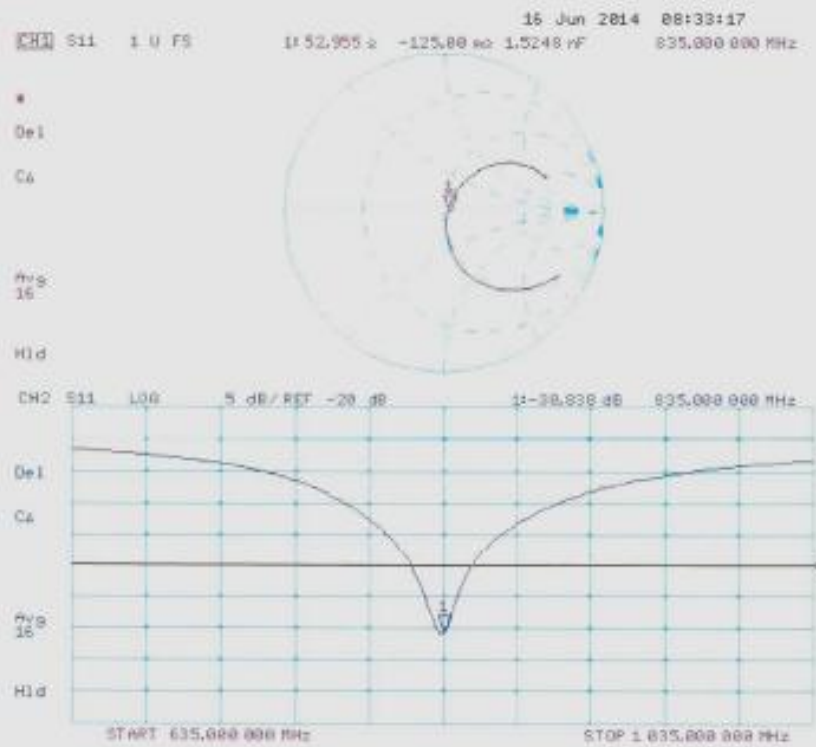
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (measured) = 2.81 W/kg





Impedance Measurement Plot for Head TSL





DASY5 Validation Report for Body TSL

Date: 12.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d120

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 1.005$ S/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

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: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

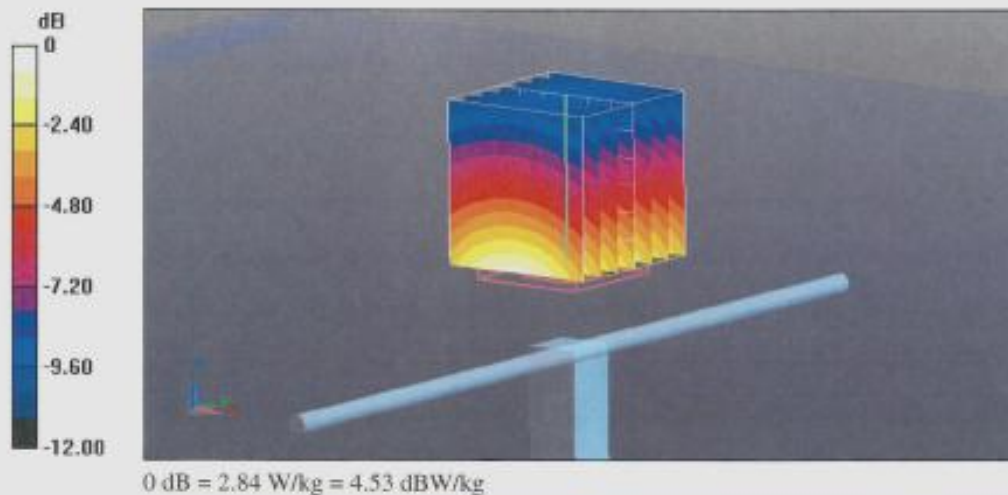
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.04 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.61 W/kg

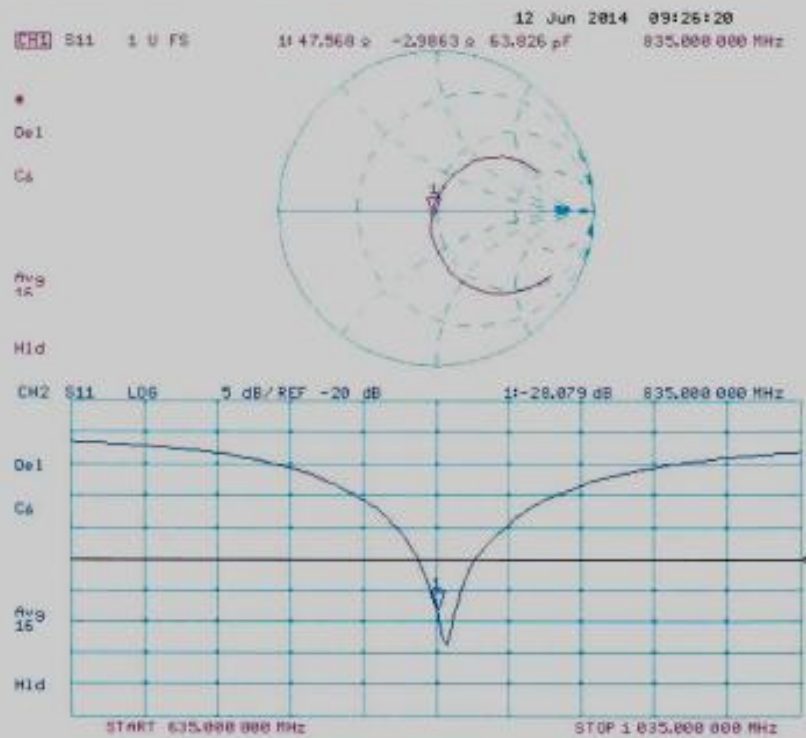
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.84 W/kg





Impedance Measurement Plot for Body TSL





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Accreditation No.: SCS 108

Client **Auden**

Certificate No: D1900V2-5d142_Jun14

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d142

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

Calibration date: June 18, 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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check:
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: June 18, 2014

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Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

**Measurement Conditions**

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

DASY Version	DASY5	V52.8.8
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 $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.5 $\pm$ 6 %	1.39 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.5 $\pm$ 6 %	1.51 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.3 W/kg $\pm$ 16.5 % (k=2)

**Appendix (Additional assessments outside the scope of SCS108)****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	$52.6 \Omega + 6.2 j\Omega$
Return Loss	- 23.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.3 \Omega + 6.6 j\Omega$
Return Loss	- 23.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011



DASY5 Validation Report for Head TSL

Date: 18.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d142

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.39$ S/m; $\epsilon_r = 39.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DY3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- 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:

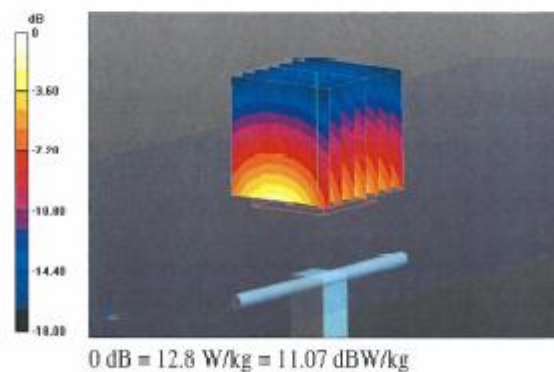
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.64 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 18.5 W/kg

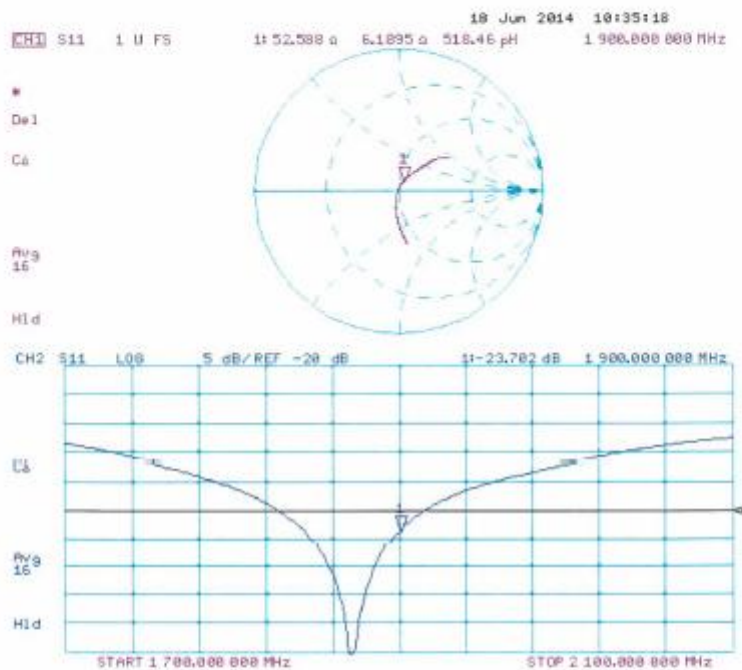
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.29 W/kg

Maximum value of SAR (measured) = 12.8 W/kg





Impedance Measurement Plot for Head TSL





DASY5 Validation Report for Body TSL

Date: 18.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d142

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.51$ S/m; $\epsilon_r = 52.5$; $\rho = 1000$ kg/m³

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: 30.04.2014
- 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:

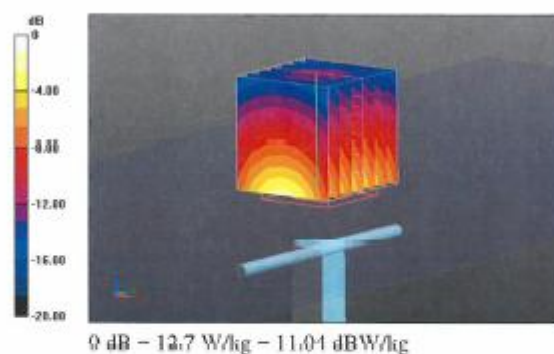
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.03 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

Maximum value of SAR (measured) = 12.7 W/kg





Impedance Measurement Plot for Body TSL

