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TEST REPORT

Product Name .... : Mobile Phone

Trademark .... : UNIMAX

Model/Type reference.............. : V351

Listed Model(s) .... : /

FCC ID .... : **P46-V351**

Test Standards.......................... : **ANSI C95.1–1999**
47CFR §2.1093
KDB 447498

Applicant.................................. : UNIMAX Communications

Address of applicant................ : 18201 McDurmott Street W.Suite E Irvine, CA 92614

Date of Receipt .... : May 10, 2015

Date of Test Date .... : May 13, 2015 - May 17, 2015

Data of issue............................ : May 22, 2015

Test result	**Pass ***

* In the configuration tested, the EUT complied with the standards specified above

GENERAL DESCRIPTION OF EUT	
Equipment:	Mobile Phone
Model Name:	V351
Manufacturer:	Shenzhen Tonhorn Communication Technology CO., LTD
Manufacturer Address:	Room402, Block East, 2nd Phase of Innovation and Technology Square, Tian'an Digital City, Futian District, Shenzhen China.
Power Rating:	DC 3.7V form 1200mAh by rechargeable battery or DC 5.0V form Input:100-240V~,50/60Hz Output: 5.0V⎓600mA adapter

Compiled By:

(Thomas Morgan)

Reviewed By:

(Tony Wang)

Approved By:

(Walter Chen)

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1. SUMMARY

1.1 Test Standards

IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

IEEE Std 1528™-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

FCC Part 2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices

KDB 447498 D01 Mobile Portable RF Exposure v05r02: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r03: SAR Measurement Requirements for 100 MHz to 6 GHz

KDB865664 D02 SAR Reporting v01r01: RF Exposure Compliance Reporting and Documentation Considerations

248227 D01 802.11 Wi-Fi SAR v02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

KDB648474 D04 Handset SAR V01r02: SAR Evaluation Considerations for Wireless Handsets.

KDB941225 D06 Hot Spot SAR v02: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

941225 D01 3G SAR Procedures v03: 3G SAR MEAUREMENT PROCEDURES

1.2 Summary of Maximum SAR Value

The maximum results of Specific Absorption Rate (SAR) found during testing for EUT are as follows:

Head SAR Configuration

Mode	Test Position	Channel /Frequency(MHz)	Limit SAR_{1g} 1.6 W/kg	
			Highest Tested 1g-SAR(W/Kg)	Highest Scaled Maximum SAR(W/Kg)
GSM 850	Left Cheek	190/836.6	0.398	0.406
PCS 1900	Left Cheek	661/1880	0.591	0.609
WCDMA Band II	Left Cheek	9400/1880	0.849	**0.891**
WCDMA Band V	Left Cheek	4183/836.6	0.345	0.359
WLAN2450	Right Cheek	6/2437	0.242	0.252

Body-Worn& Hotspot Mode Configuration

Mode	Test Position	Channel /Frequency(MHz)	Limit SAR_{1g} 1.6 W/kg	
			Highest Tested 1g-SAR(W/Kg)	Highest Scaled Maximum SAR(W/Kg)
GSM 850	Rear Side	190/836.6	0.680	0.694
PCS 1900	Rear Side	661/1880	0.761	0.784
WCDMA Band II	Front Side	9400/1880	1.16	**1.218**
WCDMA Band V	Rear Side	4183/836.6	0.658	0.684
WLAN2450	Rear Side	6/2437	0.336	0.349

Highest Simultaneous transmission SAR Summary

Exposure Position	Transmission Combination	Highest Simultaneous Maximum SAR(W/Kg)
Head	WCDMA Band II+WLAN	1.131
Body-worn& Hotspot Mode	WCDMA Band II+ WLAN	1.431

Note:

1. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/Kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1, and had been tested in accordance with measurement methods and procedures specified in IEEE 1528-2003 and the relevant KDB files.
2. This EUT owns G Sensor, this sensor will not affect the RF characteristic, so no power reduction concerned in this report.
3. This EUT supported VoIP in GPRS, EGPRS, WCDMA
4. This EUT is Class B – EUT, cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.

1.3 Test Facility

1.3.1 Address of the test laboratory

Shenzhen General Testing & Inspection Technology Co., Ltd.

Add: 1F, 2 Block, Jiaquan Building, Guanlan High-tech Park Baoan District, Shenzhen, Guangdong, China.

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 9783A

The 3m alternate test site of Shenzhen GTI Technology Co., Ltd.EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Aug, 2011.

FCC-Registration No.: 214666

Shenzhen GTI Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 214666, Sep 19, 2011

1.4 Measurement Uncertainty (300MHz-3GHz)

No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.55%	N	1	1	1	6.55%	6.55%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.88%	3.88%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.71%	2.71%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
7	Readout Electronics	A	0.30%	N	1	1	1	0.30%	0.30%	∞
8	Response Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Integration Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
10	RF ambient conditions-noise	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
11	RF ambient conditions-reflection	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
12	Probe positioned mech. restrictions	B	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞

13	Probe positioning with respect to phantom shell	B	6.70%	R	$\sqrt{3}$	1	1	3.87%	3.87%	∞
14	Max.SAR evaluation	B	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
Test Sample Related										
15	Test sample positioning	A	1.86%	N	1	1	1	1.86%	1.86%	∞
16	Device holder uncertainty	A	1.70%	N	1	1	1	1.70%	1.70%	∞
17	Drift of output power	B	5.00%	R	$\sqrt{3}$	1	1	2.89%	2.89%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.31%	2.31%	∞
19	Liquid conductivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.85%	1.24%	∞
20	Liquid conductivity (meas.)	A	2.50%	N	1	0.64	0.43	1.60%	1.08%	∞
21	Liquid permittivity (target)	B	5.00%	R	$\sqrt{3}$	0.60	0.49	1.73%	1.41%	∞
22	Liquid permittivity (meas.)	A	2.50%	N	1	0.60	0.49	1.50%	1.23%	∞
Combined standard uncertainty	$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	/	10.87%	10.63 %	∞
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$		/	R	K=2	/	/	21.73%	21.27 %	∞

1.5 System Check Uncertainty

No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.55%	N	1	1	1	6.55%	6.55%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.88%	3.88%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.71%	2.71%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
7	Readout Electronics	A	0.30%	N	1	1	1	0.30%	0.30%	∞
8	Response Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞

9	Integration Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
10	RF ambient conditions-noise	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
11	RF ambient conditions-reflec tion	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
12	Probe positioned mech. restrictions	B	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞
13	Probe positioning with respect to phantom shell	B	6.70%	R	$\sqrt{3}$	1	1	3.87%	3.87%	∞
14	Max.SAR evaluation	B	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
Dipole Related										
15	Dev. of experimental dipole	B	5.50%	R	$\sqrt{3}$	1	1	3.18%	3.18%	∞
16	Dipole Axis to Liquid Dist.	B	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
17	Input power & SAR drift	B	3.40%	R	$\sqrt{3}$	1	1	1.96%	1.96%	∞
Phantom and Setup										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.31%	2.31%	∞
19	SAR correction	B	1.90%	R	$\sqrt{3}$	1	0.84	1.10%	0.92%	
20	Liquid conductivity (meas.)	A	2.50%	N	1	0.78	0.71	1.95%	1.78%	∞
21	Liquid permittivity (meas.)	A	2.50%	N	1	0.26	0.26	0.65%	0.65%	∞
22	Temp. unc. - Conductivity	B	1.70%	R	$\sqrt{3}$	0.78	0.71	0.77%	0.70%	∞
23	Temp. unc. - Permittivity	B	0.30%	R	$\sqrt{3}$	0.23	0.26	0.04%	0.05%	∞
Combined standard uncertainty	$u_c = \sqrt{\sum_{i=1}^{23} c_i^2 u_i^2}$		/	/	/	/	/	10.65%	10.60 %	∞
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$		/	R	K=2	/	/	21.31%	21.20 %	∞

2. GENERAL INFORMATION

2.1 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	22°C
Relative Humidity:	35%-55 %
Air Pressure:	101 kPa

2.2 General Description of EUT

Product Name:	Mobile Phone
Model/Type reference:	V351
IMEI:	352273017386340
Test Device	Prototype
Power supply:	DC 3.7V from battery
Adapter information 1:	Model:V351 Input: AC100-240VAC, 50/60Hz 0.15A Output: DC5V⎓DC600mA
Adapter information 2:	Model:V351CHG Input: AC100-240VAC, 50/60Hz 0.15A Output: DC5V⎓DC600mA
Hardware version:	GW-SN01M_V1.1
Software version:	Android 4.4.2
2G	
Operation Band:	GSM850, PCS1900
Supported Type:	GSM/GPRS/EGPRS
Power Class:	GSM850:Power Class 4 PCS1900:Power Class 1
Modulation Type:	GMSK for GSM/GPRS/EGPRS
GSM Release Version	R99
GPRS Multislot Class	12
EGPRS Multislot Class	12
GSM/(E)GPRS Transfer Mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
WCDMA	
Operation Band:	FDD Band II & Band V
Power Class:	Power Class 3
Modulation Type:	QPSK for WCDMA/HSUPA/HSDPA

WCDMA Release Version:	R99
HSDPA Release Version:	Release 7, CAT14
HSUPA Release Version:	Release 6, CAT6
DC-HSUPA Release Version:	Not Supported
WIFI	
Supported type:	802.11b/802.11g/802.11n(H20)
Modulation:	802.11b: DSSS 802.11g/802.11n(H20): OFDM
Operation frequency:	802.11b/802.11g/802.11n(H20): 2412MHz~2462MHz
Channel number:	802.11b/802.11g/802.11n(H20): 11
Channel separation:	5MHz
Antenna type:	FPC Antenna
Antenna gain:	1.0dBi
Bluetooth 2.1+EDR	
Version:	Supported 2.1+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	1.0dBi

2.3 Description of Test Modes

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power the EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.4 Measurement Instruments List

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibrated until
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	July 21,2015
E-field Probe	SPEAG	ES3DV3	3292	Aug 14,2015
System Validation Dipole 835V2	SPEAG	D835V2	4d134	July 23,2015
System Validation Dipole 1900V2	SPEAG	D1900V2	5d150	July 24,2015
System Validation Dipole 2450V2	SPEAG	D2450V2	884	Aug 31,2015
Dielectric Probe Kit	Agilent	85070E	US44020288	/
Power meter	Agilent	E4417A	GB41292254	Nov 25,2015
Power sensor	Agilent	8481H	MY41095360	Nov 25,2015
Power meter	Agilent	E4417A	GB41292255	Nov 25,2015
Power sensor	Agilent	8481H	MY41095361	Nov 25,2015
Network analyzer	Agilent	8753E	US37390562	Nov 24,2015
Dual Directional Coupler	Agilent	778D	50127	Nov 24,2015
Dual Directional Coupler	Agilent	772D	50348	Nov 24,2015
Power Amplifier	Mini-Circuits	ZHL-42W	13440021132	Nov 24,2015
Attenuator	PE	PE7005-10	E048	Nov 24,2015
Attenuator	PE	PE7005-3	E049	Nov 24,2015
Attenuator	Woken	WK0602-XX	E050	Nov 24,2015
Universal Radio Communication Tester	ROHDE & SCHWARZ	CMU200	112012	Oct 22,2015

Note: 1. The Cal. Interval was one year.

3. SAR MEASUREMENTS SYSTEM CONFIGURATION

3.1 SAR MEASUREMENT SET-UP

The DASY5 system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot (Stäubli RX family) with controller 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 electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003. DASY5 software and SEMCAD data evaluation software.

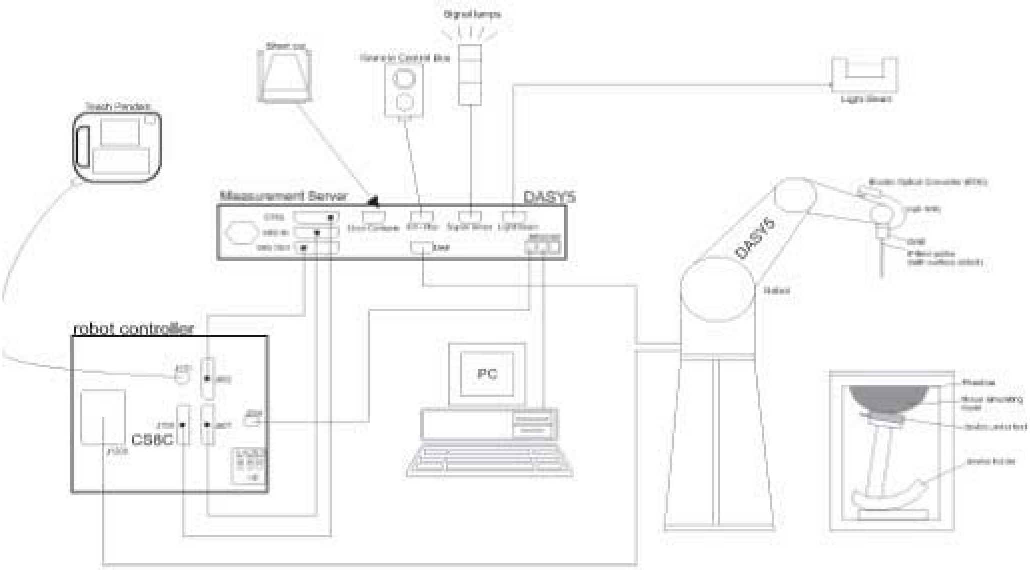
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld Mobile Phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



3.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

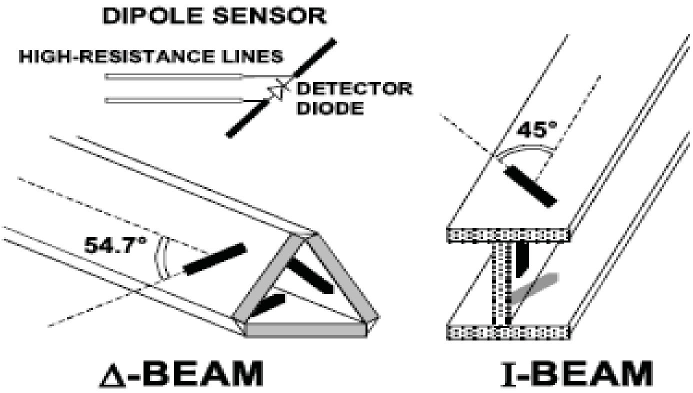
Probe Specification:

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100 W/kg; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

Isotropic E-Field Probe:

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



3.3 PHANTOMS

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fibreglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

3.4 DEVICE HOLDER

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

3.5 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe

(It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

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

(a) Power reference measurement

(b) Area scan

(c) Zoom scan

(d) Power drift measurement

Power Reference Measurement

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

Area Scan

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

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Zoom Scan

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

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

Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <u>*reported*</u> SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Volume Scan Procedures

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

Power Drift Monitoring

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

Spatial Peak Detection

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

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

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

(a) Extraction of the measured data (grid and values) from the Zoom Scan

(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)

(c) Generation of a high-resolution mesh within the measured volume

(d) Interpolation of all measured values form the measurement grid to the high-resolution grid

(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface

(f) Calculation of the averaged SAR within masses of 1g and 10g

3.6 DATA STORAGE AND EVALUATION

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [W/kg], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

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

With Vi = compensated signal of channel i (i = x, y, z)
Ui = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcpi = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E} - \text{fieldprobes :} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes :} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

With SAR = local specific absorption rate in W/kg
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

4. TISSUE SIMULATING LIQUID

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm.The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in 4.2

4.1 The composition of the tissue simulating liquid

Ingredient	835MHz		1900MHz		2450MHz	
(% Weight)	Head	Body	Head	Body	Head	Body
Water	41.45	52.5	55.242	69.91	62.7	73.2
Salt	1.45	1.40	0.306	0.13	0.50	0.10
Sugar	56	45.0	0.00	0.00	0.00	0.00
Preventol	0.10	0.10	0.00	0.00	0.00	0.00
HEC	1.00	1.00	0.00	0.00	0.00	0.00
DGBE	0.00	0.00	44.452	29.96	36.8	26.7

4.2 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using Agilent Dielectric Probe Kit and Agilent Network Analyzer 8753E.

Frequency (MHz)		Dielectric Parameters (±5%)		Tissue Temp [°C]	Test Date
835	head	εr 39.425-43.575	δ[s/m] 0.855-0.945	22	May,13,2015
		41.48	0.89		
	body	εr 52.44-57.96	δ[s/m] 0.9215-1.0185	22	May,14,2015
		55.88	0.96		

Frequency (MHz)		Dielectric Parameters (±5%)		Tissue Temp [°C]	Test Date
1900	head	εr 38.00-42.00	δ[s/m] 1.33-1.47	22	May,15,2015
		39.76	1.42		
	body	εr 50.635-55.965	δ[s/m] 1.444-1.596	22	May,16,2015
		51.13	1.57		

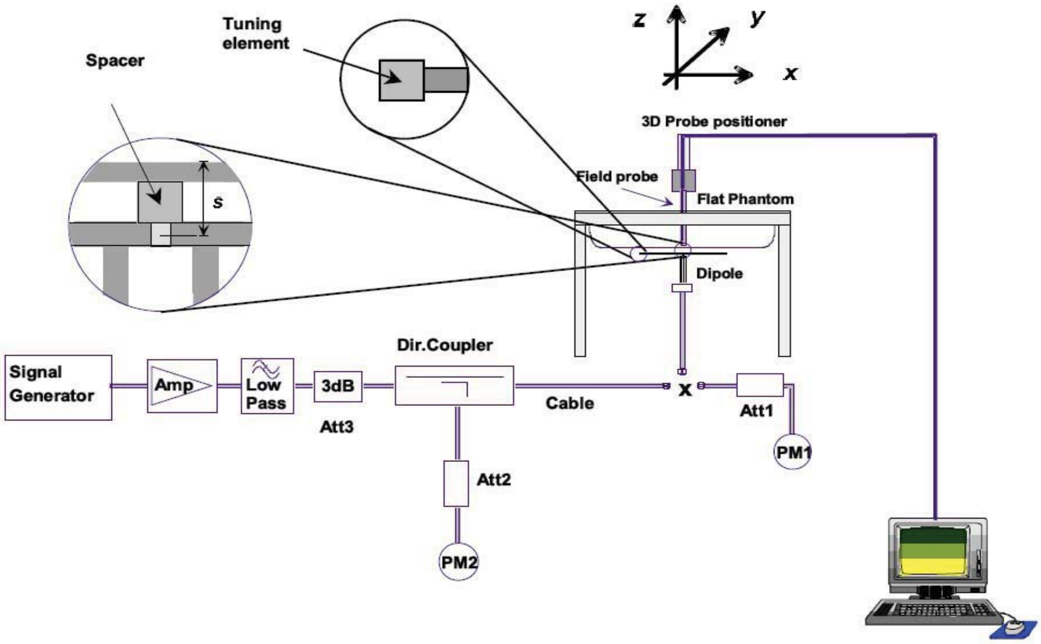
Frequency (MHz)		Dielectric Parameters (±5%)		Tissue Temp [°C]	Test Date
2450	head	εr 37.24-41.16	δ[s/m] 1.71-1.89	22	May,17,2015
		38.02	1.85		
	body	εr 50.065-55.335	δ[s/m] 1.8525-2.0475	22	May,17,2015
		50.74	2.01		

5. System Check

The purpose of the system check is to verify that the system operates within its specifications at the device test frequency. The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.

Photo of Dipole Setup

System Check in Head Tissue Simulating Liquid

Measurement is made at temperature 22.0 ℃ and relative humidity 55%.						Measurement Date
Verification results	Frequency (MHz)	Target value (W/kg)	Measured 250mW value (W/kg)	Normalized 1W value (W/kg)	Deviation	
	835	9.62	2.40	9.60	-0.21%	May,13,2015
	1900	38.30	9.66	38.64	0.89%	May,15,2015
	2450	52.10	12.94	51.76	-0.65%	May,17,2015
Note：1. The graph results see Chapter9. 2. Target Values used derive from the calibration certificate						

System Check in Body Tissue Simulating Liquid

Measurement is made at temperature 22.0 ℃ and relative humidity 55%.						Measurement Date
Verification results	Frequency (MHz)	Target value (W/kg)	Measured 250mW value (W/kg)	Normalized 1W value (W/kg)	Deviation	
	835	9.77	2.42	9.68	-0.92%	May,14,2015
	1900	39.90	9.83	39.32	-1.45%	May,16,2015
	2450	51.60	12.86	51.44	-0.31%	May,17,2015
Note：1. The graph results see Chapter9. 2. Target Values used derive from the calibration certificate						

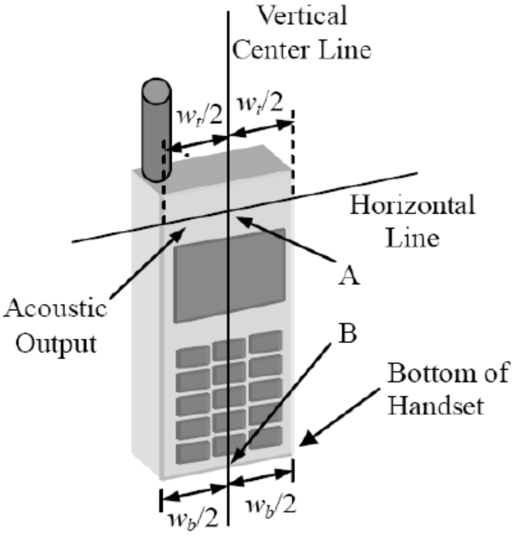
6. EUT TEST POSITION

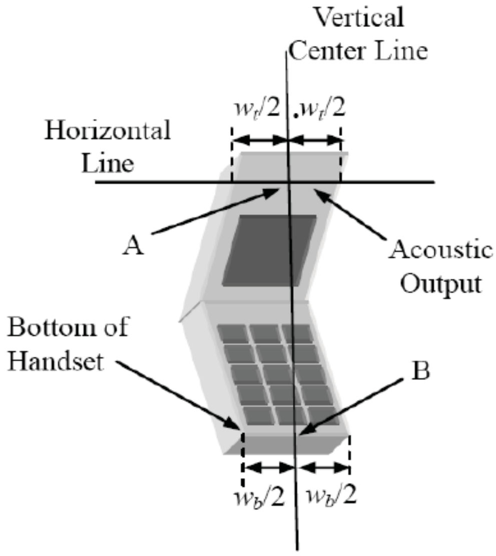
6.1 Define Two Imaginary Lines on the Handset

(1) The vertical centerline passes through two points on the front side of the handset the midpoint of the width wt of the handset at the level of the acoustic output, and the midpoint of the width wb of the handset.

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

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

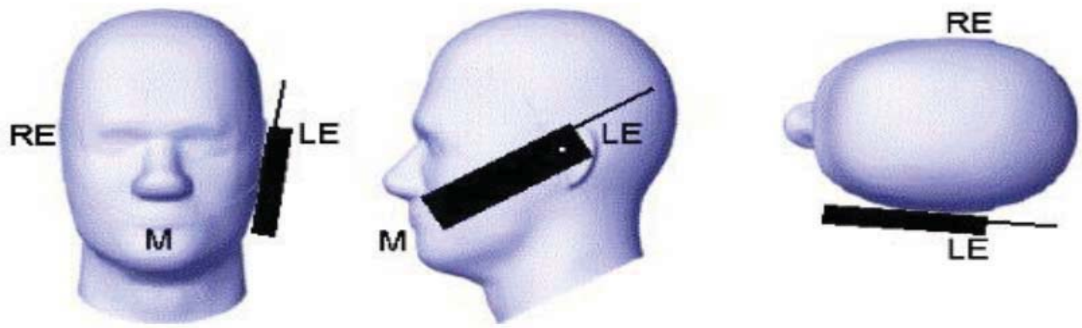




6.2 Cheek Position

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

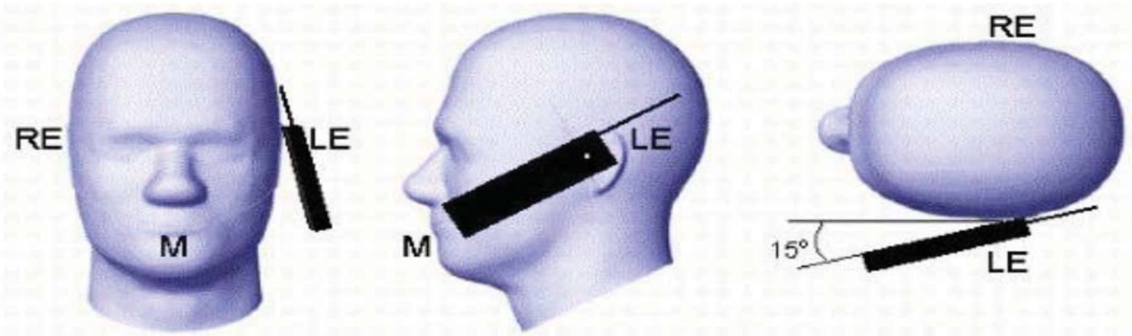
(2) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with ear, move the bottom of the phone until any point on the front side is in contact with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



6.3 Title Position

(1) To position the device in the —cheek position described above.

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

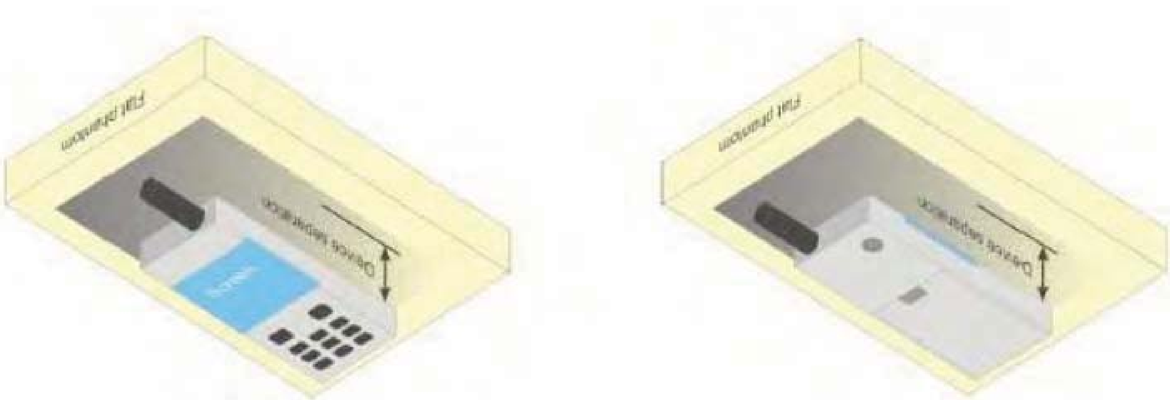


6.4 Body Worn Position

(1) To position the EUT parallel to the phantom surface.

(2) To adjust the EUT parallel to the flat phantom.

(3) To adjust the distance between the EUT surface and the flat phantom to 5mm. (Hotspot mode the distance of 10mm).



7. Measurement Procedures

The measurement procedures are as follows:

7.1 Conducted power measurement

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

7.2 SAR measurement

7.2.1 GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. The power level is set to “5” for GSM 850, set to “0” for GSM 1900. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction calculation method are shown in chapter8.1 NOTES 1).

7.2.2 WCDMA Test Configuration

7.2.2.1 3G SAR Test Reduction Procedure

In the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

7.2.2.2 Output power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1’s” for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, $DPDCH_n$ and spreading codes, HSDPA, HSPA) are required in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

7.2.2.3 Head SAR

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

7.2.2.4 Body-Worn Accessory SAR

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to other spreading codes and multiple $DPDCH_n$ configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or $DPDCH_n$, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 $DPDCH_n$ are supported by the handset, it may be necessary to configure additional $DPDCH_n$ using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

7.2.2.5 Handsets with Release 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the "Release 5 HSDPA Data Devices" section of KDB 941225 D01, for the highest reported SAR body-worn accessory exposure configuration in 12.2 kbps RMC. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

Release 5 HSDPA Data Devices: The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with WCDMA and requires an active DPCCH. The default test configuration is to measure SAR in WCDMA with HSDPA remain inactive, to establish a radio link between the test device and a communication test set using a 12.2 kbps RMC configured in Test Loop Mode 1. SAR for HSDPA is selectively measured using the highest reported SAR configuration in WCDMA, with an FRC in H-set 1 and a 12.2 kbps RMC. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$) according to exposure conditions, device operating capabilities and maximum output power specified for production units, including tune-up tolerance by applying the 3G SAR test reduction procedures. Maximum output power is verified according to the applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories, and explained in the SAR report.

When voice transmission in next to the ear head exposure conditions is applicable to a WCDMA/HSDPA data device, head SAR is measured according to the 'Head SAR' procedures in section 7.2.2.3. SAR for body exposure configurations is measured according to the 'Body-Worn Accessory SAR' procedures in the section 7.2.2.4. The 3G SAR test reduction procedure is applied to HSDPA body SAR with 12.2 kbps RMC as the primary mode. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to the UE category of a test device. The number of HSDSCH/ HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors (βc, βd), and HS-DPCCH power offset parameters (Δ_{ACK}, Δ_{NACK}, Δ_{CQI}) should be set according to values indicated in Table1. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Table 1: Subtests for WCDMA Release 5 HSDPA

Sub-set	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (note 1)	CM(dB) (note 2)	MPR(dB)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (note 3)	15/15 (note 3)	64	12/15 (note 3)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note1: ΔACK, ΔNACK and ΔCQI = 8 ⇔ Ahs = β_{hs}/β_c = 30/15 ⇔ β_{hs}= 30/15 *β_c
Note2: CM=1 for β_c/β_d =12/15, β_{hs}/β_c=24/15.
Note3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1,TF1) to β_c=11/15 and β_d=15/15.

7.2.2.6 Handsets with Release 6 HSPA (HSDPA/HSUPA)

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the “Release 6 HSPA Data Devices” section of KDB 941225 D01, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

Release 6 HSPA Data Devices: The following procedures are applicable to HSPA (HSUPA/HSDPA) data devices operating under 3GPP Release 6. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSUPA operates in conjunction with WCDMA and HSDPA. SAR is initially measured in WCDMA test configurations with HSPA remain inactive. The default test configuration is to establish a radio link between the test device and a communication test set to configure a 12.2 kbps RMC in Test Loop Mode 1. SAR for HSPA is selectively measured with HS-DPCCH, E-DPCCH and E-DPDCH, all enabled, along with a 12.2 kbps RMC using the highest reported SAR configuration in WCDMA with 12.2 kbps RMC only. An FRC is configured according to HS-DPCCH Sub-test 1 using H-set 1 and QPSK. HSPA is configured according to E-DCH Sub-test 5 requirements. SAR for other HSPA sub-test configurations is confirmed selectively according to exposure conditions, E-DCH UE Category and maximum output power of production units, including tune-up tolerance by applying the 3G SAR test reduction procedure. Maximum output power is verified according to procedures in applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories for HS-DPCCH and HSPA, and explained in the SAR report.

Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the β values indicated in Table 2 and other applicable procedures described in the 'WCDMA Test Configuration' and 'Release 5 HSDPA Data Devices' sections of this report.

Table 2：Sub-Test 5 Setup for Release 6 HSUPA

Sub-set	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: ΔACK, ΔNACK and ΔCQI = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for βc/βd =12/15, β_{hs}/β_c =24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the βc/βd ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 10/15 and βd = 15/15.
Note 4: For subtest 5 the βc/βd ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 14/15 and βd = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Figure 5.1g.
Note 6: β_{ed} cannot be set directly; it is set by Absolute Grant Value.

7.2.2.7 HSPA, HSPA+ Test Configuration

SAR test exclusion may apply to 3GPP Rel. 6 HSPA, Rel. 7 HSPA+.

SAR test exclusion for HSPA, HSPA+ is determined according to the following:

1) The HSPA procedures are applied to configure 3GPP Rel. 6 HSPA devices in the required sub-test mode(s) to determine SAR test exclusion.

2) SAR is required for Rel. 7 HSPA+ when SAR is required for Rel. 6 HSPA; otherwise, the 3G SAR test reduction procedure is applied to (uplink) HSPA+ with 12.2 kbps RMC as the primary mode. Power is measured for HSPA+ that supports uplink 16 QAM according to configurations in Table C.11.1.4 of 3GPP TS 34.121-1 to determine SAR test reduction.

7.2.3 WIFI Test Configuration

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. The Tx power is set to maximum limit for 802.11 b mode by software. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WIFI mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.

802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

8. TEST CONDITIONS AND RESULTS

8.1 Conducted Power Results

Max Conducted power measurement results and power drift from tune-up tolerance provide by manufacturer:

Conducted power measurement results (GSM850/1900)

Mode	Txslot	Burst Average Power (dBm)			Tune-up Limit (dBm)	Calculation (dB)	Frame-Averaged Power (dBm)			Tune-up Limit (dBm)
		128	190	251			128	190	251	
GSM 850	/	32.76	32.82	32.79	33	-9.03	23.73	23.79	23.76	23.97
GPRS 850 (GMSK)	1 Txslot	32.72	32.81	32.75	33	-9.03	23.69	23.78	23.72	23.97
	2 Txslot	29.89	29.91	29.90	30	-6.02	23.87	23.89	23.88	23.98
	3 Txslot	27.84	27.88	27.86	28	-4.26	23.58	23.62	23.60	23.74
	4 Txslot	26.67	26.71	26.69	27	-3.01	23.66	23.70	23.68	23.99
EGPRS 850 (GMSK)	1 Txslot	32.65	32.68	32.67	33	-9.03	23.62	23.65	23.64	23.97
	2 Txslot	29.85	29.89	29.87	30	-6.02	23.83	23.87	23.85	23.98
	3 Txslot	27.78	27.82	27.79	28	-4.26	23.52	23.56	23.53	23.74
	4 Txslot	26.61	26.68	26.66	27	-3.01	23.60	23.67	23.65	23.99
Mode	Txslot	Burst Average Power (dBm)			Tune-up Limit (dBm)	Calculation (dB)	Frame-Averaged Power (dBm)			Tune-up Limit (dBm)
		512	661	810			512	661	810	
PCS 1900	/	29.79	29.84	29.86	30	-9.03	20.76	20.81	20.83	20.97
GPRS 1900 (GMSK)	1 Txslot	29.76	29.83	29.84	30	-9.03	20.73	20.80	20.81	20.97
	2 Txslot	27.82	27.89	27.88	28	-6.02	21.80	21.87	21.86	21.98
	3 Txslot	25.84	25.88	25.86	26	-4.26	21.58	21.62	21.60	21.74
	4 Txslot	24.55	24.59	24.60	25	-3.01	21.54	21.58	21.59	21.99
EGPRS 1900 (GMSK)	1 Txslot	29.72	29.79	29.80	30	-9.03	20.69	20.76	20.77	20.97
	2 Txslot	27.78	27.84	27.83	28	-6.02	21.76	21.82	21.81	21.98
	3 Txslot	25.77	25.82	25.81	26	-4.26	21.51	21.56	21.55	21.74
	4 Txslot	24.52	24.57	24.58	25	-3.01	21.51	21.56	21.57	21.99

NOTES:

1) Division Factors

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

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

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

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

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

2) According to the conducted power as above, the GPRS measurements are performed with 2Txslots for GPRS850 and GPRS1900.

Conducted power measurement results (WCDMA Band II/V)

Item	Band	FDD Band II result (dBm)			Tune-up Limit (dBm)
		Test Channel			
	ARFCN	9262	9400	9538	
AMR	12.2kbps AMR	22.72	22.75	22.71	23
RMC	12.2kbps RMC	22.73	22.77	22.72	23
HSDPA	Sub - Test 1	21.76	21.74	21.75	23
	Sub - Test 2	21.73	21.78	21.74	23
	Sub - Test 3	21.12	21.18	21.16	22
	Sub - Test 4	21.09	21.19	21.14	22
HSUPA	Sub - Test 1	21.05	21.34	21.08	23
	Sub - Test 2	21.32	21.47	21.88	23
	Sub - Test 3	20.55	20.68	20.78	22
	Sub - Test 4	20.29	20.13	20.06	22
	Sub - Test 5	21.39	21.33	21.14	23

Item	Band	FDD Band V result (dBm)			Tune-up Limit (dBm)
		Test Channel			
	ARFCN	4132	4183	4233	
AMR	12.2kbps AMR	22.80	22.81	22.77	23
RMC	12.2kbps RMC	22.81	22.83	22.79	23
HSDPA	Sub - Test 1	21.74	21.72	21.73	23
	Sub - Test 2	21.73	21.74	21.76	23
	Sub - Test 3	21.16	21.19	21.13	22
	Sub - Test 4	21.18	21.17	21.15	22
HSUPA	Sub - Test 1	21.73	21.78	21.77	23
	Sub - Test 2	21.71	21.74	21.72	23
	Sub - Test 3	21.12	21.16	21.13	22
	Sub - Test 4	21.21	21.22	21.14	22
	Sub - Test 5	21.45	21.59	21.56	23

Conducted Power Measurement Results (Wifi 802.11 b/g/n)

Conducted Power of 802.11b mode					
Power Comparison of Channels			Power Comparison of Date Rates		
Channel	Frequency (MHz)	Data rate 1Mbps	CH1 2Mbps	CH1 5.5Mbps	CH1 11Mbps
CH 1	2412	16.87	16.83	16.81	16.82
CH 6	2437	16.85			
CH 11	2462	16.82			

Conducted Power of 802.11g mode									
Power Comparison of Channels			Power Comparison of Date Rates						
Channel	Frequency (MHz)	Data rate 6Mbps	CH1 9Mbps	CH1 12Mbps	CH1 18Mbps	CH1 24Mbps	CH1 36Mbps	CH1 48MBps	CH1 54Mbps
CH 1	2412	12.81	12.78	12.76	12.76	12.74	12.76	12.79	12.77
CH 6	2437	12.77							
CH 11	2462	12.52							

Conducted Power of 802.11n(20MHz) mode									
Power Comparison of Channels			Power Comparison of Date Rates						
Channel	Frequency (MHz)	Data rate 6.5Mbps	CH1 MCS1	CH1 MCS2	CH1 MCS3	CH1 MCS4	CH1 MCS5	CH1 MCS6	CH1 MCS7
CH 1	2412	12.77	12.75	12.74	12.74	12.73	12.72	12.76	12.74
CH 6	2437	12.72							
CH 11	2462	12.45							

Note:

1. Per KDB 248227 D01 802.11 Wi-Fi SAR v02, For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate.
2. Per KDB 248227 D01 802.11 Wi-Fi SAR v02, 802.11g, 802.11n-HT20 output power is less than 1/4dB higher than 11b mode, SAR can be excluded

Conducted Power Measurement Results (Bluetooth)

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power	
			(dBm)	(mW)
GFSK	00	2402	6.09	4.06
	39	2441	6.11	4.08
	78	2480	5.87	3.86
π/4DQPSK	00	2402	5.40	3.47
	39	2441	5.34	3.42
	78	2480	5.06	3.21
8DPSK	00	2402	5.39	3.46
	39	2441	5.34	3.42
	78	2480	5.05	3.20

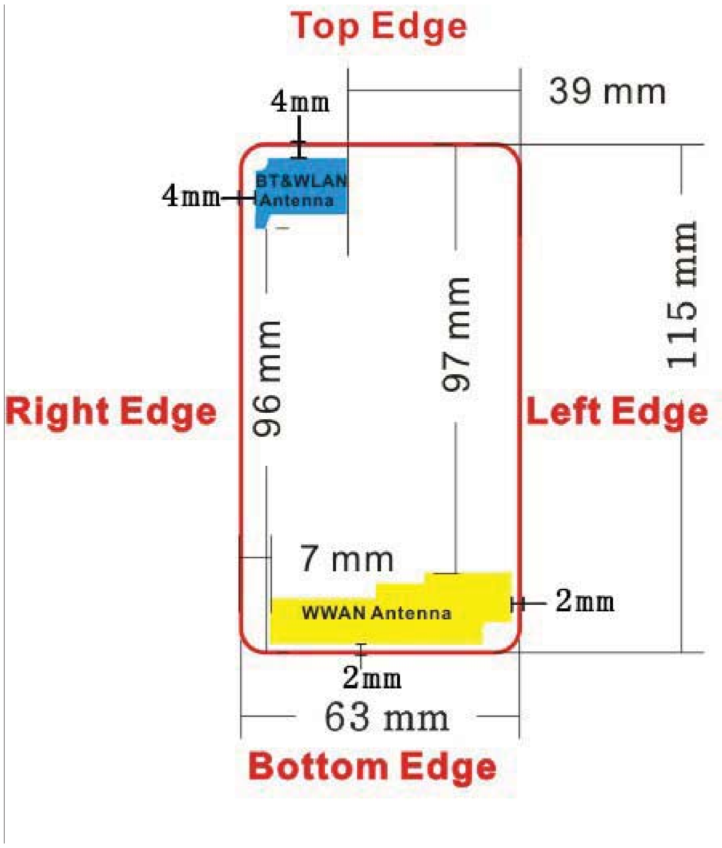
Note:
Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] . [√f(GHz)] ≤ 3 for 1-g SAR and] ≤ 7.5 for 10-g extremity SAR

f(GHz) is the RF channel transmit frequency in GHz
Power and distance are rounded to the nearest mW and mm before calculation
The result is rounded to one decimal place for comparison

Bluetooth Max Power Allowed (dBm)	Bluetooth Max Power Rounded (mW)	Calculated Value Rounded	Separation Distance (mm)	Frequency (GHz)	Exclusion thresholds
7	5	1.6	5	2441	3

Note:
Per KDB 447498 D01v05r02, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 1.6 which is≤ 3, SAR testing is not required.

8.2 Antenna Location



DUT Rear View

SAR Measurement Positions

According to the KDB447498 D01 General RF Exposure Guidance v05r02, the test exclusion threshold is determined by the closet separation between the antenna and the user, if the test separation distance is <5mm, 5mm is used to determin SAR exclusion threshold.

Per KDB447498 D01, 4.3.1. Standalone SAR test exclusion considerations

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
• f(GHz) is the RF channel transmit frequency in GHz
• Power and distance are rounded to the nearest mW and mm before calculation
• The result is rounded to one decimal place for comparison
• 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

2) At 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:

a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz

b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

SAR test exclusion table

Exposure Position	Wireless Interface	GPRS850 2Tx Slot	PCS1900 4Tx Slot	WCDMA Band II RMC	WCDMA Band V RMC	802.11 b/g/n
	Tune-up Maximum Power(dBm) **rounded**	24.0	22.0	23.0	23.0	17.0
	Tune-up Maximum Power(mW) **rounded**	251	158	200	200	50
Rear side	Antenna to User(mm)	1				1
	SAR exclusion threshold(mW)	16	11	11	16	10
	SAR test required?	Yes	Yes	Yes	Yes	Yes
Front side	Antenna to User(mm)	9				9
	SAR exclusion threshold(mW)	30	20	20	30	17
	SAR test required?	Yes	Yes	Yes	Yes	Yes
Right side	Antenna to User(mm)	7				4
	SAR exclusion threshold(mW)	23	15	15	23	10
	SAR test required?	Yes	Yes	Yes	Yes	Yes
Left side	Antenna to User(mm)	2				39
	SAR exclusion threshold(mW)	16	11	11	16	75
	SAR test required?	Yes	Yes	Yes	Yes	No
Top side	Antenna to User(mm)	97				4
	SAR exclusion threshold(mW)	427	579	579	427	10
	SAR test required?	No	No	No	No	Yes
Bottom side	Antenna to User(mm)	2				96
	SAR exclusion threshold(mW)	16	11	11	16	556
	SAR test required?	Yes	Yes	Yes	Yes	No

8.3 TEST RESULTS

8.3.1 SAR Test Results Summary

Operation Mode ·

According to KDB 447498 D01 v05r02 ,for each exposure position, if the highest 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional.

Per KDB 865664 D01 v01r03,for each frequency band, if the measured SAR is ≥0.8W/Kg, testing for repeated SAR measurement is required , that the highest measured SAR is only to be tested. When the SAR results are near the limit, the following procedures are required for each device to verify these types of SAR measurement related variation concerns by repeating the highest measured SAR configuration in each frequency band.

1) When the original highest measured SAR is ≥0.8W/Kg, repeat that measurement once.
2) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is ＞1.20 or when the original or repeated measurement is ≥1.45 W/Kg.
3) Perform a third repeated measurement only if the original, first and second repeated measurement is ≥1.5 W/Kg and ratio of largest to smallest SAR for the original, first and second measurement is ≥1.20.

According to KDB 648474 D04 v01r02,when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤1.2W/Kg, SAR testing with a headset connected is not required. ·

According to 941225 D06 v02, when the overall device length and width are＞9cm×5cm, Hotspot mode with a test separation distance of 10mm. For device with form factors smaller than 9cm×5cm, Hotspot mode with a test separation distance of 5mm. Body SAR was also performed with the headset attached and without.

According to 941225 D06 v02, when the same wireless mode transmission configurations are required for SAR measurements, the more conservative configuration with a smaller separation distance should be tested for the overlapping SAR configurations. This typically applies to the back and front surfaces of a handset when SAR is required for both hotspot mode and body-worn accessory exposure conditions.

According to 248227 D01 802.11 Wi-Fi SAR v02, SAR is not required for 802.11g channels when the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b channels.

Maximum Scaling SAR in order to calculate the Maximum SAR values to test under the standard Peak Power, Calculation method is as follows:

Maximum Scaling SAR =tested SAR (Max.) × [maximum turn-up power (mw)/ maximum measurement output power(mw)]

8.3.2 Standalone SAR

SAR Values [GSM 850 (GSM/GPRS)]

Test Position	Channel/ Frequency(MHz)	Test Mode	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB Drift (dB)	Limit SAR_{1g} 1.6 W/kg Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Head										
Left/Cheek	190/836.6	Voice	1:8.3	23.97	23.79	-0.08	0.302	1.04	0.314	N/A
Left/Tilt	190/836.6	Voice	1:8.3	23.97	23.79	-0.07	0.105	1.04	0.109	N/A
Right/Cheek	190/836.6	Voice	1:8.3	23.97	23.79	-0.14	0.211	1.04	0.219	N/A
Right/Tilt	190/836.6	Voice	1:8.3	23.97	23.79	0.03	0.085	1.04	0.088	N/A
Left/Cheek	190/836.6	2Txslots	1:4.15	23.98	23.89	-0.10	0.398	1.02	0.406	Figure. 1
Left/Tilt	190/836.6	2Txslots	1:4.15	23.98	23.89	-0.08	0.146	1.02	0.149	N/A
Right/Cheek	190/836.6	2Txslots	1:4.15	23.98	23.89	-0.12	0.295	1.02	0.301	N/A
Right/Tilt	190/836.6	2Txslots	1:4.15	23.98	23.89	-0.09	0.112	1.02	0.114	N/A
Test position of Body-worn accessory(Distance 5mm)										
Rear Side	190/836.6	Voice	1:8.3	23.97	23.79	0.12	0.602	1.04	0.626	N/A
Front Side	190/836.6	Voice	1:8.3	23.97	23.79	0.04	0.421	1.04	0.438	N/A
Test position of Hotspot Mode (Distance 5mm)										
Rear Side	190/836.6	2Txslots	1:4.15	23.98	23.89	0.02	0.680	1.02	0.694	Figure.2
Front Side	190/836.6	2Txslots	1:4.15	23.98	23.89	-0.03	0.514	1.02	0.524	N/A
Test position of Hotspot Mode (Distance 10mm)										
Left Edge	190/836.6	2Txslots	1:4.15	23.98	23.89	0.03	0.041	1.02	0.042	N/A
Right Edge	190/836.6	2Txslots	1:4.15	23.98	23.89	0.05	0.076	1.02	0.078	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	190/836.6	2Txslots	1:4.15	23.98	23.89	-0.04	0.134	1.02	0.137	N/A
Worst Case Position of Body with EGPRS GMSK(Distance 5mm)										
Rear Side	190/836.6	2Txslots	1:4.15	23.98	23.87	-0.06	0.661	1.03	0.681	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.
4. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
5. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

SAR Values [GSM 1900 (GSM/GPRS)]

Test Position	Channel/ Frequency (MHz)	Test Mode	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ± 0.21dB	Limit SAR_{1g} 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Head										
Left Cheek	661/1880	Voice	1:8.3	20.97	20.81	0.09	0.532	1.04	0.553	N/A
Left Tilt	661/1880	Voice	1:8.3	20.97	20.81	-0.05	0.165	1.04	0.172	N/A
Right Cheek	661/1880	Voice	1:8.3	20.97	20.81	0.12	0.452	1.04	0.470	N/A
Right Tilt	661/1880	Voice	1:8.3	20.97	20.81	0.14	0.138	1.04	0.144	N/A
Left Cheek	661/1880	2Txslots	1:4.15	21.98	21.87	0.02	0.591	1.03	0.609	Figure.3
Left Tilt	661/1880	2Txslots	1:4.15	21.98	21.87	-0.03	0.221	1.03	0.228	N/A
Right Cheek	661/1880	2Txslots	1:4.15	21.98	21.87	0.06	0.507	1.03	0.522	N/A
Right Tilt	661/1880	2Txslots	1:4.15	21.98	21.87	0.04	0.194	1.03	0.200	N/A
Test position of Body-worn accessory(Distance 5mm)										
Rear Side	661/1880	Voice	1:8.3	20.97	20.81	-0.05	0.706	1.04	0.734	N/A
Front Side	661/1880	Voice	1:8.3	20.97	20.81	-0.04	0.589	1.04	0.613	N/A
Test position of Hotspot Mode (Distance 5mm)										
Rear Side	661/1880	2Txslots	1:4.15	21.98	21.87	-0.07	0.761	1.03	0.784	Figure.4
Front Side	661/1880	2Txslots	1:4.15	21.98	21.87	-0.06	0.659	1.03	0.679	N/A
Test position of Hotspot Mode (Distance 10mm)										
Left Edge	661/1880	2Txslots	1:4.15	21.98	21.87	-0.02	0.072	1.03	0.074	N/A
Right Edge	661/1880	2Txslots	1:4.15	21.98	21.87	0.04	0.036	1.03	0.037	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	661/1880	2Txslots	1:4.15	21.98	21.87	-0.07	0.224	1.03	0.231	N/A
Worst Case Position of Body With EGPRS GMSK (Distance 5mm)										
Rear Side	661/1880	2Txslots	1:4.15	21.98	21.82	-0.06	0.745	1.04	0.775	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.
4. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg; no additional SAR evaluations using a headset cable were required.
5.When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

SAR Values [WCDMA Band II (WCDMA/HSDPA/HSUPA)]

Test Position	Channel/ Frequency (MHz)	Channel Type	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Head										
Left Cheek	9262/1852.4	RMC 12.2K	1:1	23	22.73	0.15	0.837	1.06	0.887	N/A
	9400/1880	RMC 12.2K	1:1	23	22.77	0.16	0.849	1.05	0.891	Figure.5
	9538/1907.6	RMC 12.2K	1:1	23	22.72	0.16	0.830	1.07	0.888	N/A
Left Tilt	9400/1880	RMC 12.2K	1:1	23	22.77	0.11	0.426	1.05	0.447	N/A
Right Cheek	9400/1880	RMC 12.2K	1:1	23	22.77	0.14	0.757	1.05	0.795	N/A
Right Tilt	9400/1880	RMC 12.2K	1:1	23	22.77	0.12	0.364	1.05	0.382	N/A
Worst Case Position of Head SAR (1st Repeated SAR)										
Left Cheek	9400/1880	RMC 12.2K	1:1	23	22.77	0.15	0.847	1.05	0.889	N/A
Test position of Body-worn accessory& Hotspot Mode (Distance 5mm)										
Rear Side	9400/1880	RMC 12.2K	1:1	23	22.77	0.14	0.672	1.05	0.706	N/A
Front Side	9262/1852.4	RMC 12.2K	1:1	23	22.73	0.16	1.14	1.06	1.208	N/A
	9400/1880	RMC 12.2K	1:1	23	22.77	0.17	1.16	1.05	1.218	Figure.6
	9538/1907.6	RMC 12.2K	1:1	23	22.72	0.16	1.11	1.07	1.188	N/A
Test position of Hotspot Mode (Distance 10mm)										
Left Edge	9400/1880	RMC 12.2K	1:1	23	22.77	0.06	0.041	1.05	0.043	N/A
Right Edge	9400/1880	RMC 12.2K	1:1	23	22.77	0.04	0.062	1.05	0.065	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	9400/1880	RMC 12.2K	1:1	23	22.77	0.09	0.321	1.05	0.337	N/A
Worst Case Position of SAR (1st Repeated SAR, Distance 5mm)										
Front Side	9400/1880	RMC 12.2K	1:1	23	22.77	0.16	1.15	1.05	1.208	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
4.When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

SAR Values [WCDMA Band V (WCDMA/HSDPA/HSUPA)]

Test Position	Channel/ Frequency (MHz)	Channel Type	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Head										
Left Cheek	4183/836.6	RMC 12.2K	1:1	23	22.83	-0.18	0.345	1.04	0.359	Figure.7
Left Tilt	4183/836.6	RMC 12.2K	1:1	23	22.83	-0.14	0.114	1.04	0.119	N/A
Right Cheek	4183/836.6	RMC 12.2K	1:1	23	22.83	-0.11	0.309	1.04	0.321	N/A
Right Tilt	4183/836.6	RMC 12.2K	1:1	23	22.83	-0.09	0.102	1.04	0.106	N/A
Test position of Body-worn accessory& Hotspot Mode (Distance 5mm)										
Rear Side	4183/836.6	RMC 12.2K	1:1	23	22.83	0.03	0.658	1.04	0.684	Figure.8
Front Side	4183/836.6	RMC 12.2K	1:1	23	22.83	-0.04	0.441	1.04	0.459	N/A
Test position of Hotspot Mode (Distance 10mm)										
Left Edge	4183/836.6	RMC 12.2K	1:1	23	22.83	0.02	0.063	1.04	0.066	N/A
Right Edge	4183/836.6	RMC 12.2K	1:1	23	22.83	-0.05	0.112	1.04	0.116	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	4183/836.6	RMC 12.2K	1:1	23	22.83	0.06	0.082	1.04	0.085	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).

3. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.

4.When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

SAR Values (802.11b/g/n)

Test Position	Channel/ Frequency (MHz)	Service	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit of SAR 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Head										
Left Cheek	6/2437	DSSS	1:1	17	16.85	-0.04	0.231	1.04	0.240	N/A
Left Tilt	6/2437	DSSS	1:1	17	16.85	-0.02	0.215	1.04	0.224	N/A
Right Cheek	6/2437	DSSS	1:1	17	16.85	-0.06	0.242	1.04	0.252	Figure.9
Right Tilt	6/2437	DSSS	1:1	17	16.85	-0.05	0.224	1.04	0.233	N/A
Test position of Body-worn accessory& Hotspot Mode (Distance 5mm)										
Rear Side	6/2437	DSSS	1:1	17	16.85	0.10	0.336	1.04	0.349	Figure.10
Front Side	6/2437	DSSS	1:1	17	16.85	0.04	0.205	1.04	0.213	N/A
Test position of Hotspot Mode (Distance 10mm)										
Left Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Edge	6/2437	DSSS	1:1	17	16.85	-0.06	0.217	1.04	0.226	N/A
Top Edge	6/2437	DSSS	1:1	17	16.85	0.12	0.212	1.04	0.220	N/A
Bottom Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: 1. The value with green color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. KDB 248227 D01 802.11 Wi-Fi SAR v02-SAR is not required for 802.11g/n channels when the maximum average output power is less than ¼ dB higher than measured on the corresponding 802.11b channels.

8.3.3 Simultaneous SAR Evaluation

Application Simultaneous Transmission information:

NO.	Simultaneous Transmission Configurations	Smartphone		Note
		Head	Body	
1	GSM(Voice) + WLAN2.4GHz(data)	Yes	Yes	-
2	WCDMA(Voice) + WLAN2.4GHz(data)	Yes	Yes	-
3	GSM(Voice) + Bluetooth(data)	Yes	Yes	-
4	WCDMA((Voice) + Bluetooth(data)	Yes	Yes	-
5	GPRS/EDGE(Data) + WLAN2.4GHz(data)	Yes	Yes	2.4GHz Hotspot
6	WCDMA(Data) + WLAN2.4GHz(data)	Yes	Yes	2.4GHz Hotspot
7	GPRS/EDGE(Data) + Bluetooth(data)	Yes	Yes	Bluetooth Tethering
8	WCDMA(Data) + Bluetooth(data)	Yes	Yes	Bluetooth Tethering

NOTE:

1) WLAN2.4GHz and Bluetooth share the same antenna, and cannot transmit simultaneously.
2) The Reported SAR summation is calculated based on the same configuration and test position.
3) Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
   a) Scalar SAR summation < 1.6W/kg.
   b) SPLSR = $(SAR1 + SAR2)^{1.5}$ / (min. separation distance, mm), and the peak separation distance is determined from the square root of \[$(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2$], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan
   c) If SPLSR≦ 0.04, simultaneously transmission SAR measurement is not necessary
   d) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg
4) For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
   a) (max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] .[√f(GHz)/ x] W/kg for test separation distances≦50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
   b) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   c) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Bluetooth Max Power Allowed (dBm)	Bluetooth Max Power Rounded(mW)	Exposure Position	Test Separation Distances	Estimated SAR (W/kg)
7	5	Head, Body Front &Rear	5mm	0.208
7	5	Bluetooth Tethering Left & Top Edge	10mm	0.104
7	5	Bluetooth Tethering Right & Bottom Edge	> 50 mm	0.400
WiFi Max Power Allowed (dBm)	WiFi Max Power Rounded(mW)	Exposure Position	Test Separation Distances	Estimated SAR (W/kg)
17	50	Hotspot Left Edge	39mm	0.267
17	50	Hotspot Bottom Edge	> 50 mm	0.400
WWAN Antenna		Exposure Position	Test Separation Distances	Estimated SAR (W/kg)
		Hotspot Top Edge	> 50 mm	0.400

Simultaneous transmission SAR for WIFI and GSM/WCDMA

SAR_{1g}(W/kg) / Test Position	GSM 850	GSM 1900	WCDMA Band II	WCDMA Band V	WIFI	MAX. ΣSAR_{1g}	Peak location separation ratio
Left, Cheek	0.406	0.609	**0.891**	0.359	0.240	1.131	N/A
Left, Tilt	0.149	0.228	**0.447**	0.119	0.224	0.671	N/A
Right, Cheek	0.301	0.522	**0.795**	0.321	0.252	1.047	N/A
Right, Tilt	0.114	0.200	**0.382**	0.106	0.233	0.615	N/A
Rear Side	0.694	**0.784**	0.706	0.684	0.349	1.133	N/A
Front Side	0.524	0.679	**1.218**	0.459	0.213	1.431	N/A
Left Edge	0.042	0.074	0.043	0.066	**0.267**	0.341	N/A
Right Edge	0.078	0.037	0.065	0.116	**0.226**	0.342	N/A
Top Edge	**0.400**	**0.400**	**0.400**	**0.400**	0.220	0.620	N/A
Bottom Edge	0.137	0.231	0.337	0.085	**0.400**	0.737	N/A

Note: 1.The value with blue color is estimated by the maximum tune-up power per KDB 447498 D01v05r02. Refer to chapter 8.3.3 sub-clause 4) of this report.

MAX. ΣSAR_{1g} = 1.431 W/kg<1.6 W/kg, so the Simultaneous transmission SAR with volume scan are not required for WIFI and GSM/WCDMA

Simultaneous transmission SAR for Bluetooth and GSM/WCDMA

SAR_{1g}(W/kg) / Test Position	GSM 850	GSM 1900	WCDMA Band II	WCDMA Band V	Estimated SAR of Bluetooth (W/kg)	MAX. ΣSAR_{1g}	Peak location separation ratio
Left, Cheek	0.406	0.609	**0.891**	0.359	**0.208**	1.099	N/A
Left, Tilt	0.149	0.228	**0.447**	0.119	**0.208**	0.655	N/A
Right, Cheek	0.301	0.522	**0.795**	0.321	**0.208**	1.003	N/A
Right, Tilt	0.114	0.200	**0.382**	0.106	**0.208**	0.590	N/A
Rear Side	0.694	**0.784**	0.706	0.684	**0.208**	0.992	N/A
Front Side	0.524	0.679	**1.218**	0.459	**0.208**	1.426	N/A
Left Edge	0.042	0.074	0.043	0.066	**0.400**	0.474	N/A
Right Edge	0.078	0.037	0.065	**0.116**	**0.104**	0.220	N/A
Top Edge	**0.400**	**0.400**	**0.400**	**0.400**	**0.104**	0.504	N/A
Bottom Edge	0.137	0.231	0.337	0.085	**0.400**	0.737	N/A

Note: 1.The value with blue color is estimated by the maximum tune-up power per KDB 447498 D01v05r02. Refer to chapter 8.3.3 sub-clause 4) of this report.

MAX. ΣSAR_{1g} = 1.426 W/kg <1.6 W/kg, so the Simultaneous transmission SAR with volume scan are not required for BT and GSM/WCDMA

9. System Check Results

System Performance Check at 835 MHz Head
Date: 13/05/2015

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d134

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

Medium parameters used (interpolated): f = 835 MHz; σ = 0.89 S/m; ε_r = 41.48; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF(6.23, 6.23, 6.23); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (7x7x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (measured) = 3.10 W/kg

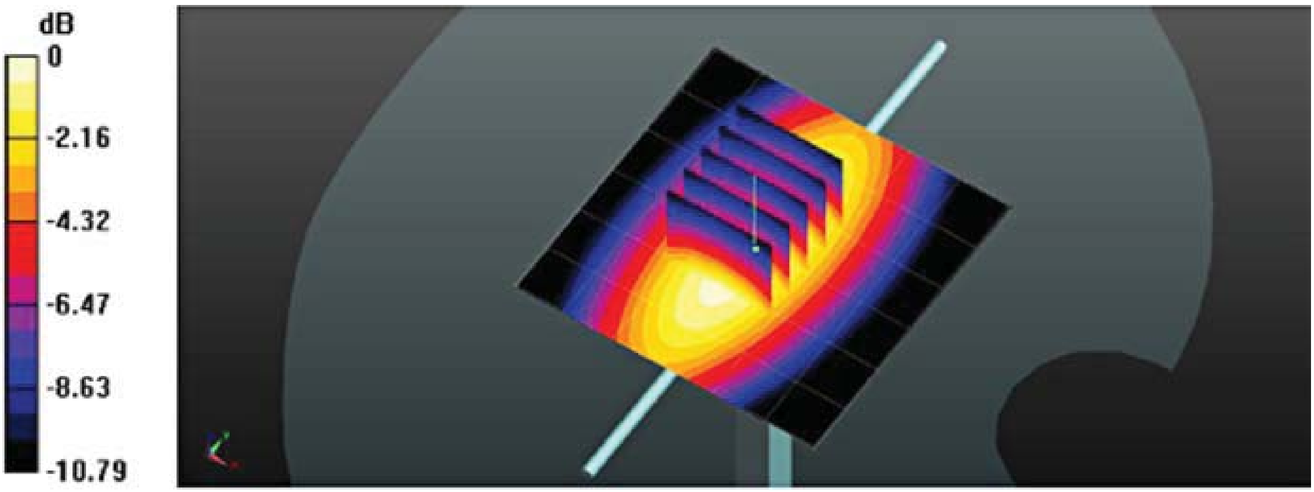
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 52.987 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.448 W/kg

SAR(1 g) = 2.40 W/kg; SAR(10 g) = 1.49 W/kg

Maximum value of SAR (measured) = 3.02 W/kg



0 dB = 3.10 W/kg=9.83 dB W/kg

System Performance Check 835MHz Head 250mW

System Performance Check at 835 MHz Body

Date: 14/05/2015

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d134

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

Medium parameters used (interpolated): f = 835 MHz; σ = 0.96 S/m; ε_r = 55.88; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (6.11, 6.11, 6.11); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (7x7x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (measured) = 3.25 W/kg

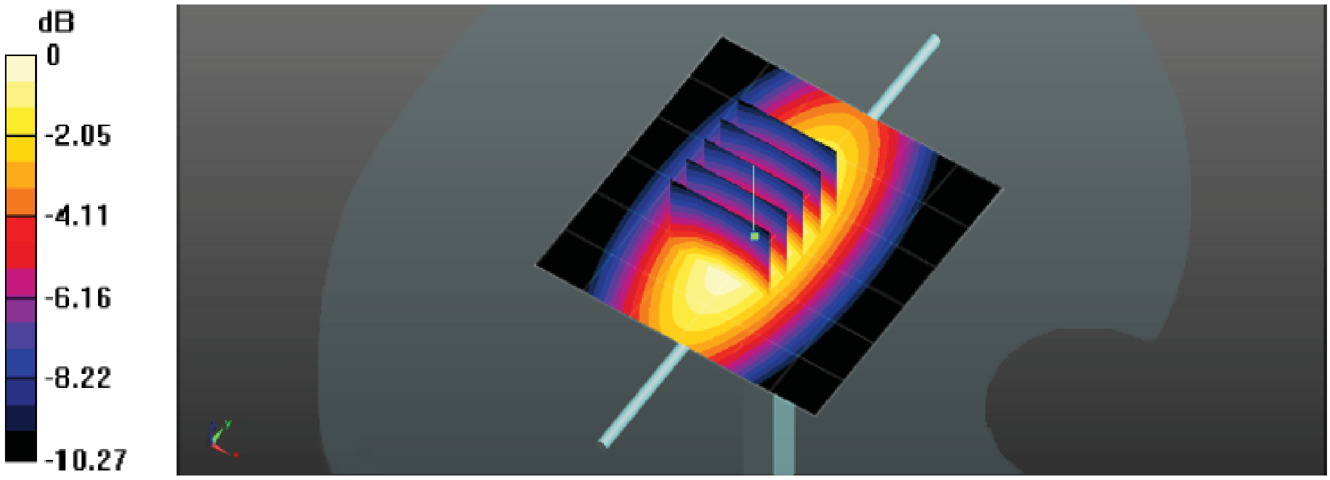
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 46.531 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.568 W/kg

SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.17 W/kg



0 dB = 3.25 W/kg = 10.24dB W/kg

System Performance Check 835MHz Body 250mW

System Performance Check at 1900 MHz Head

Date: 15/05/2015

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d150
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1900 MHz; σ = 1.42 S/m; ε_r = 39.76; ρ = 1000 kg/m^3
Phantom section: Flat Section

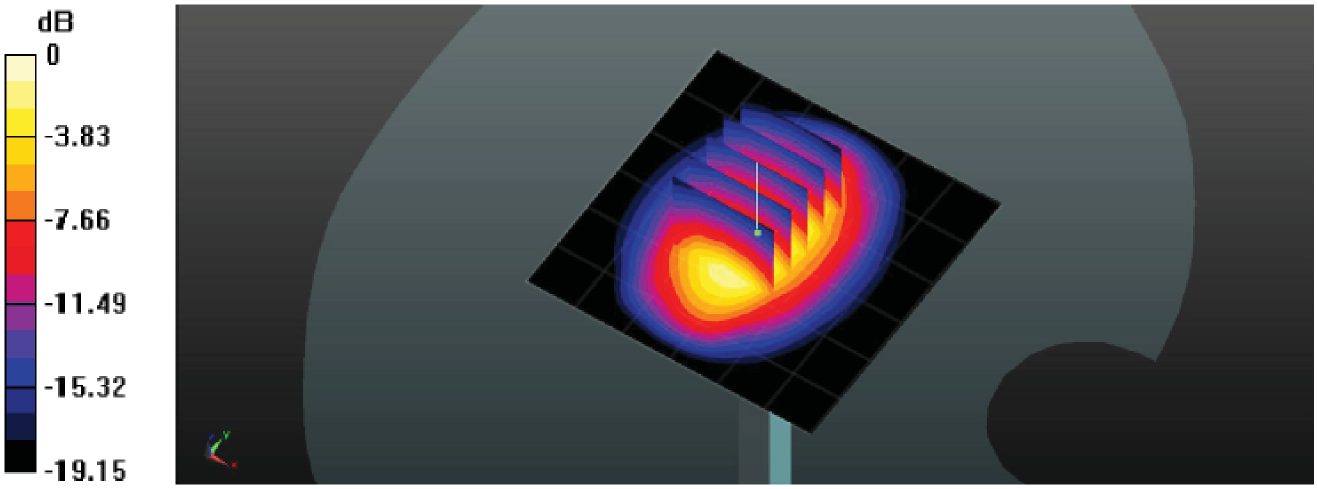
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (5.03, 5.03, 5.03); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (7x7x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (measured) = 11.58 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 91.813 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 14.363 W/kg

SAR(1 g) = 9.66 W/kg; SAR(10 g) = 5.00 W/kg
Maximum value of SAR (measured) = 11.44 W/kg



0 dB = 11.58 W/kg = 21.27 dB W/kg

System Performance Check 1900MHz Head 250mW

System Performance Check at 1900 MHz Body

Date: 16/05/2015

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d150

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

Medium parameters used (interpolated): f = 1900 MHz; σ = 1.57 S/m; εr =51.13; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (4.66, 4.66, 4.66); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (7x7x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (measured) = 12.49 W/kg

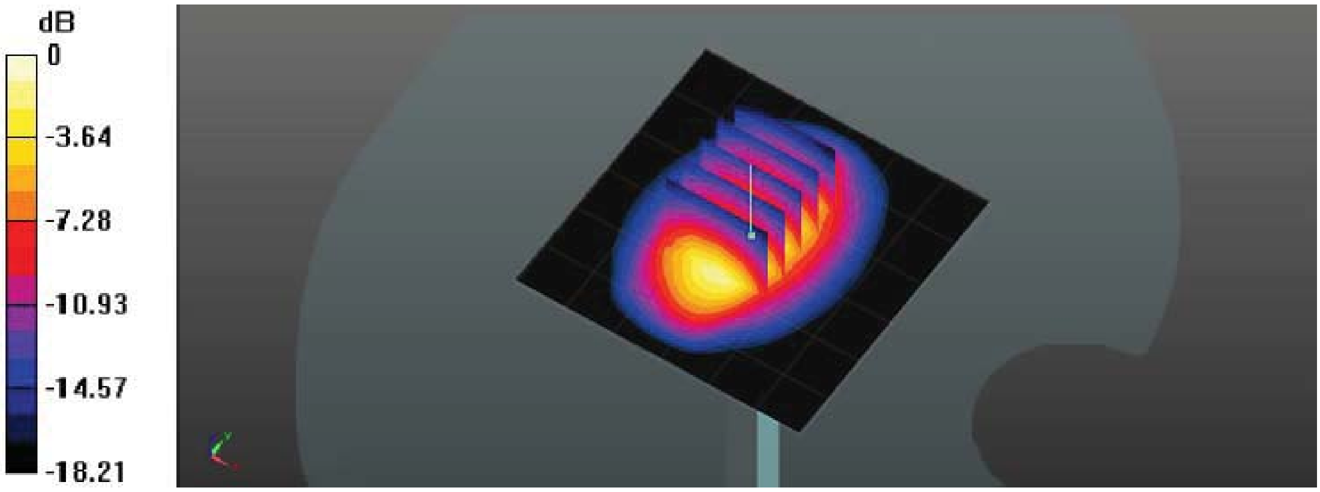
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 83.826 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.824 W/kg

SAR (1 g) = 9.83 W/kg; SAR (10 g) = 5.17 W/kg

Maximum value of SAR (measured) = 12.38 W/kg



0 dB = 12.49 W/kg = 21.93 dB W/kg

System Performance Check 1900MHz Body 250mW

System Performance Check at 2450 MHz Head

Date: 17/05/2015

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 884

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz; σ = 1.85 S/m; εr = 38.02; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (4.43, 4.43, 4.43); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x8x1): Measurement grid: dx=12.00 mm, dy=12.00 mm

Maximum value of SAR (measured) = 17.12 W/kg

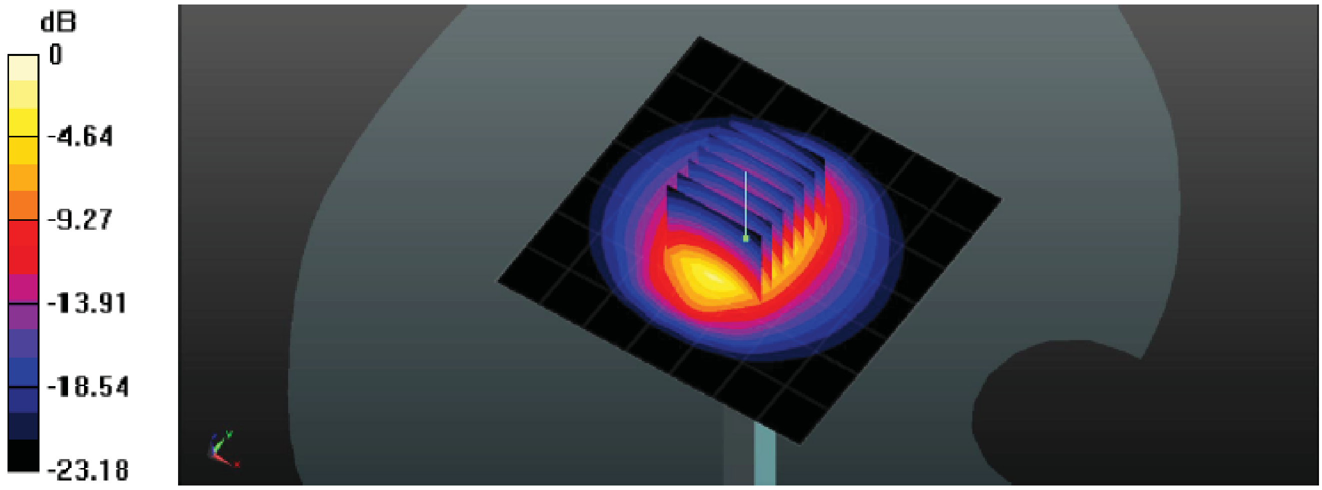
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.641 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 26.35 W/kg

SAR (1 g) = 12.94 W/kg; SAR (10 g) = 6.01 W/kg

Maximum value of SAR (measured) = 17.08 W/kg



0 dB = 17.12 W/kg = 24.67 dB W/kg

System Performance Check 2450MHz Head 250mW

System Performance Check at 2450 MHz Body

Date: 17/05/2015

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 884

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz; σ = 2.01 S/m; εr = 50.74; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (4.23, 4.23, 4.23); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x8x1): Measurement grid: dx=12.00 mm, dy=12.00 mm

Maximum value of SAR (measured) = 16.73 W/kg

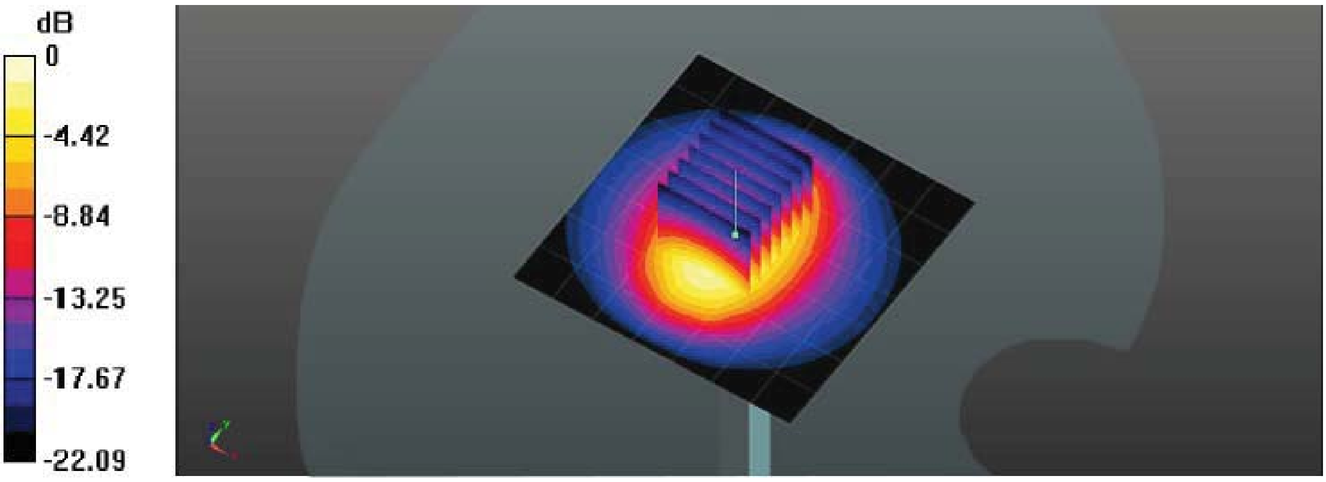
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.982 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 26.51 W/kg

SAR (1 g) = 12.86 W/kg; SAR (10 g) = 6.02 W/kg

Maximum value of SAR (measured) = 16.66 W/kg



0 dB = 16.73 W/kg = 24.47 dB W/kg

System Performance Check 2450MHz Body 250mW

10. SAR Test Graph Results

GSM 850 GPRS (2Txslots) Left Cheek Middle Channel

Date: 13/05/2015

Communication System: Customer System; Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium parameters used: f = 836.6 MHz; σ = 0.89 S/m; ε_r = 41.48; ρ = 1000 kg/m^3

Phantom section: Left Section

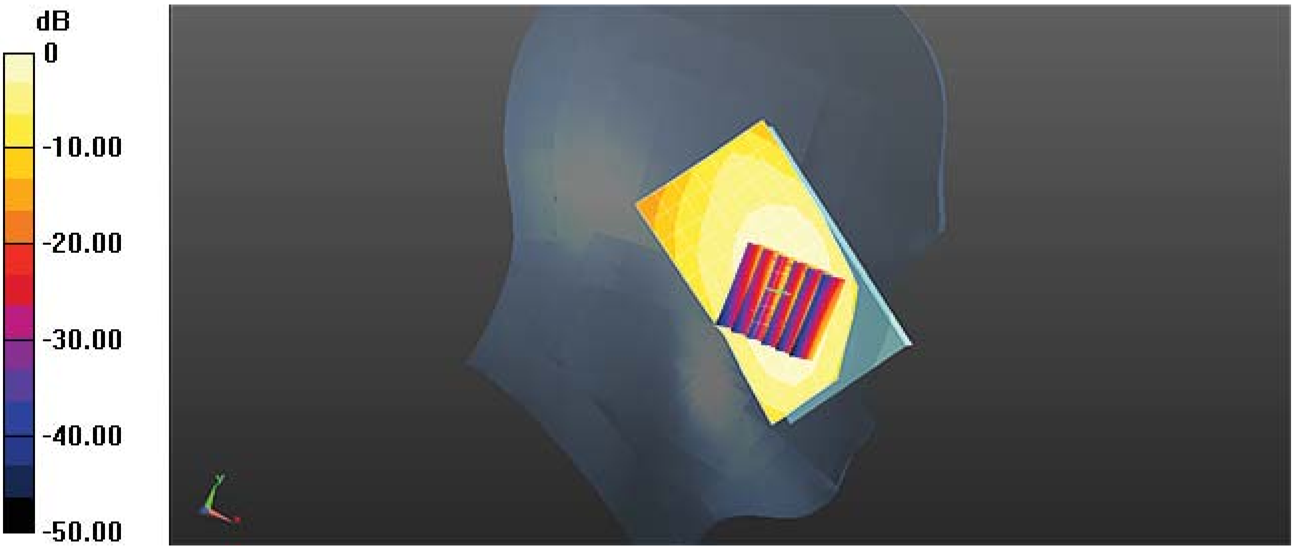
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (6.23, 6.23, 6.23); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.422 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.482 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.561 W/kg

SAR(1 g) = 0.398 W/kg; SAR(10 g) = 0.283 W/kg
Maximum value of SAR (measured) = 0.419 W/kg



0 dB = 0.422 W/kg = -7.49 dB W/kg

Figure 1 Left Cheek GSM 850 GPRS (2Txslots) Channel 190

GSM 850 GPRS (2Txslots) Rear Side Middle Channel

Date: 14/05/2015

Communication System: Customer System; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium parameters used: f = 836.6 MHz; σ = 0.96 S/m; ε_r = 55.88; ρ = 1000 kg/m^3

Phantom section: Flat Section

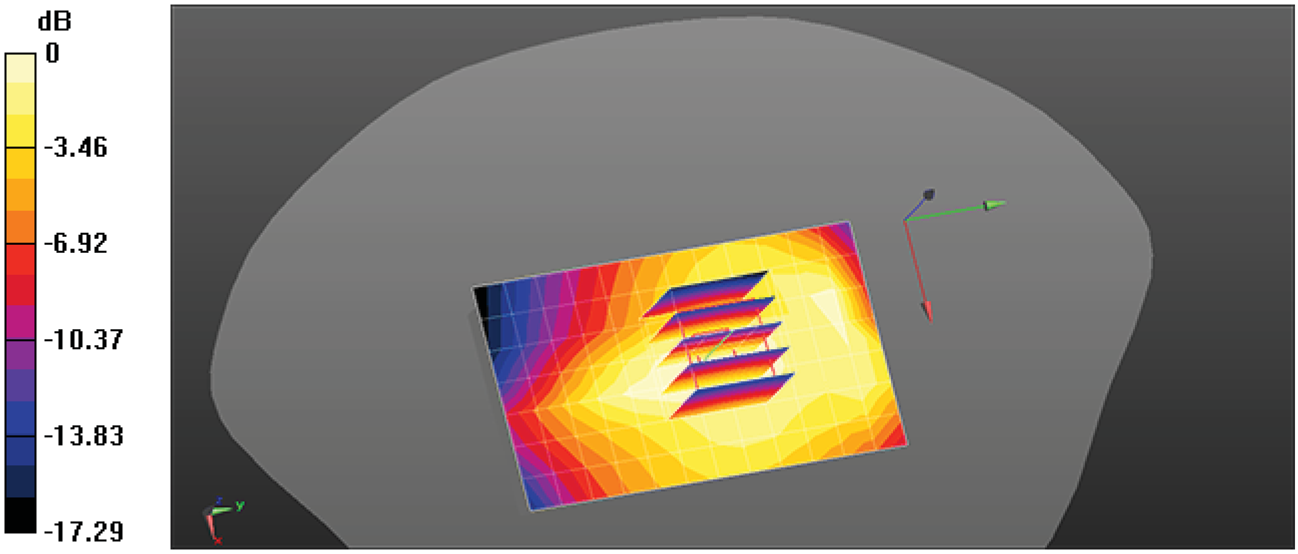
DASY5 Configuration:

- Probe: ES3DV3 - SN3292; ConvF (6.11, 6.11, 6.11); Calibrated: 15/08/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.667 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.401 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.896 W/kg

SAR(1 g) = 0.680 W/kg; SAR(10 g) = 0.467 W/kg
Maximum value of SAR (measured) = 0.756 W/kg



0 dB = 0.667 W/kg = -3.52 dB W/kg

Figure 2 : Body Rear Side, GSM 850 GPRS (2Txslots) Channel 190

GSM 1900 GPRS (2Txslots) Left Cheek Middle Channel

Date: 15/05/2015

Communication System: Customer System; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.43 S/m; ε_r = 39.80; ρ = 1000 kg/m^3

Phantom section: Left Section

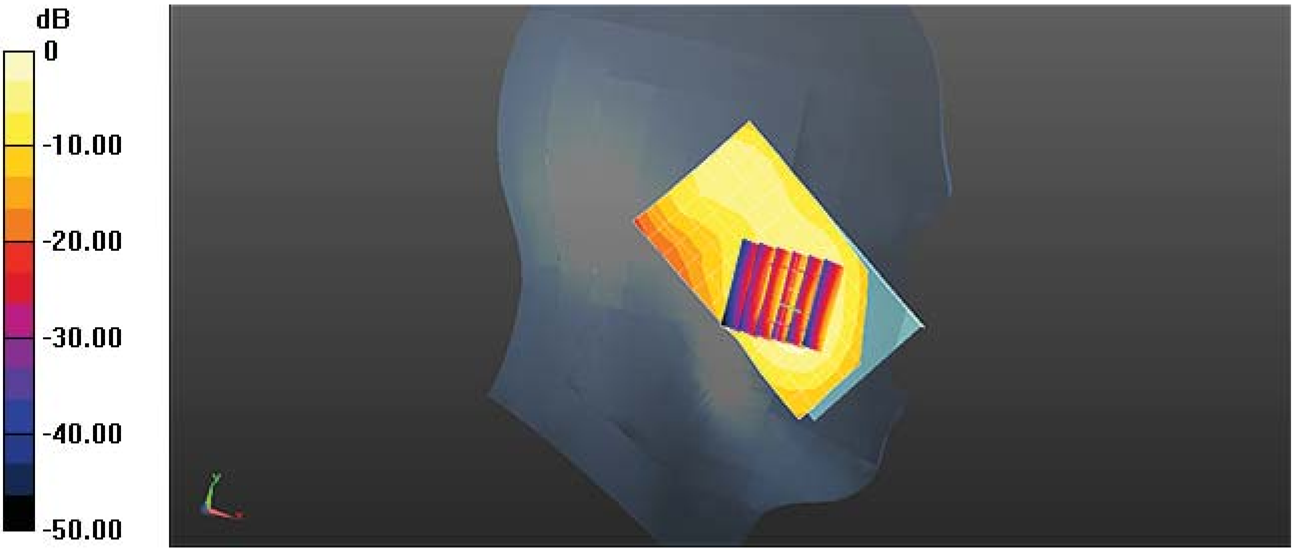
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (5.03, 5.03, 5.03); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.601 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.211 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.883 W/kg

SAR(1 g) = 0.591 W/kg; SAR(10 g) = 0.362 W/kg
Maximum value of SAR (measured) = 0.649 W/kg



0 dB = 0.601 W/kg = -4.42 dB W/kg

Figure 3 Left Cheek GSM 1900 GPRS (2Txslots) Channel 661

GSM 1900 GPRS (2Txslots) Rear Side Middle Channel

Date: 16/05/2015

Communication System: Customer System; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.58 S/m; ε_r = 51.22; ρ = 1000 kg/m^3

Phantom section: Flat Section

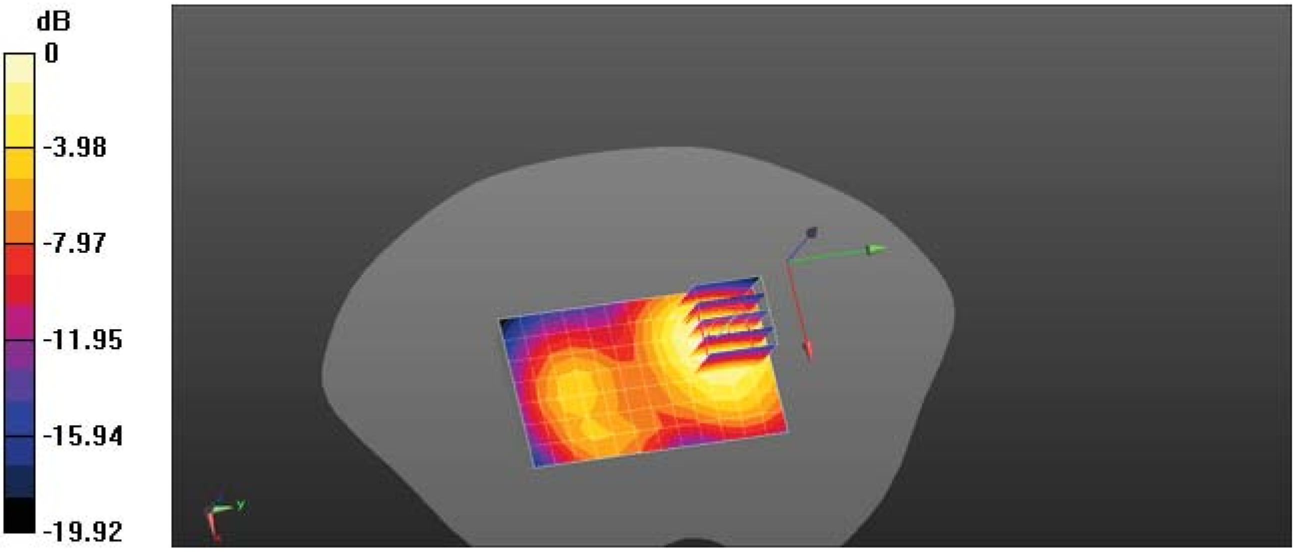
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (4.66, 4.66, 4.66); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.785 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.797 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.228 W/kg

SAR(1 g) = 0.761 W/kg; SAR(10 g) = 0.452 W/kg
Maximum value of SAR (measured) = 0.827 W/kg



0 dB = 0.785 W/kg = -2.10 dB W/kg

Figure 4 : Body Rear Side, GSM 1900 GPRS (2Txslots) Channel 661

WCDMA Band II Left Cheek Middle Channel

Date: 15/05/2015

Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.43 S/m; ε_r = 39.80; ρ = 1000 kg/m^3

Phantom section: Left Section

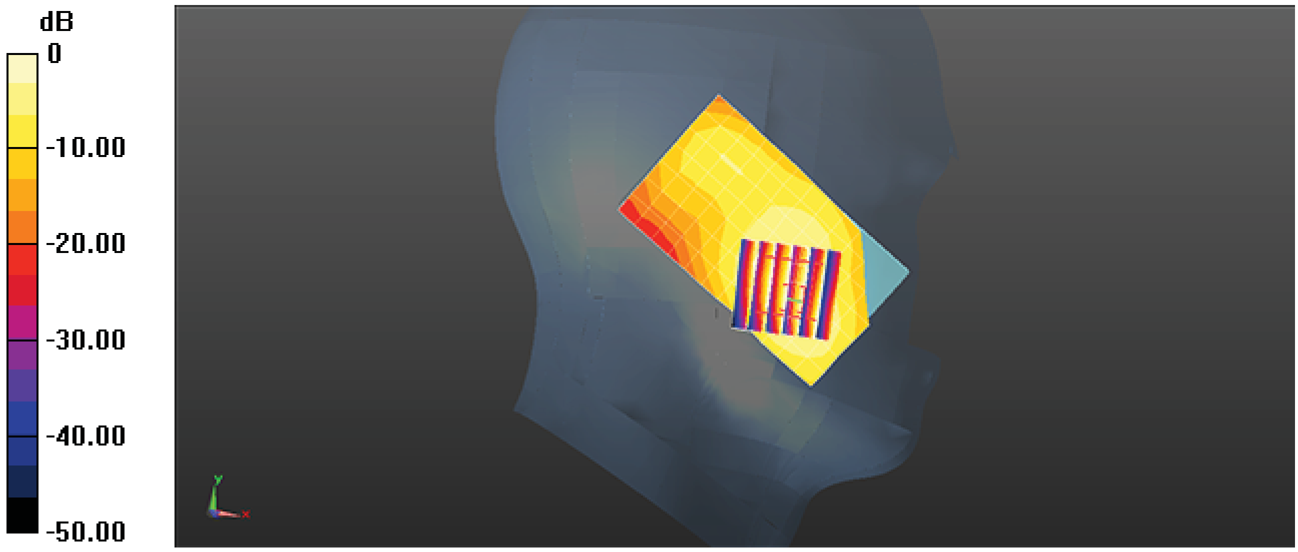
DASY5 Configuration:

- Probe: ES3DV3 - SN3292; ConvF (5.03, 5.03, 5.03); Calibrated: 15/08/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.878 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.084 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 1.372 W/kg

SAR(1 g) = 0.849 W/kg; SAR(10 g) = 0.483 W/kg
Maximum value of SAR (measured) = 0.896 W/kg



0 dB = 0.878 W/kg = -1.13 dB W/kg

Figure 5: Left Cheek WCDMA Band II Channel 9400

WCDMA Band II Front Side Middle Channel

Date: 16/05/2015

Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.58 S/m; ε_r = 51.22; ρ = 1000 kg/m^3

Phantom section: Flat Section

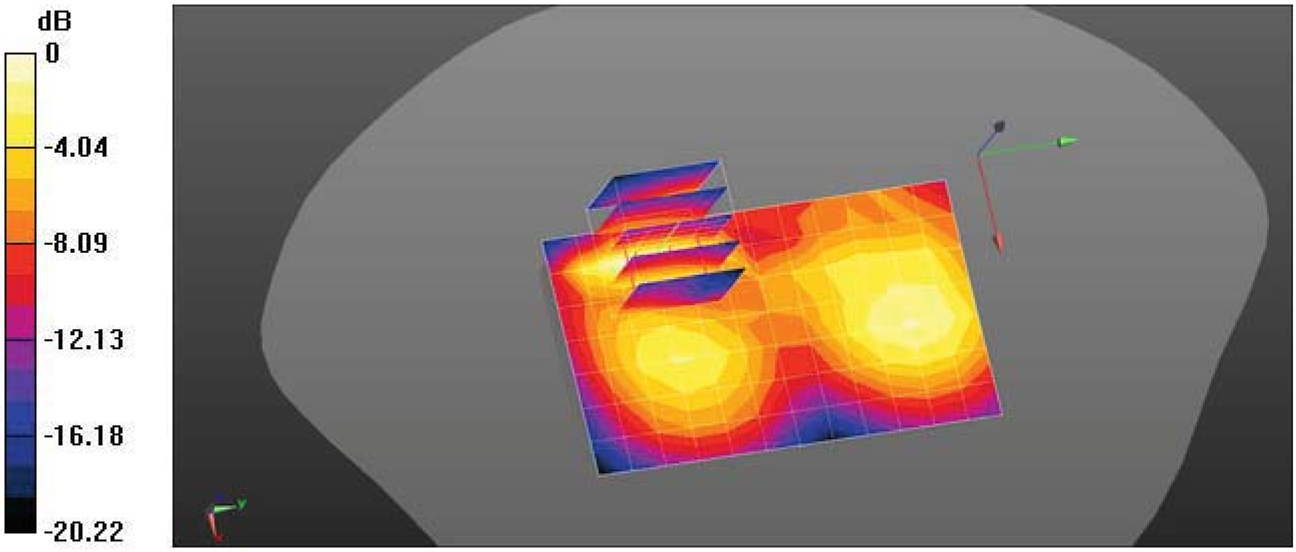
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (4.66, 4.66, 4.66); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.958 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.091 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 2.182 W/kg

SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.621 W/kg
Maximum value of SAR (measured) = 1.28 W/kg



0 dB = 0.958 W/kg = -0.37 dB W/kg

Figure 6 : Body Front Side, WCDMA Band II Channel 9400

WCDMA Band V Left Cheek Middle Channel

Date: 13/05/2015

Communication System: WCDMA; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.89 S/m; ε_r = 41.48; ρ = 1000 kg/m^3

Phantom section: Left Section

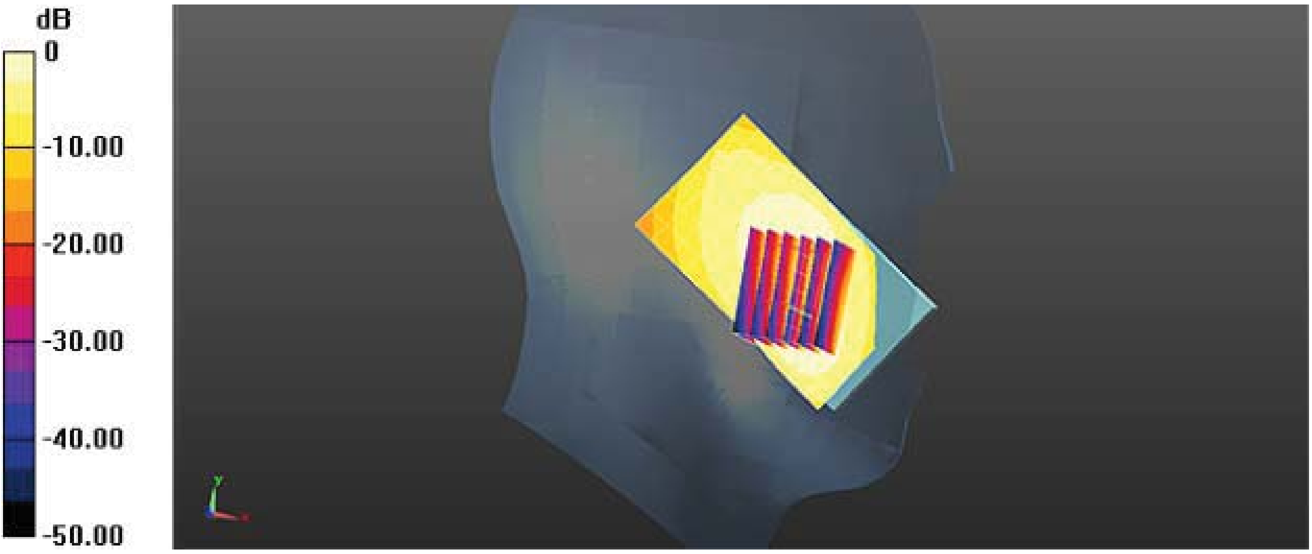
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (6.23, 6.23, 6.23); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.357 W/kg

Zoom Scan (6x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.092 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.505 W/kg

SAR(1 g) = 0.345 W/kg; SAR(10 g) = 0.241 W/kg
Maximum value of SAR (measured) = 0.369 W/kg



0 dB = 0.357 W/kg = -8.95 dB W/kg

Figure 7 Left Cheek WCDMA Band V Channel 4183

WCDMA Band V Rear Side Middle Channel

Date: 14/05/2015

Communication System: WCDMA; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.96 S/m; ε_r = 55.88; ρ = 1000 kg/m^3

Phantom section: Flat Section

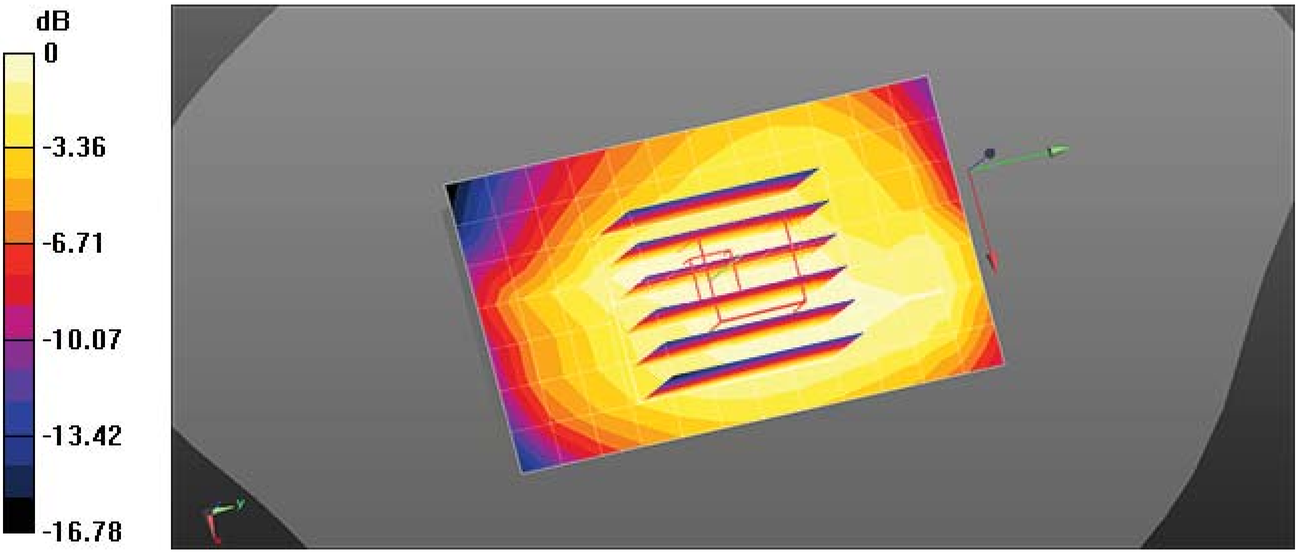
DASY5 Configuration:

- Probe: ES3DV3 - SN3292; ConvF (6.11, 6.11, 6.11); Calibrated: 15/08/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (8x13x1): Measurement grid: dx=10 mm, dy=10 mm
Maximum value of SAR (measured) = 0.709 W/kg

Zoom Scan (6x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.708 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.927 W/kg

SAR(1 g) = 0.658 W/kg; SAR(10 g) = 0.500 W/kg
Maximum value of SAR (measured) = 0.693 W/kg



0 dB = 0.709 W/kg = -2.99 dB W/kg

Figure 8: Body Rear Side, WCDMA Band V Channel 4183

802.11b Right Cheek Middle Channel

Date: 17/05/2015

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.84 S/m; ε_r = 38.04; ρ = 1000 kg/m^3

Phantom section: Right Section

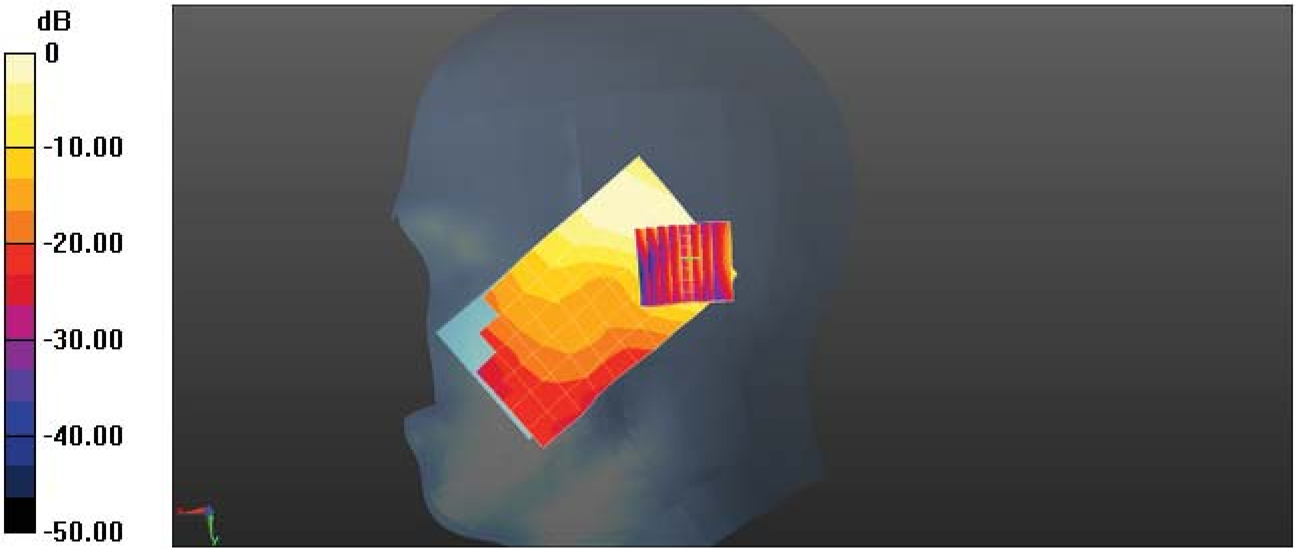
DASY5 Configuration:

- Probe: ES3DV3 - SN3292; ConvF (4.43, 4.43, 4.43); Calibrated: 15/08/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (7x11x1): Measurement grid: dx=12 mm, dy=12 mm
Maximum value of SAR (measured) = 0.254 W/kg

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.185 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.439 W/kg

SAR(1 g) = 0.242 W/kg; SAR(10 g) = 0.139 W/kg
Maximum value of SAR (measured) = 0.261 W/kg



0 dB = 0.254 W/kg = -11.90 dB W/kg

Figure 9: Right Head Cheek 802.11b Channel 6

802.11b Rear Side Middle Channel

Date: 17/05/2015

Communication System: Customer System; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 2.00 S/m; ε_r = 50.75; ρ = 1000 kg/m^3

Phantom section: Flat Section

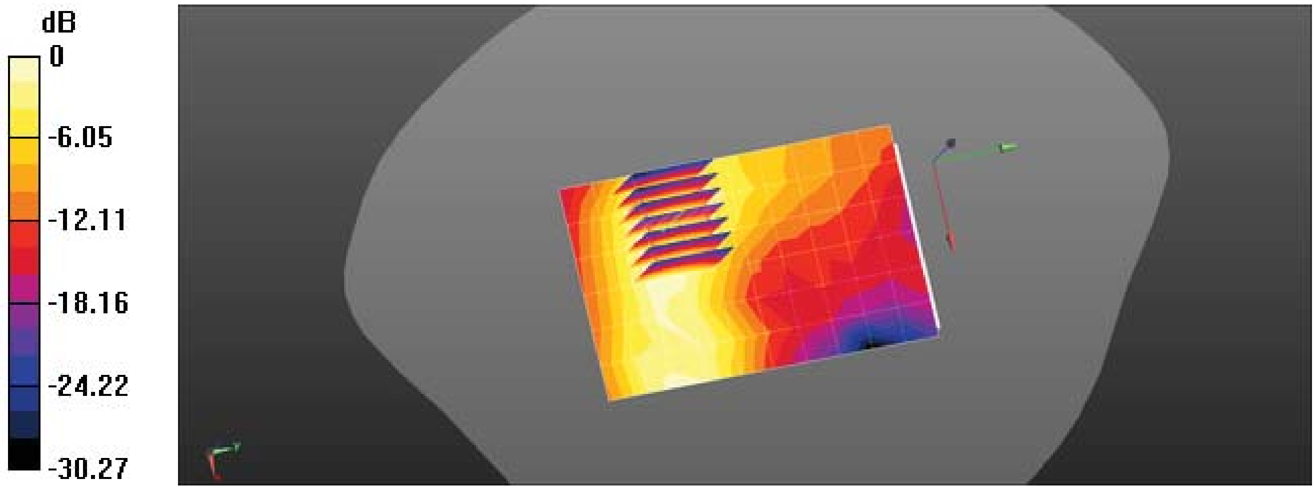
DASY5 Configuration:

- •Probe: ES3DV3 - SN3292; ConvF (4.23, 4.23, 4.23); Calibrated: 15/08/2014;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (7x11x1): Measurement grid: dx=12 mm, dy=12 mm
Maximum value of SAR (measured) = 0.348 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.757 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.667 W/kg

SAR(1 g) = 0.336 W/kg; SAR(10 g) = 0.174 W/kg
Maximum value of SAR (measured) = 0.369 W/kg



0 dB = 0.348 W/kg = -9.17 dB W/kg

Figure 10: Body, Back Side, 802.11b Channel 6

11. CALIBRATION CERTIFICATE

11.1 Probe Calibration Certificate ES3DV3 (3292)

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

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

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

Accreditation No.: **SCS 108**

Client **CIQ (Auden)**

Certificate No: **ES3-3292_Aug14**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3292
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	August 15, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: August 15, 2014

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

Certificate No: ES3-3292_Aug14 Page 1 of 11

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3292

Manufactured: July 6, 2010
Repaired: July 28, 2014
Calibrated: August 15, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.89	0.95	1.46	± 10.1 %
DCP (mV)[B]	107.1	106.1	103.9	

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	209.7	±3.8 %
		Y	0.0	0.0	1.0		218.8	
		Z	0.0	0.0	1.0		198.5	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	6.23	6.23	6.23	0.80	1.11	± 12.0 %
900	41.5	0.97	6.10	6.10	6.10	0.76	1.17	± 12.0 %
1810	40.0	1.40	5.07	5.07	5.07	0.61	1.36	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.45	1.55	± 12.0 %
2100	39.8	1.49	5.04	5.04	5.04	0.77	1.17	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.73	1.23	± 12.0 %

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
450	56.7	0.94	7.10	7.10	7.10	0.13	1.00	± 13.3 %
835	55.2	0.97	6.11	6.11	6.11	0.36	1.78	± 12.0 %
900	55.0	1.05	5.97	5.97	5.97	0.73	1.22	± 12.0 %
1810	53.3	1.52	4.79	4.79	4.79	0.59	1.45	± 12.0 %
1900	53.3	1.52	4.66	4.66	4.66	0.41	1.79	± 12.0 %
2100	53.2	1.62	4.77	4.77	4.77	0.63	1.42	± 12.0 %
2450	52.7	1.95	4.23	4.23	4.23	0.66	0.98	± 12.0 %

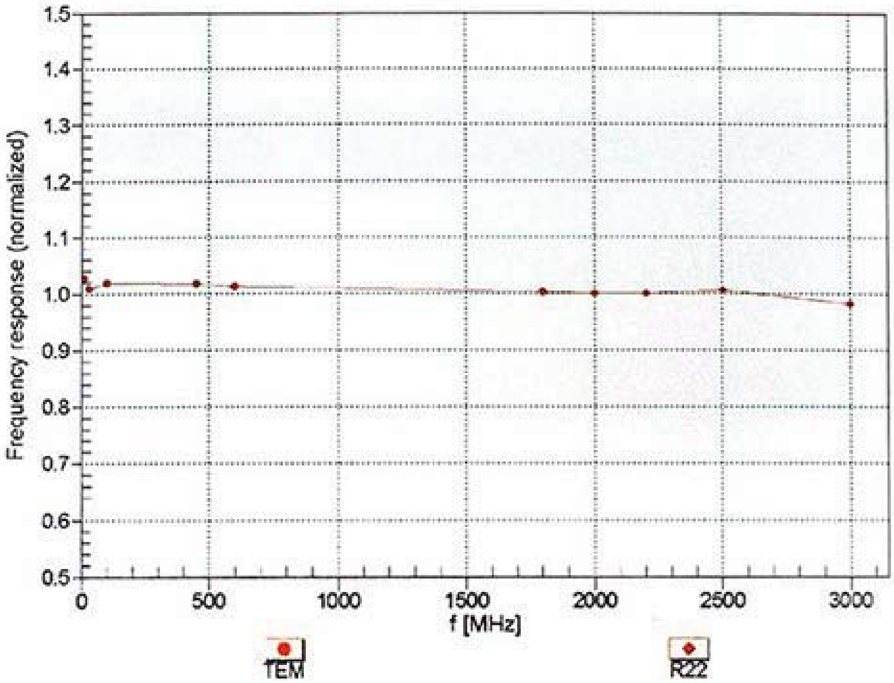
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz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

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

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

ES3DV3– SN:3292 August 15, 2014

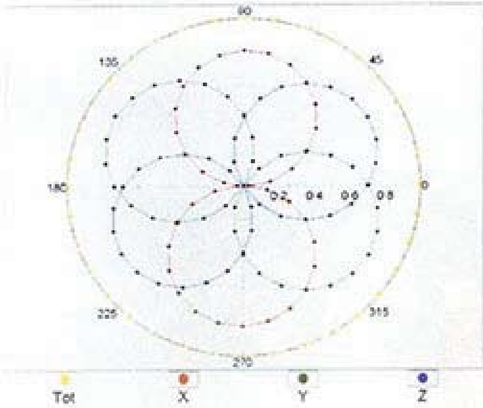
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



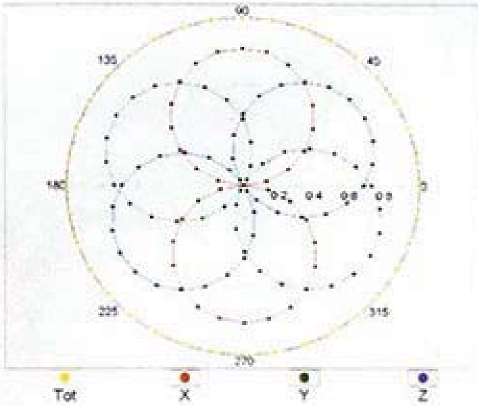
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

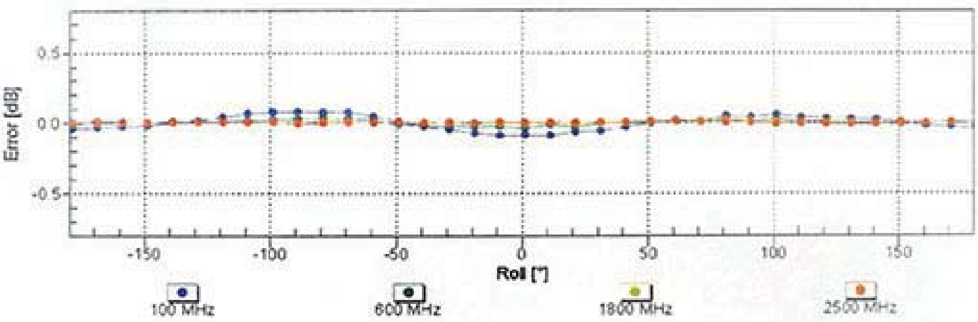
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



f=1800 MHz,R22

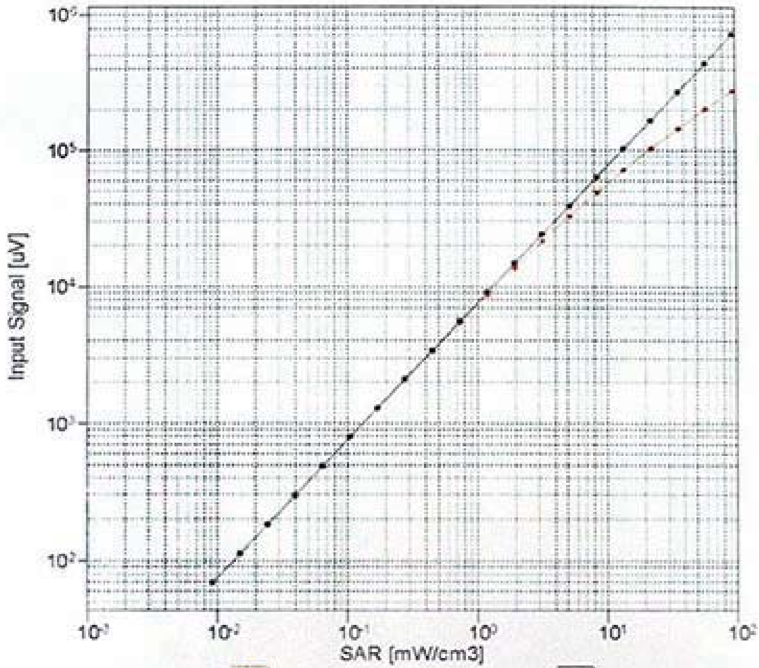


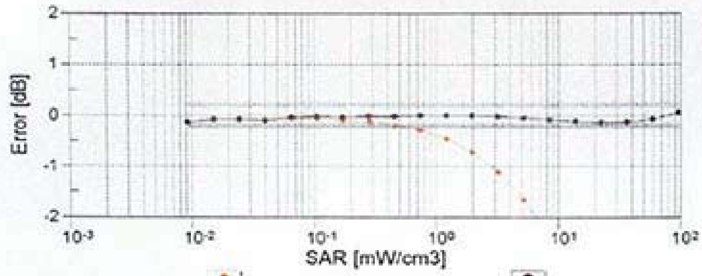


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)

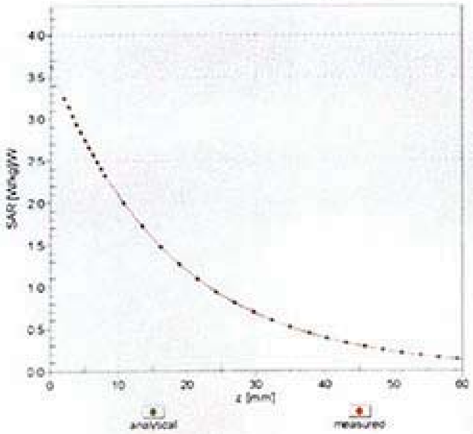


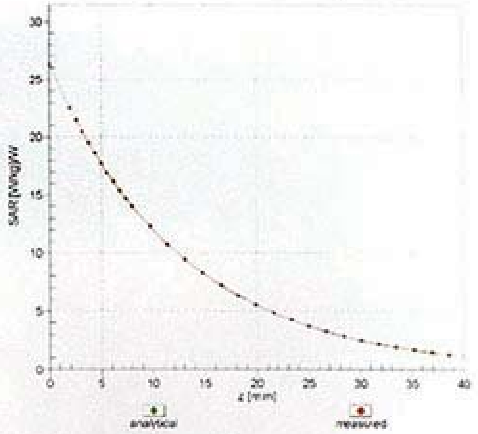


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ES3DV3– SN:3292 August 15, 2014

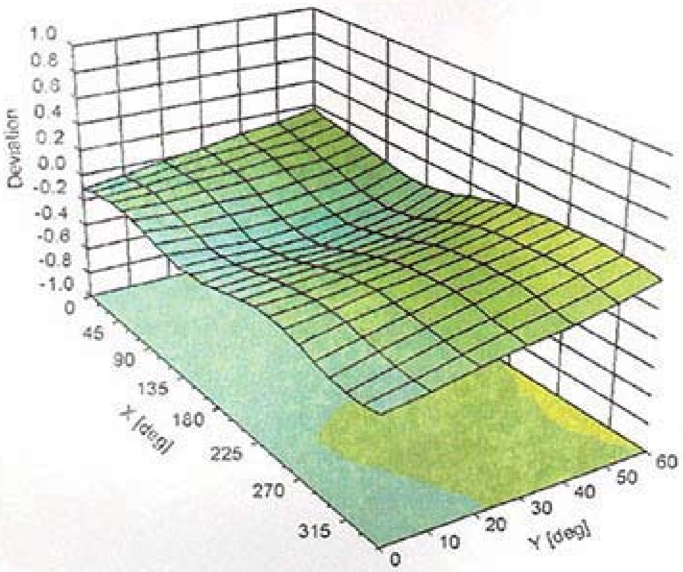
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Shenzhen General Testing & Inspection Technology Co., Ltd.
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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-8.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

11.2 Probe Calibration Certificate D835V2 (4d134)

In Collaboration with speag
CALIBRATION LABORATORY

CALIBRATION No. L0570

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Client CIQ (Auden) Certificate No: Z14-97067

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 4d134

Calibration Procedure(s): TMC-OS-E-02-194
Calibration procedure for dipole validation kits

Calibration date: July 24, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	11-Sep-13 (TMC, No.JZ13-443)	Sep-14
Power sensor NRV-Z5	100595	11-Sep-13 (TMC, No. JZ13-443)	Sep -14
Reference Probe EX3DV4	SN 3846	3- Sep-13 (SPEAG, No.EX3-3846_Sep13)	Sep-14
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No.JZ13-278)	Oct-14

	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: July 28, 2014

Certificate No: Z14-97067 Page 1 of 8

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CALIBRATION
No. L0570

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

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

c) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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CALIBRATION No. L0570

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.41 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.62 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.27 mW /g ± 20.4 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.6 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.77 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.64 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.50 mW /g ± 20.4 % (k=2)**

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CNAS CALIBRATION No. L0570

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8Ω + 3.34jΩ
Return Loss	- 28.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.9Ω + 7.08jΩ
Return Loss	- 23.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.261 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

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CALIBRATION No. L0570

DASY5 Validation Report for Head TSL Date: 24.07.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d134

Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.904 S/m; ε_r = 41.7; ρ = 1000 kg/m^3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(9.32, 9.32, 9.32); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/2
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

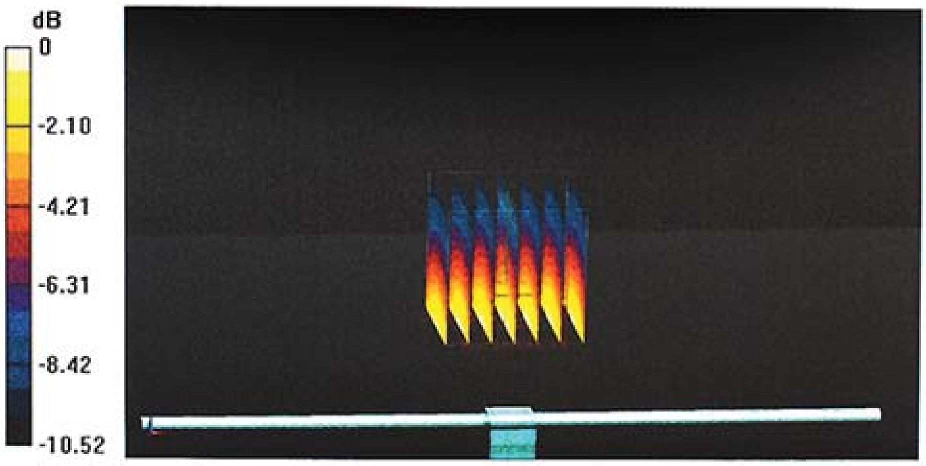
System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.91 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.05 W/kg



0 dB = 3.05 W/kg = 4.84 dBW/kg

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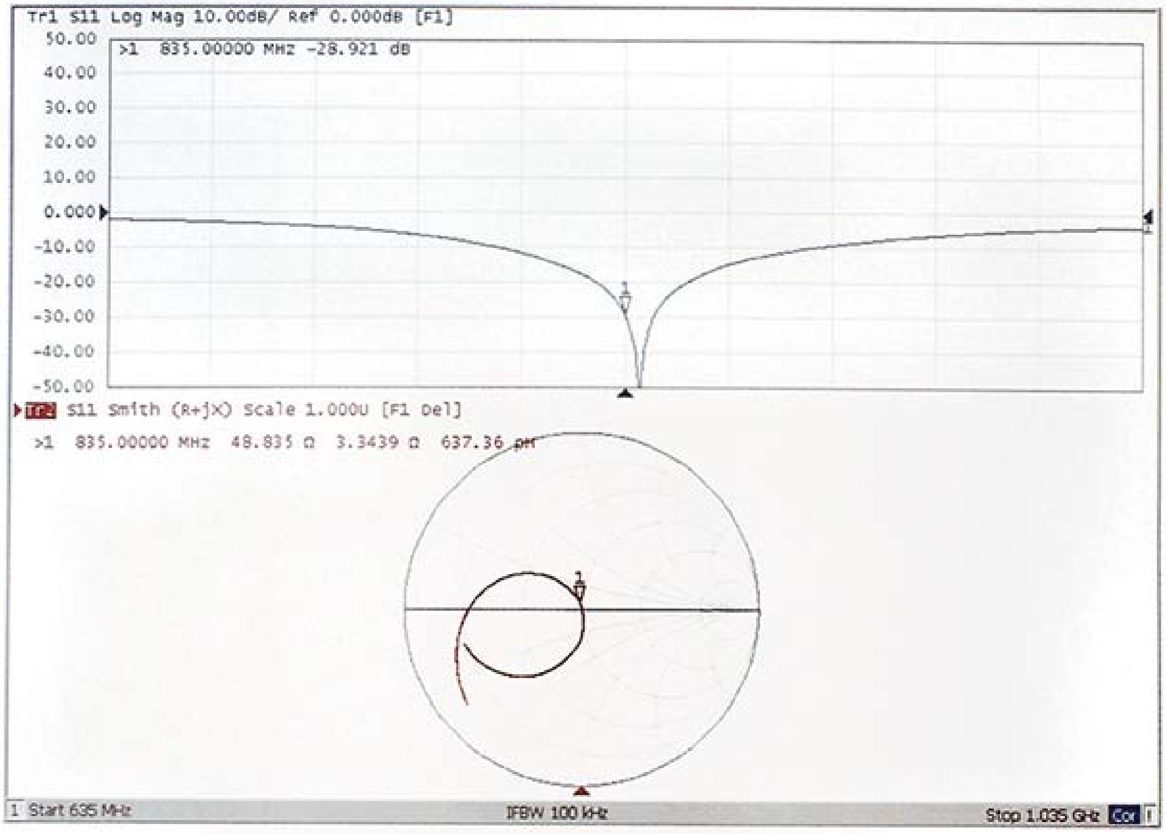
CALIBRATION
No. L0570

Impedance Measurement Plot for Head TSL



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CALIBRATION No. L0570

DASY5 Validation Report for Body TSL

Date: 24.07.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d134

Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.986 S/m; ε_r = 55.6; ρ = 1000 kg/m^3

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(8.96, 8.96, 8.96); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

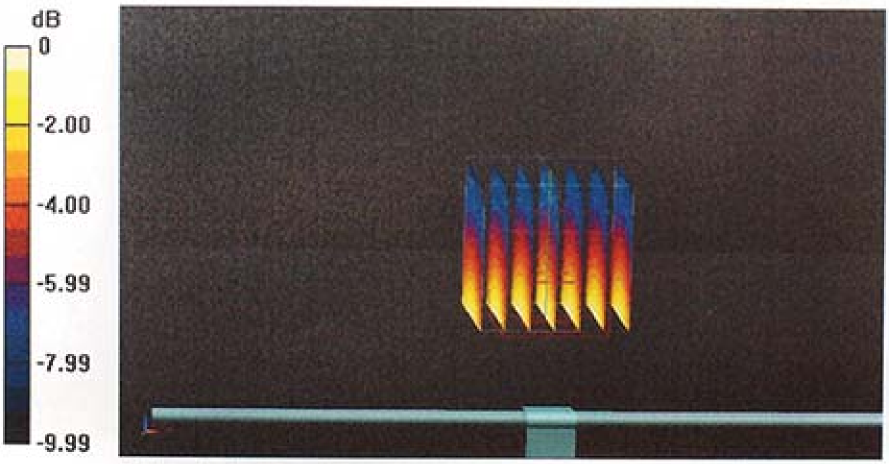
System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.01 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.66 W/kg

SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.64 W/kg

Maximum value of SAR (measured) = 3.10 W/kg



0 dB = 3.10 W/kg = 4.91 dBW/kg

Certificate No: Z14-97067

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CALIBRATION
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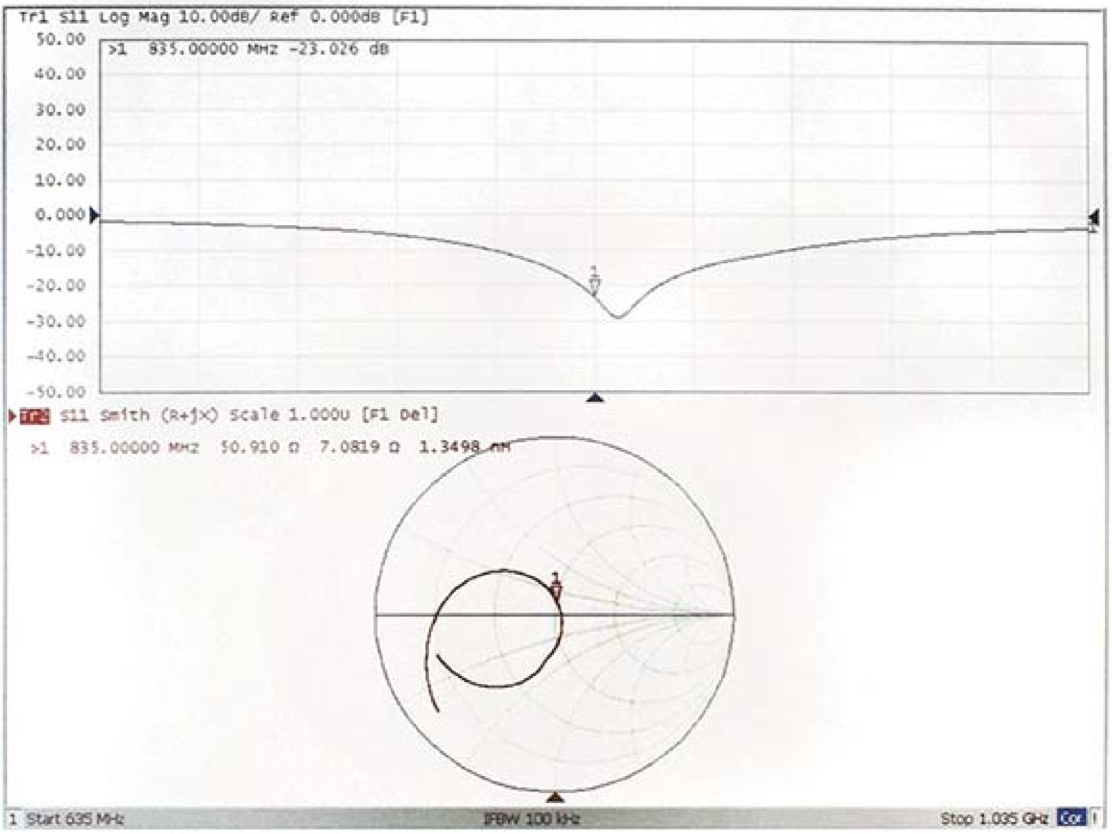
Impedance Measurement Plot for Body TSL



11.3 Probe Calibration Certificate D1900V2 (5d150)

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ilac-MRA CNAS CALIBRATION No. L0570

Client **CIQ (Auden)** **Certificate No: Z14-97071**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d150
Calibration Procedure(s)	TMC-OS-E-02-194 Calibration procedure for dipole validation kits
Calibration date:	July 25, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	11-Sep-13 (TMC, No.JZ13-443)	Sep-14
Power sensor NRV-Z5	100595	11-Sep-13 (TMC, No. JZ13-443)	Sep -14
Reference Probe EX3DV4	SN 3846	3- Sep-13 (SPEAG, No.EX3-3846_Sep13)	Sep-14
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No.JZ13-278)	Oct-14

	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: July 28, 2014

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CALIBRATION
No. L0570

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
c) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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CALIBRATION
No. L0570

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.42 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.71 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**38.3 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.08 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.2 mW /g ± 20.4 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.7 ± 6 %	1.53 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.98 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**39.9 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.26 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 mW /g ± 20.4 % (k=2)**

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CALIBRATION No. L0570

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.3Ω+ 3.17jΩ
Return Loss	- 30.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8Ω+ 3.92jΩ
Return Loss	- 27.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.048 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

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CALIBRATION
No. L0570

DASY5 Validation Report for Head TSL Date: 25.07.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d150

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.416 S/m; ε_r = 38.91; ρ = 1000 kg/m^3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.65, 7.65, 7.65); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/2
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

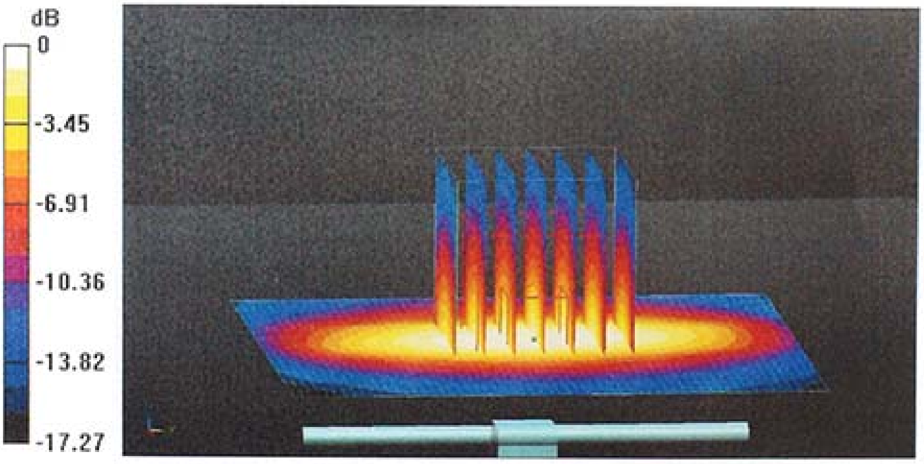
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.05 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 9.71 W/kg; SAR(10 g) = 5.08 W/kg

Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

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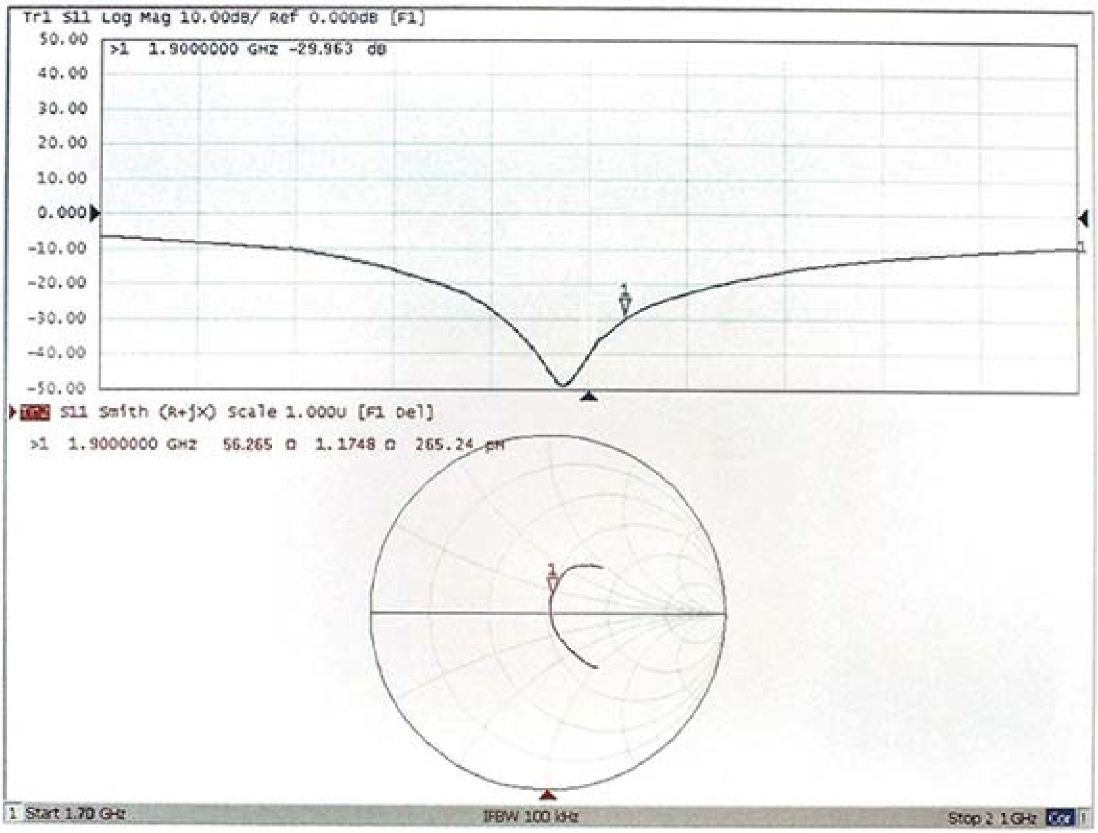
CALIBRATION
No. L0570

Impedance Measurement Plot for Head TSL



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CALIBRATION No. L0570

DASY5 Validation Report for Body TSL Date: 25.07.2014

Test Laboratory: TMC, Beijing, China

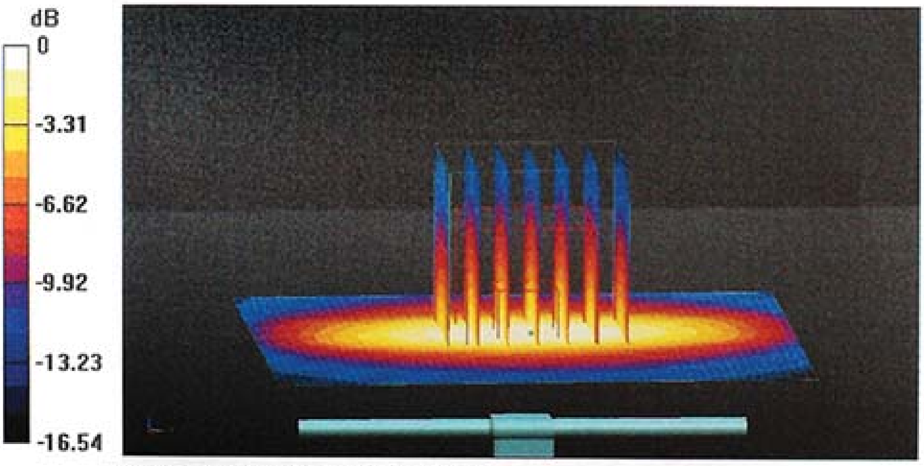
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d150

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.528 S/m; ε_r = 53.74; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.36, 7.36, 7.36); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 83.606 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 9.98 W/kg; SAR(10 g) = 5.26 W/kg
Maximum value of SAR (measured) = 12.1 W/kg



0 dB = 12.1 W/kg = 10.83 dBW/kg

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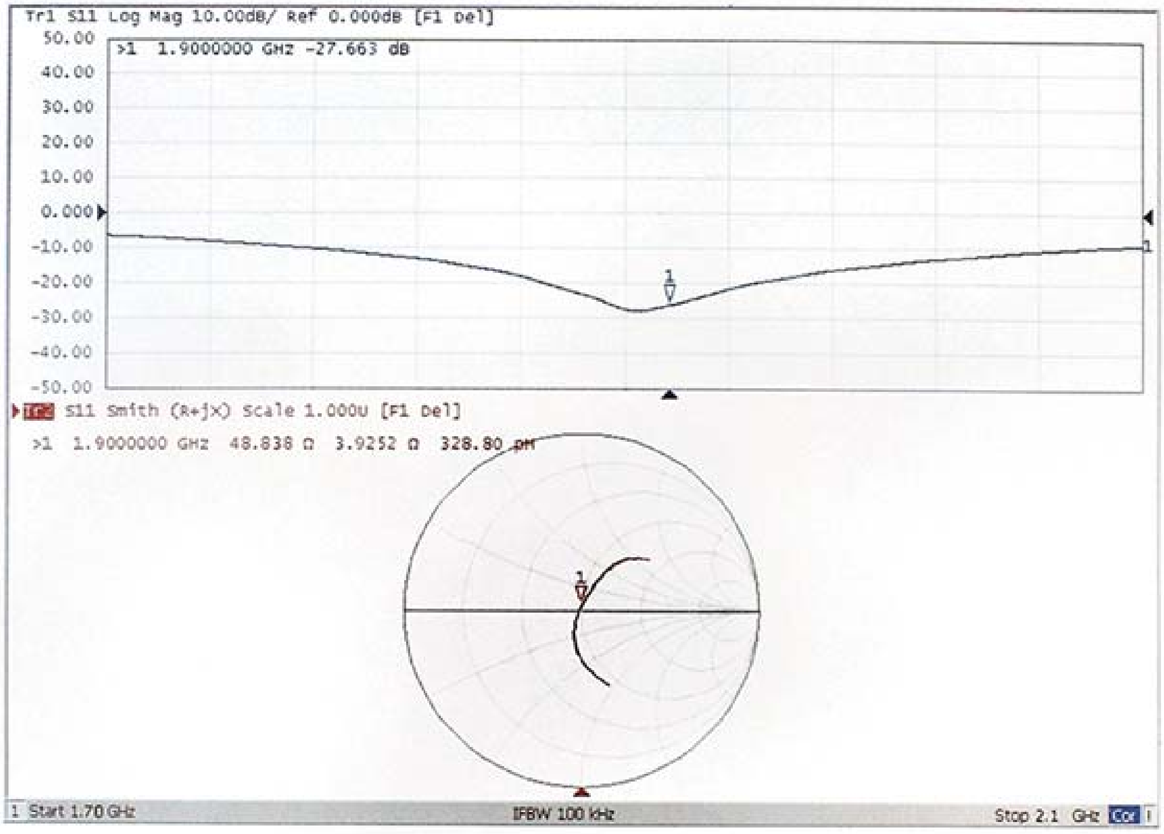
CALIBRATION No. L0570

Impedance Measurement Plot for Body TSL



11.4 Probe Calibration Certificate D2450V2 (884)

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CALIBRATION No. L0570

Client **CIQ (Auden)** **Certificate No: Z14-97070**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 884

Calibration Procedure(s): TMC-OS-E-02-194
Calibration procedure for dipole validation kits

Calibration date: September 1, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	11-Sep-13 (TMC, No.JZ13-443)	Sep-14
Power sensor NRV-Z5	100595	11-Sep-13 (TMC, No. JZ13-443)	Sep -14
Reference Probe ES3DV3	SN 3149	5- Sep-13 (SPEAG, No.ES3-3149_Sep13)	Sep-14
DAE3	SN 536	23-Jan-14 (SPEAG, DAE3-536_Jan14)	Jan -15
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No.JZ13-278)	Oct-14

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

Issued: September 4, 2014

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CALIBRATION
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Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

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

c) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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CALIBRATION No. L0570

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**52.1 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.17 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 mW /g ± 20.4 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.3 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.6 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.11 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.2 mW /g ± 20.4 % (k=2)**

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CALIBRATION No. L0570

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	58.3Ω- 0.76jΩ
Return Loss	- 22.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	58.1Ω+ 2.61jΩ
Return Loss	- 22.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.224 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

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CALIBRATION
No. L0570

DASY5 Validation Report for Head TSL Date: 01.09.2014

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 40.2; ρ = 1000 kg/m^3

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(4.48, 4.48, 4.48); Calibrated: 2013-09-05;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

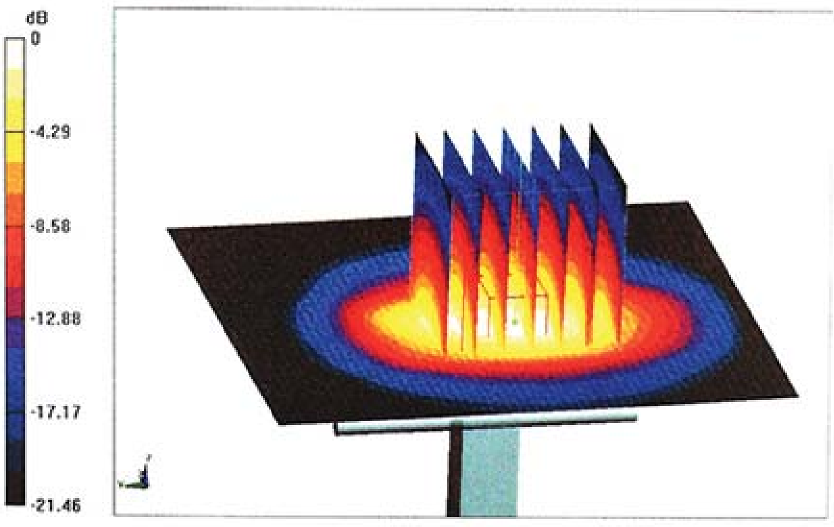
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.491 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 26.6 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.17 W/kg

Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 12.33 dBW/kg

Certificate No: Z14-97070 Page 5 of 8

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CALIBRATION
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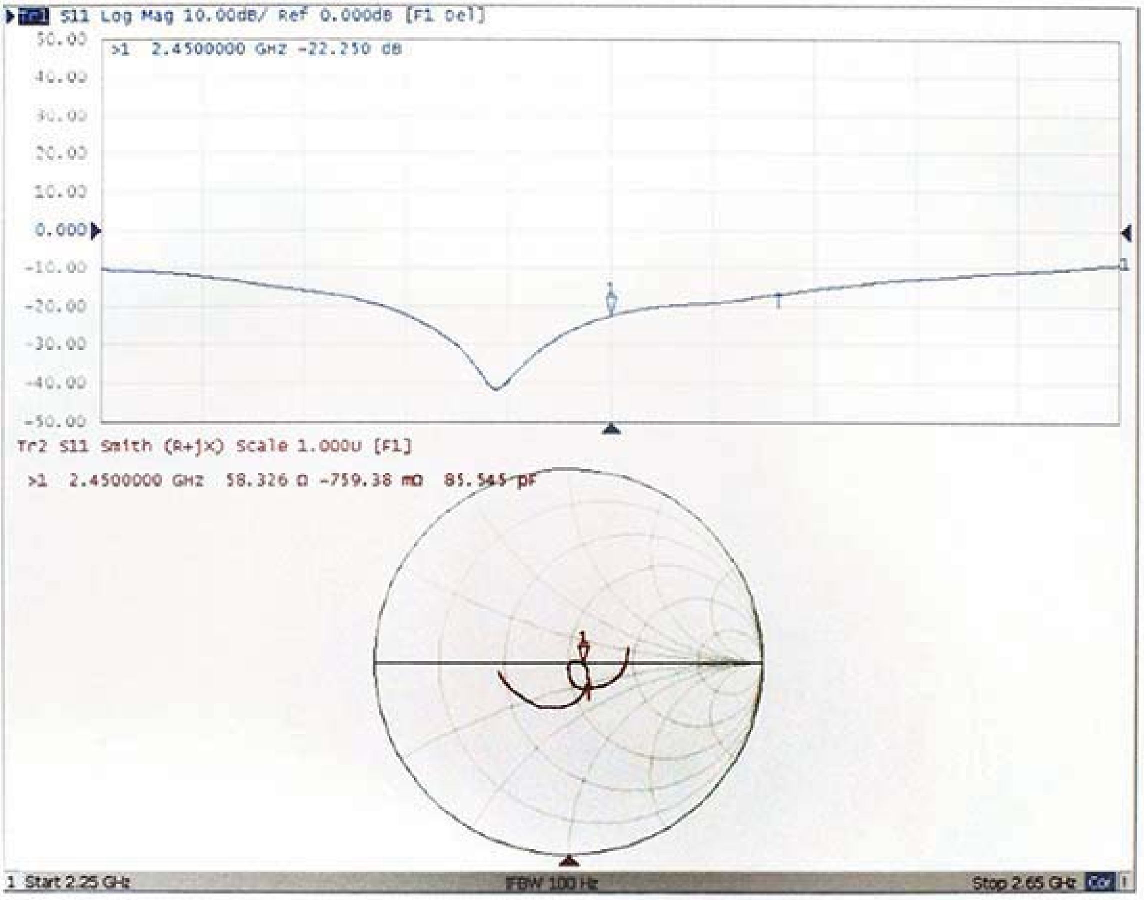
Impedance Measurement Plot for Head TSL



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CALIBRATION No. L0570

DASY5 Validation Report for Body TSL Date: 01.09.2014

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.988 S/m; ε_r = 51.25; ρ = 1000 kg/m^3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(4.21, 4.21, 4.21); Calibrated: 2013-09-03;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/2
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

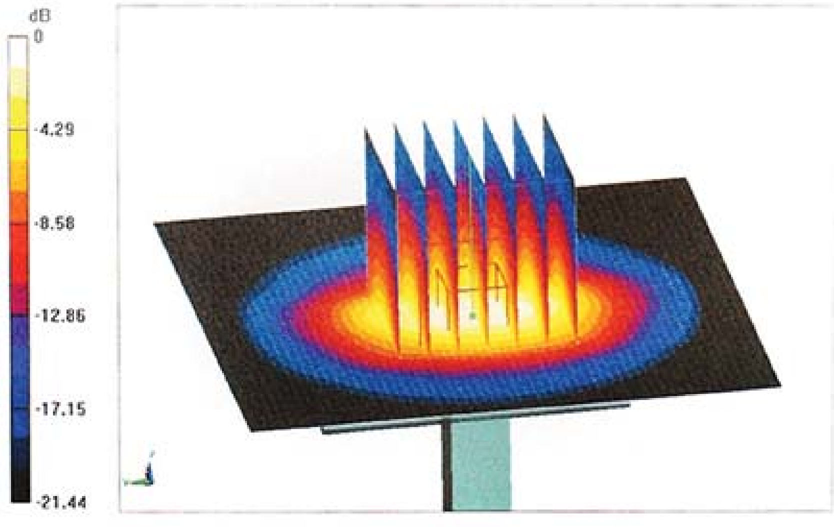
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.180 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 27.6 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.11 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

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CALIBRATION
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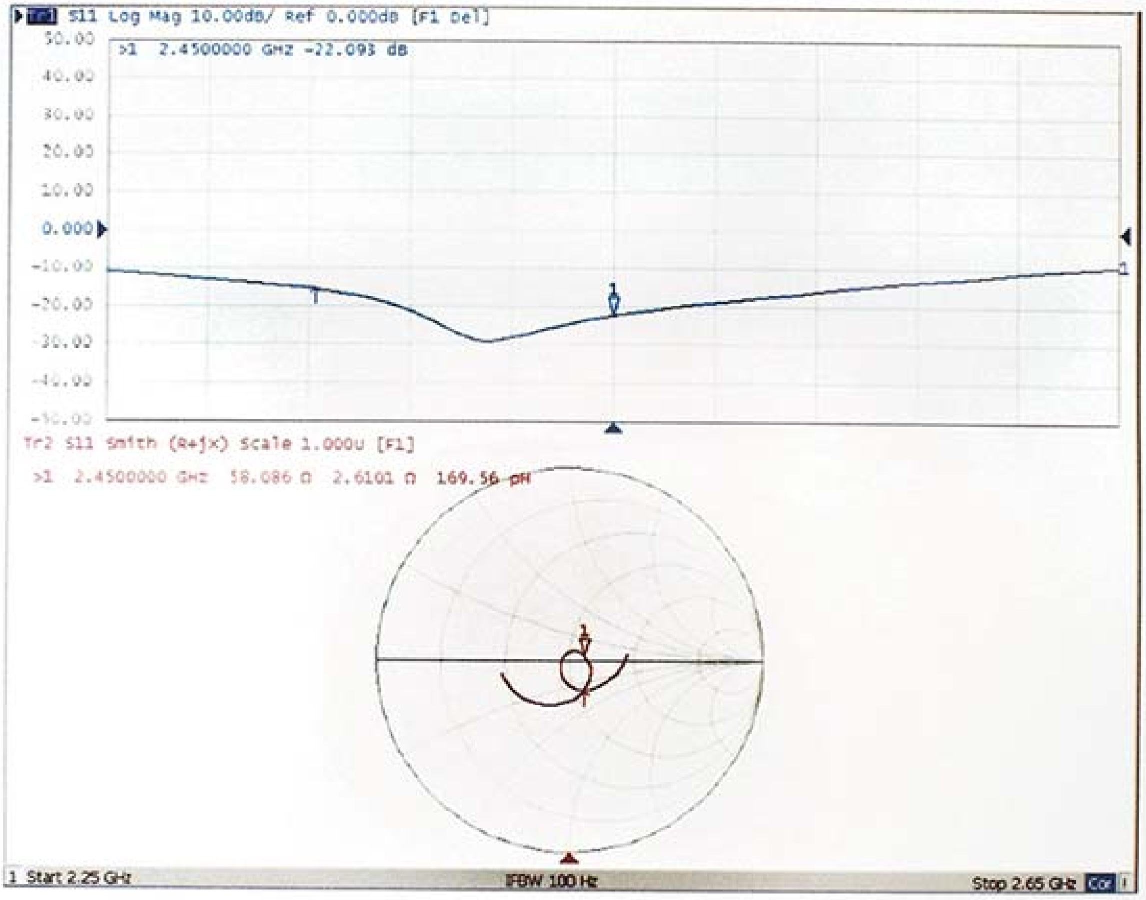
Impedance Measurement Plot for Body TSL



11.5 DAE Calibration Certificate DAE4 (1315)

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CALIBRATION No. L0570

Client : CIQ (Auden) Certificate No: Z14-97066

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1315
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	July 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Documenting Process Calibrator 753	1971018	01-July-14 (CTTL, No:J14X02147)	July-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: July 23, 2014

Certificate No: Z14-97066 Page 1 of 3

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CALIBRATION
No. L0570

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 report provide only calibration results for DAE, it does not contain other performance test results.

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CALIBRATION
No. L0570

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

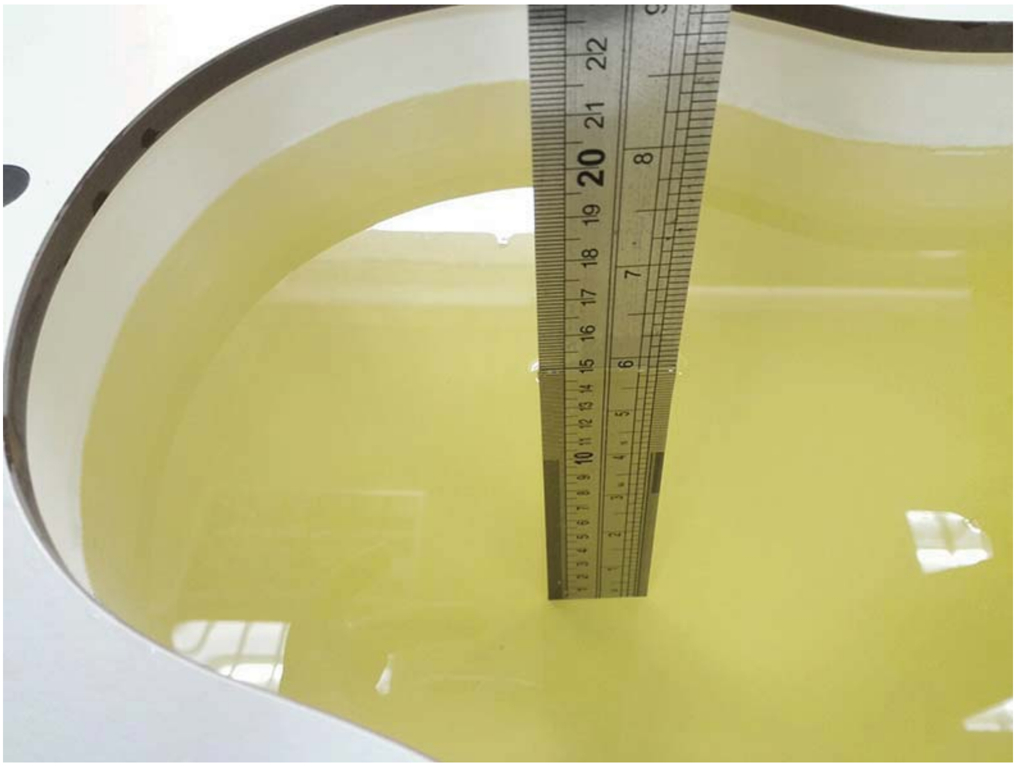
Calibration Factors	X	Y	Z
High Range	405.162 ± 0.15% (k=2)	405.006 ± 0.15% (k=2)	404.963 ± 0.15% (k=2)
Low Range	3.99072 ± 0.7% (k=2)	3.98481 ± 0.7% (k=2)	3.98836 ± 0.7% (k=2)

Connector Angle

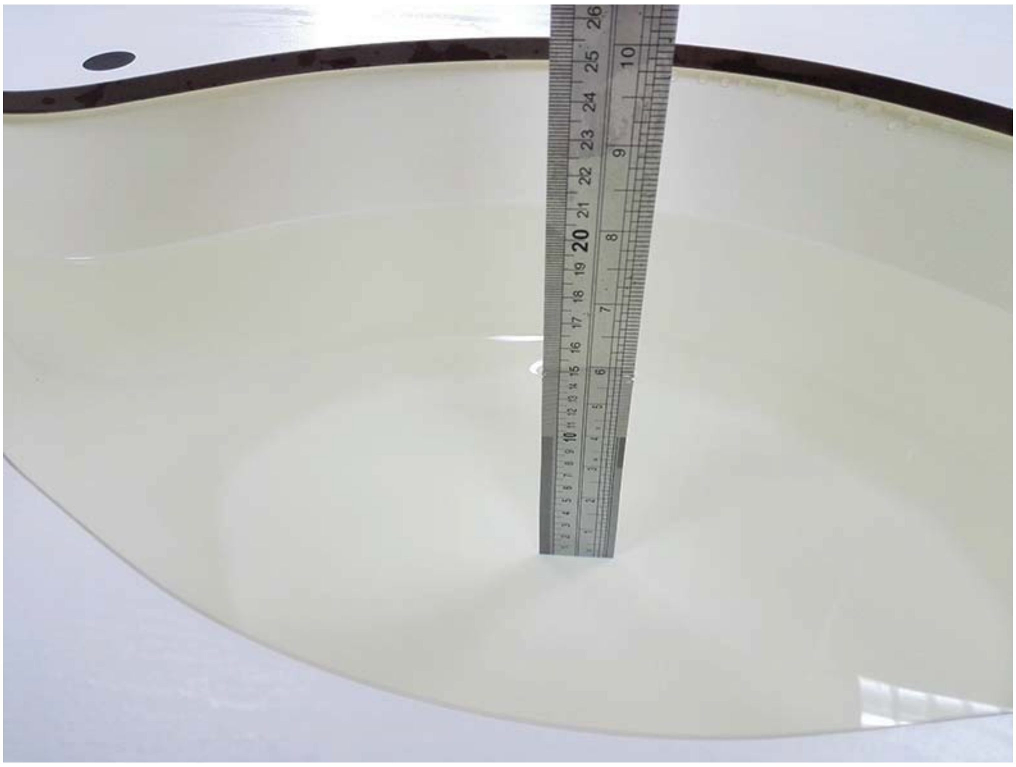
Connector Angle to be used in DASY system	22° ± 1 °

12. EUT TEST PHOTO

Liquid depth in the flat Phantom (835 MHz, 15.1cm depth)

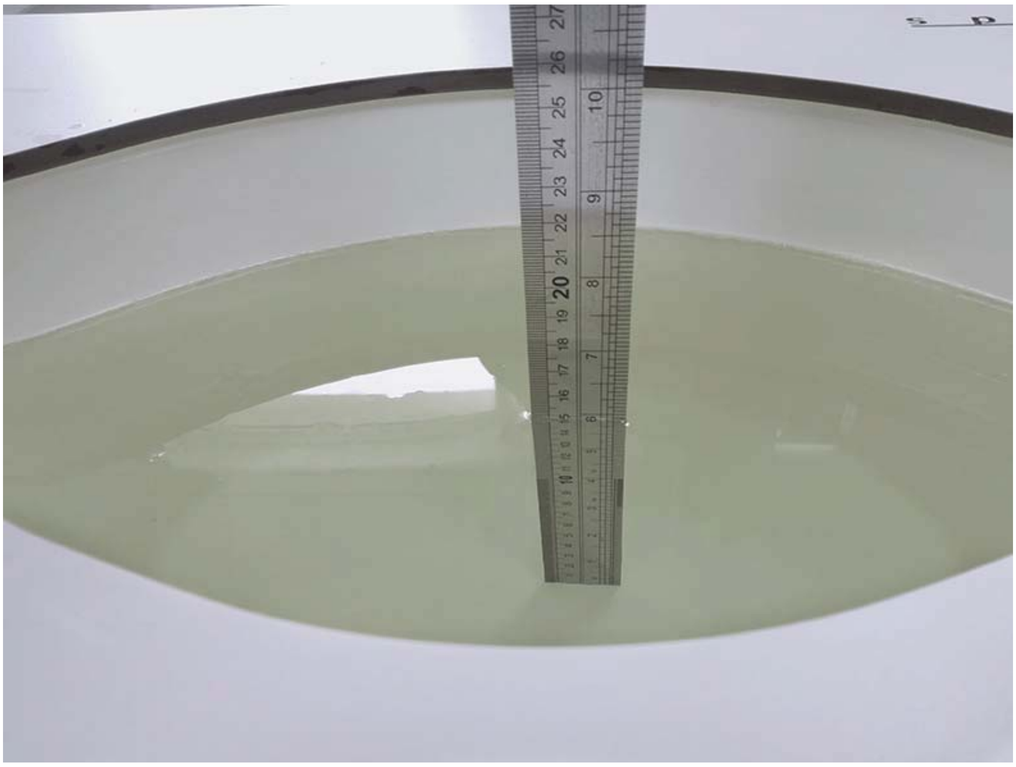


Liquid depth in the head Phantom (835 MHz, 15.0cm depth)

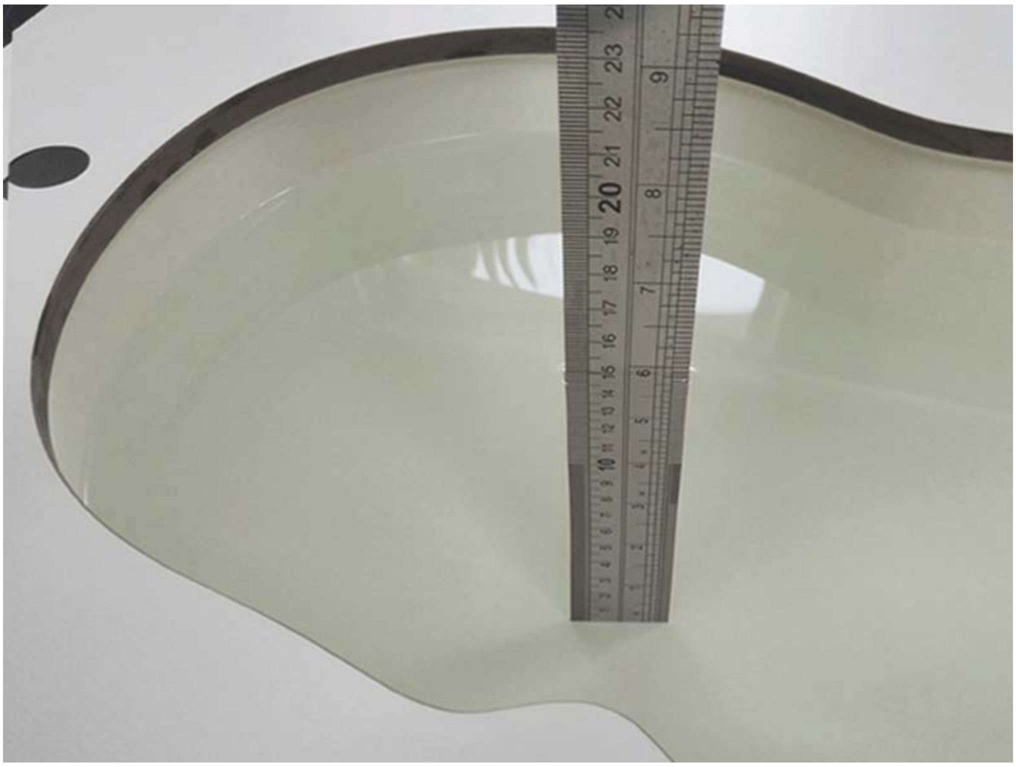


Liquid depth in the flat Phantom (1900 MHz, 15.2cm depth)

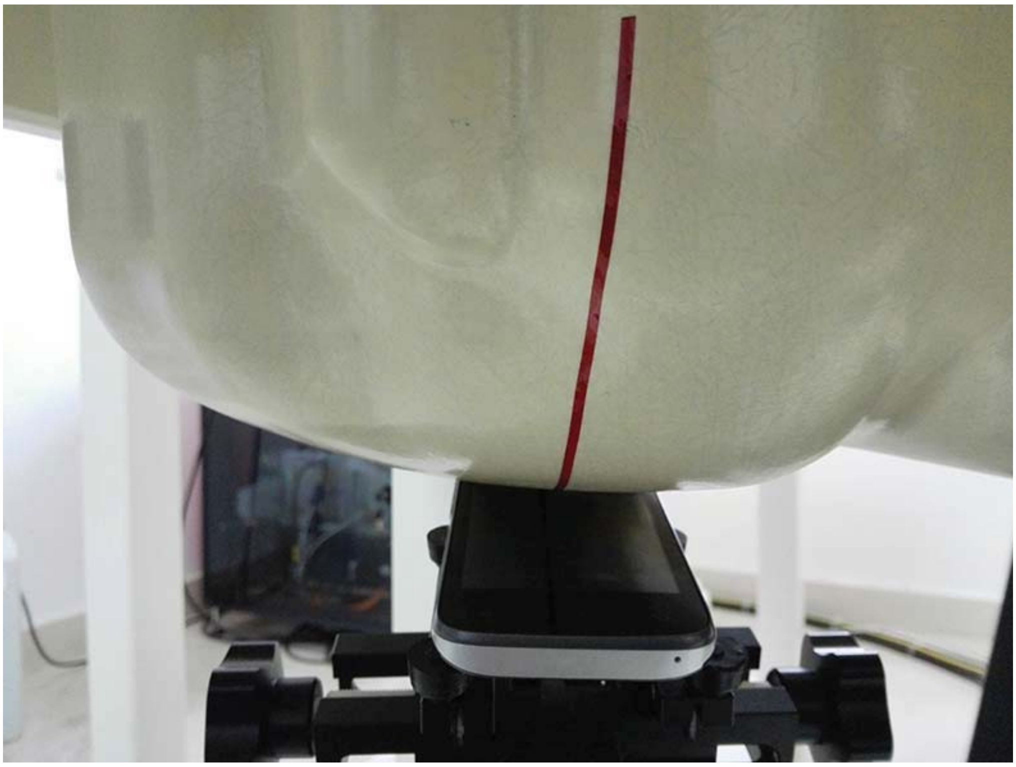
Liquid depth in the head Phantom (1900 MHz, 15.1cm depth)



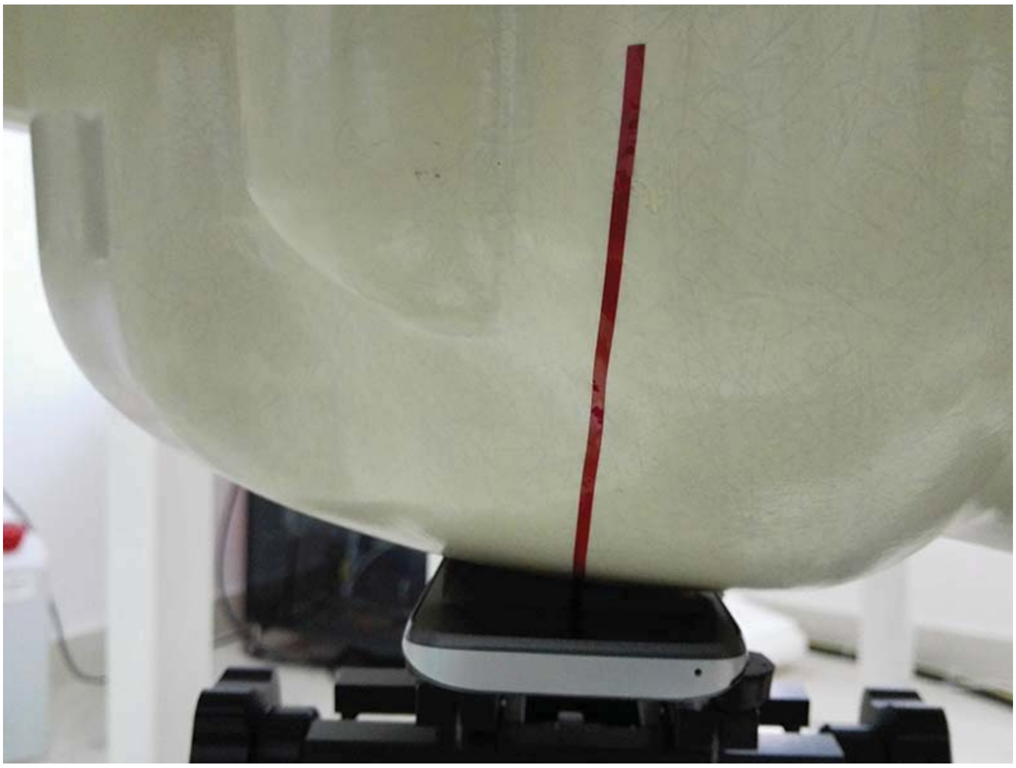
Liquid depth in the flat Phantom (2450 MHz, 15.1cm depth)



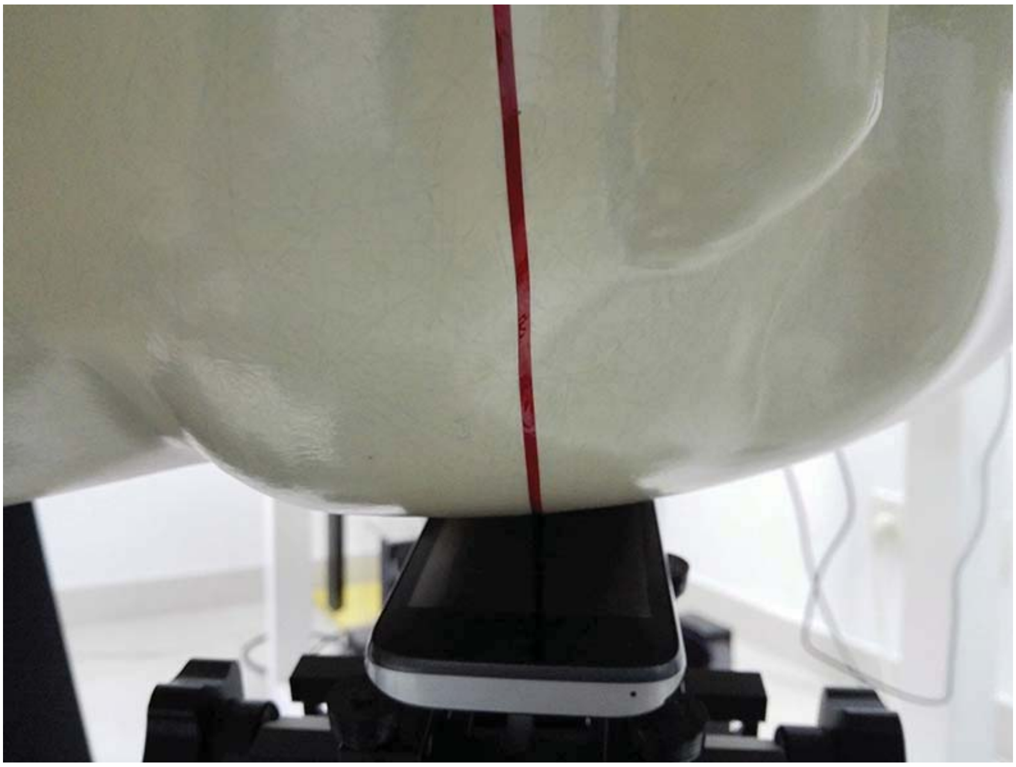
Liquid depth in the head Phantom (2450 MHz, 15.0cm depth)



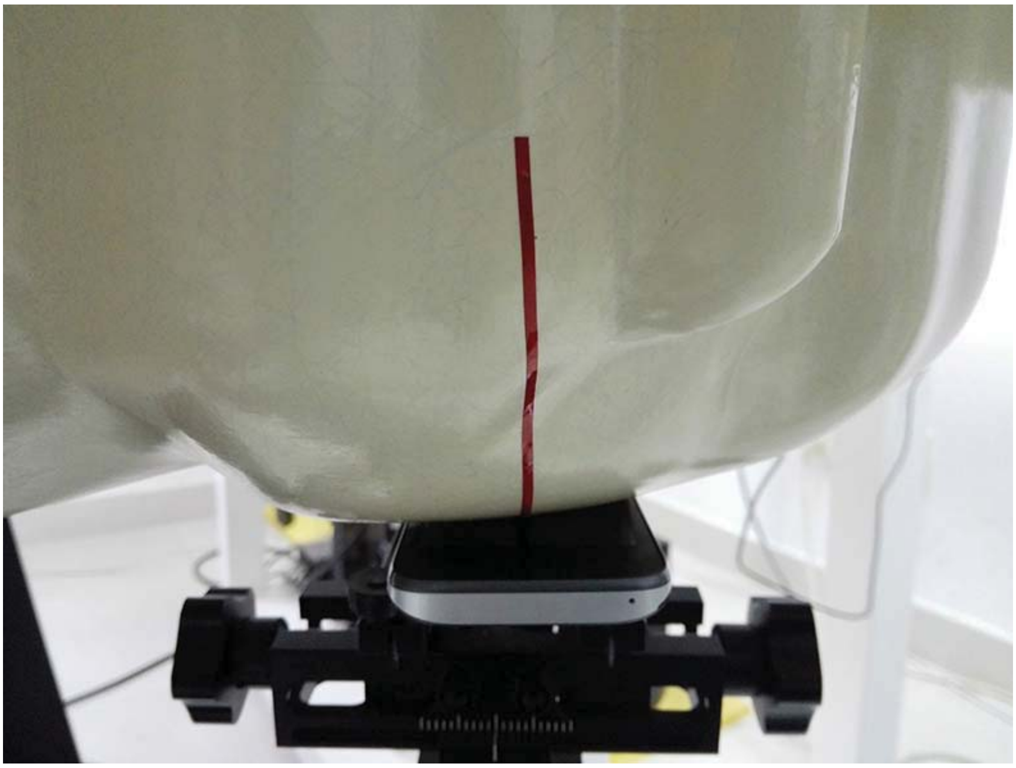
Right Head Tilt Setup Photo



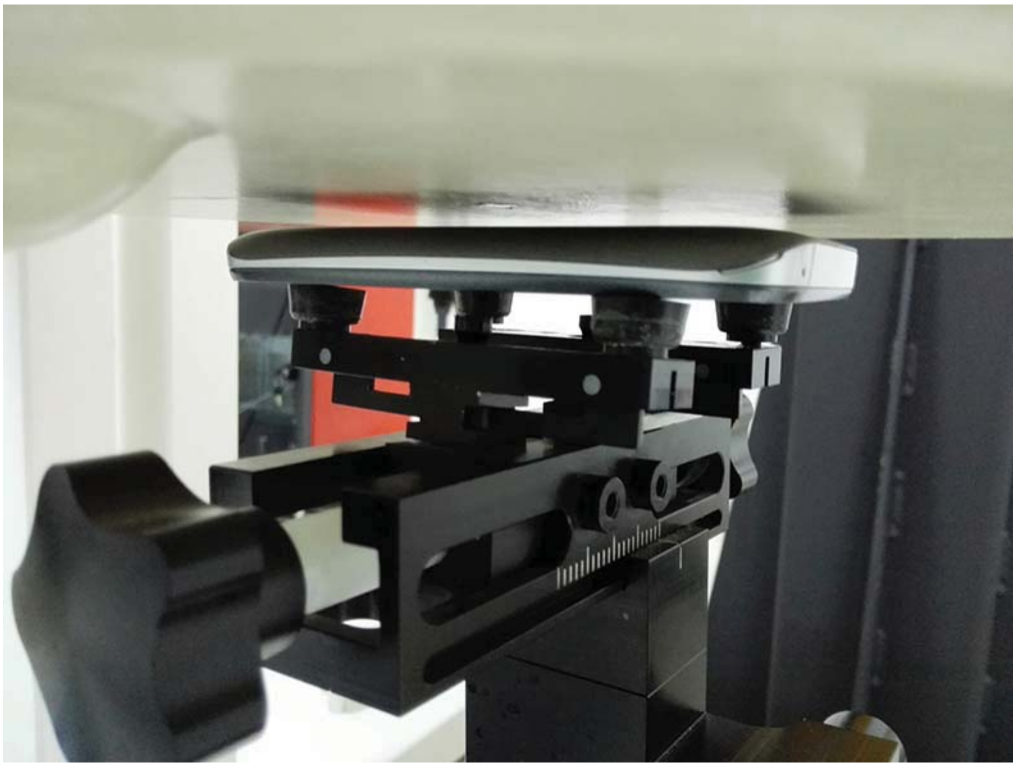
Right Head Cheek Setup Photo



Left Head Tilt Setup Photo



Left Head Cheek Setup Photo



5mm Body-worn Accessory& Hotspot Mode Rear Side Setup Photo

5mm Body-worn Accessory& Hotspot Mode Front Side Setup Photo

10mm Hotspot Mode Top Edge Setup Photo

10mm Hotspot mode Bottom Edge Setup Photo

10mm Hotspot mode Left Edge Setup Photo

10mm Hotspot mode Right Edge Setup Photo

13. PHOTOGRAPHS OF EUT CONSTRUCTIONAL

Reference to the test report No. GTI20150180F-1

**********************THE END**********************