SAR TEST REPORT

For

Mobile Phone

Model Number: MAXIM PRO

FCC ID: 2ABBT-MXMPROW7

Report Number : WT158001024

Test Laboratory	:	Shenzhen Academy of Metrology and Quality Inspection National Testing Center for Digital Electronic Products
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Test report declaration

Applicant	:	XOX Technology Limited
Address	:	7/F, Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Hong Kong
Manufacturer	:	XOX Technology Limited
Address	:	7/F, Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Hong Kong
EUT Description	:	Mobile Phone
Model No	:	MAXIM PRO
Trade mark	:	XOX
FCC ID	:	2ABBT-MXMPROW7

Test Standards:

IEEE 1528-2003　FCC KDB 865664 D01 v01

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the compliance of the applicable standards stated above.
Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results.
The results documented in this report only apply to the tested sample, under the conditions and modes of operation as described herein.
The test report shall not be reproduced in part without written approval of the laboratory.

Project Engineer:	吴飞云	Date:	Apr.12.2015
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Checked by:	杨东平	Date:	Apr.12.2015
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TABLE OF CONTENTS

1. REPORTED SAR SUMMARY

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

Highest Reported Standalone SAR Summary

Exposure Position	Frequency Band	Highest Reported1g-SAR (W/kg)	Equipment Class	Highest Reported1g-SAR (W/kg)
Head	GSM850（GSM VOICE）	0.205	PCE	0.296
	GSM1900（VOICE）	0.179		
	WCDMA Band V（RMC 12.2K）	0.296		
	WLAN 2.4GHz Band	0.021	DTS	0.021
Body-worn(10mm Gap)	GSM850（GSM VOICE）	0.425	PCE	0.603
	GSM850（GPRS 2Tx slots）	0.603		
	GSM1900（VOICE）	0.322		
	GSM1900（GPRS）	0.369		
	WCDMA Band V（RMC 12.2K）	0.560		
	WLAN 2.4GHz Band	0.009	DTS	0.009

Highest Simultaneous Transmission SAR

Exposure Position	Frequency Band	Reported1g-SAR (W/kg)	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Head	WCDMA Band V	0.296	0.349
	Bluetooth	0.053	
Head	WCDMA Band V	0.296	0.317
	WIFI	0.021	
Body worn 10mm	GSM850(GPRS 2Tx slots）	0.603	0.629
	Bluetooth	0.026	
Body worn 10mm	GSM850(GPRS 2Tx slots）	0.603	0.611
	WIFI	0.009	

2. GENERAL INFORMATION

2.1. Report information

This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.

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Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

2.2. Laboratory Accreditation and Relationship to Customer

The testing report were performed by the Shenzhen Academy of Metrology and quality Inspection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities located at Bldg. of Metrology & Quality Inspection, Longzhu Road, Nanshan District, Shenzhen, Guangdong, China. At the time of testing, Laboratory is accredited by the following organizations:

China National Accreditation Service for Conformity Assessment (CNAS) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

The Laboratory is listed in the United States of American Federal Communications Commission (FCC), and the registration number are 446246 806614 994606 (semi anechoic chamber).

The Laboratory is registered to perform emission tests with Industry Canada (IC), and the registration number is IC4174.

TUV Rhineland accredits the Laboratory for conformance to IEC and EN standards, the registration number is E2024086Z02.

3. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

3.1. DUT Description

Frequency Bands	GSM850/PCS1900MHz/WCDMA850MHz/802.11b&802.11g&802.11n-20&802.11n-40 ： 2.4GHz Bluetooth: 2.4GHz
Modulation Mode ：	GSM:GMSK 802.11b:DSSS 802.11g&802.11n-20&802.11n-40：OFDM WCDMA (Rel7): QPSK Bluetooth: GFSK, pi/4DQPSK, 8DPSK BLE:GFSK
GPRS Multislot Class	12
Antenna type	Fixed Internal Antenna
Battery Model	MAXIM PRO
Battery Specification	3.7V 1700mAh
Hardware Version	M7209_V1.2
Software Version	MX-S45028W5-20150203-v01
Serial Number/IMEI	351811065357415

3.2. RF output power Tune up limit

Maximum Tune up Burst Average power		
Mode	GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)	33	30
GPRS (GMSK, 1 Tx slot)	33	30
GPRS (GMSK, 2 Tx slots)	32	29
GPRS (GMSK, 3 Tx slots)	31	28
GPRS (GMSK, 4 Tx slots)	30	27

Maximum Tune up Target power	
Mode	WCDMA Band V
RMC 12.2K	23
HSDPA Subtest-1	23
HSDPA Subtest-2	23
HSDPA Subtest-3	23
HSDPA Subtest-4	23
HSUPA Subtest-1	23
HSUPA Subtest-2	23
HSUPA Subtest-3	22
HSUPA Subtest-4	22
HSUPA Subtest-5	22

Mode / Band	Bluetooth Average Power(dBm)
Bluetooth	1

Mode / Band	BLE Average Power(dBm)
Bluetooth	-8

Maximum Target Average Power for Production Unit (dBm)				
Mode / Band	IEEE 802.11			
	b	g	n-HT20	n-HT40
WLAN 2.4 GHz Band	13	10	10	8

3.3. Applied Standards

FCC 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI C95.1, 1992: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)
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.
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 447498 D01 Mobile Portable RF Exposure v05r02: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 648474 D04 Handset SAR v01r02: SAR Evaluation Considerations for Wireless Handsets.
KDB 941225 D01 SAR test for 3G devices v03: SAR Measurement Procedures CDMA 2000 1x RTT, 1x Ev-Do, WCDMA, HSDPA/HSPA
KDB 941225 D06 Hotspot Mode SAR v02: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
KDB 248227 D01 SAR meas for 802 11 a b g v01r02: SAR Measurement Procedures for 802.11a/b/g Transmitters.

3.4. SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

4. TEST CONDITIONS

4.1. Temperature and Humidity

Ambient temperature (°C):	21-22
Ambient humidity (RH %):	59-60

4.2. Introduction of SAR

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for general public group.

SAR Definition:

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right) \qquad SAR = C\frac{\delta T}{\delta t} \qquad SAR = \frac{\sigma |E|^2}{\rho}$$

In the first equation, the SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density ρ).

In the second equation, C is the specific head capacity, δT is the temperature rise and δt is the exposure duration.

The last equation relates to the electrical field, where σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

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

4.3. Test Configuration

GSM Test Configuration

The tests for GSM850 and GSM1900, a communication link is set up with a System Simulator by air link. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 128, 190 and 251 respectively in the case of GSM850, to 512, 700 and 885 respectively in the case of GSM1900. Device output power was set to maximum power level for all tests. Using CMU200 the power control level is set to " 5" for GSM850, set to " 0" for GSM1900.

WCDMA Test Configuration

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

	Mode	Rel99
	Subtest	---
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c / β_d	8/15

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT.

5. DESCRIPTION OF THE TEST EQUIPMENTS

5.1. Measurement System and Components

No.	Equipment	Model No.	Manufacturer	Asset No.	Last Calibration Data	Period
1	SAR test system	TX60L	SPEAG	SB6810	---	---
2	SAR Probe	ES3DV3	SPEAG	SB6810/02	2014.07.22	1year
3	System Validation Dipole,835MHz	D835V2	SPEAG	SB6810/04	2012.09.24	3year
4	System Validation Dipole,1900MHz	D1900V2	SPEAG	SB6810/05	2012.09.21	3year
5	System Validation Dipole,2450MHz	D2450V2	SPEAG	SB6810/06	2012.10.18	3year
6	Dielectric Probe Kit	85070E	Agilent	SB6810/12	---	---
7	Dual-directional coupler,0.10-2.0GHz	778D	Agilent	SB6810/07	---	---
8	Dual-directional coupler,2.00-18GHz	772D	Agilent	SB6810/08		
9	Coaxial attenuator	8491A	Agilent	SB6810/09	---	---
10	Power Amplifier	ZHL42W	Agilent	SB6810/10	---	---
11	Signal Generator	SMR20	R&S	SB3438	2015.01.17	1year
12	Power Sensor	NRP-Z21	R& S	SB7941/05	2014.08.13	1year
13	Power Sensor	NRP-Z21	R& S	SB7941/06	2014.08.13	1year
14	Call Tester	CMU 200	R&S	SB3441	2015.03.10	1year
15	Data Acquisition Electronics	DAE4	SPEAG	SB6810/01	2015.03.09	1Year
16	Software	DASY52	SPEAG	SB6810/14	--	--

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

5.2. Isotropic E-field Probe Type ES3DV3

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., butyl diglycol)
Calibration	Calibration certificate in Appendix C
Frequency	10MHz to 4GHz (dosimetry); Linearity: ±0.2dB (30MHz to 4GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

5.3. 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 fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).

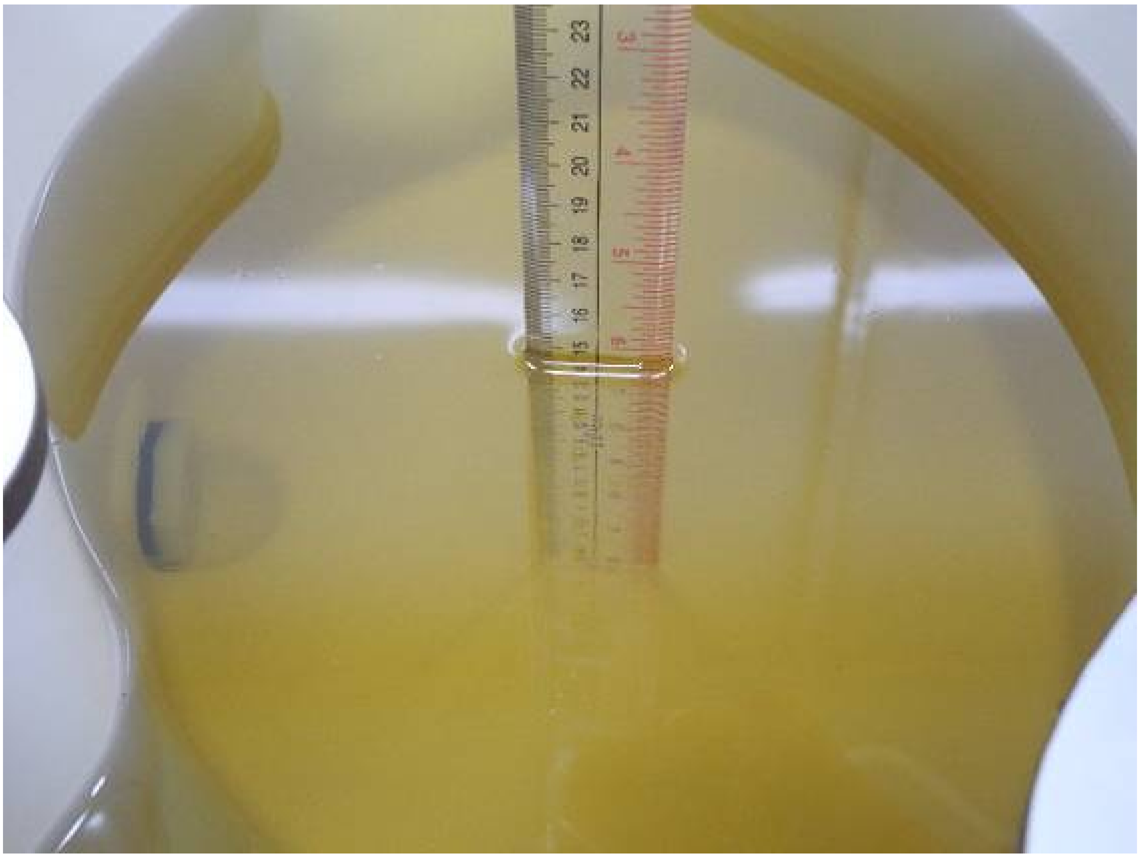
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

5.4. Tissue-equivalent Liquids

Tissue-equivalent liquids that are used for testing, which are made mainly of sugar, salt and water solution. All tests were carried out using tissue-equivalent liquids whose dielectric parameters were within ± 5% of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.
The depth of the Tissue-equivalent liquid was 15.0±0.5 cm measured from the ear reference point (ERP) during system checking and device measurements.

Tissue-equivalent liquid Recipes

The following recipe(s) were used for Head Tissue-equivalent liquid(s):



Liquid depth in the flat Phantom (15.1cm depth)

Ingredient (% by weight)	Frequency Band			
	800-900	1800-1900	800-900	1800-1900
Tissue Type	Head	Head	Body	Body
Water	40.6	56.1	50.8	68.9
Sugar	58.2	--	48.2	--
Salt	1.0	0.03	0.9	0.1
Preventol D-7	0.1	--	0.1	--
DGMBE	--	43.87	--	31
Cellulose	0.1	--	--	--
Ingredient (% by weight)	Frequency Band			
	2450	2450		
Tissue Type	Head	Body		
Water	54.8	68.4		
Sugar	--	--		
Salt	--	--		
Preventol D-7	--	--		
DGMBE	45.2	31.6		
Cellulose	--	--		

Tissue-equivalent liquids used in the Measurements

Dielectric parameters of the Tissue-equivalent liquids were measured before testing using the dielectric probe kit and the Network Analyzer. The measurement is carried out following the Agilent 85070 dielectric probe software instruction. A calibration of the probe open in air, probe with shorting block and probe in water is performed before measurement. After calibration, Insert the probe into the tissue liquid, trigger a measurement on software interface and record the data.

Head Tissue-equivalent liquid measurements:

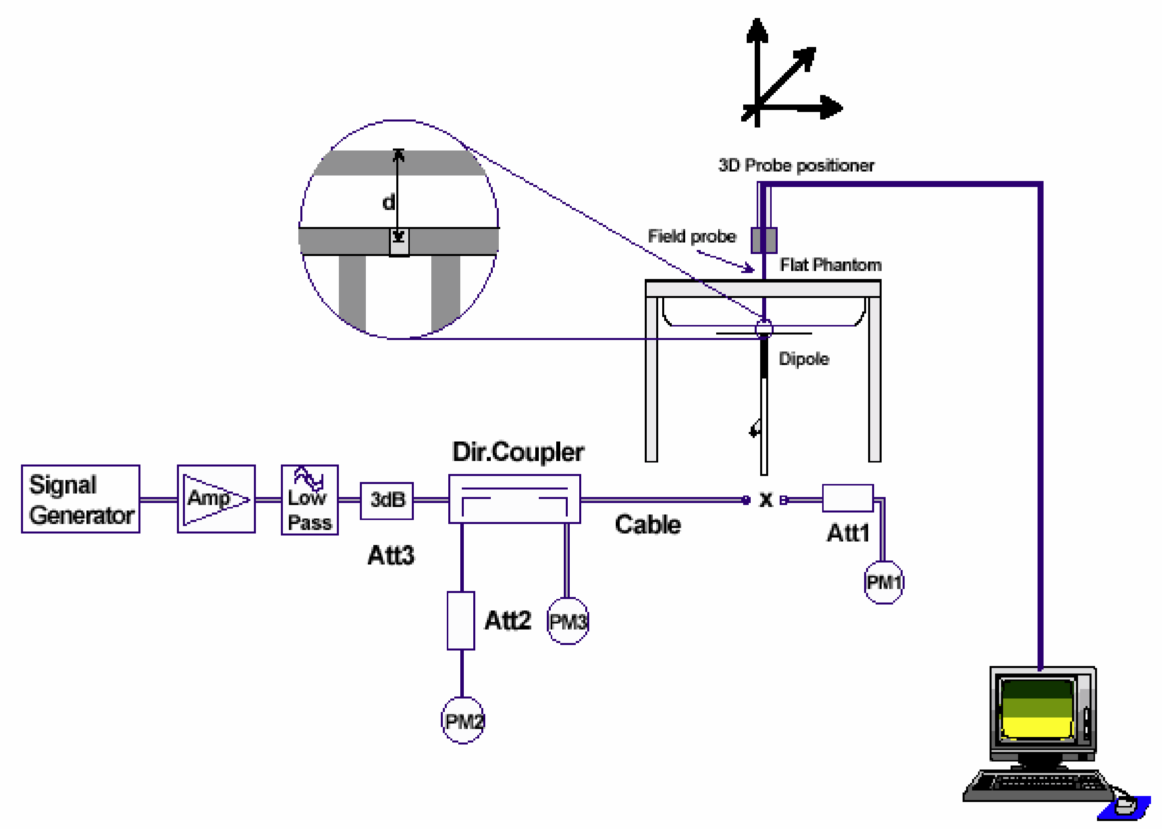
f/MHz	Date Tested	Dielectric Parameters	Target	Delta(%)	Tolerance (%)	Temp (ºC)
835	2015.03.31	ε_r =41.7	41.5	0.48%	±5	21
		σ =0.99	0.97	2.06%		
1900	2015.04.01	ε_r =40.7	40.0	1.75%	±5	22
		σ =1.43	1.40	2.14%		
2450	2015.04.01	ε_r =39.0	39.2	-0.51%	±5	22
		σ =1.74	1.80	-3.33%		

Body Tissue-equivalent liquid measurements:

f/MHz	Date Tested	Dielectric Parameters	Target	Delta(%)	Tolerance (%)	Temp (ºC)
835	2015.03.31	ε_r =55.6	55.2	0.72%	±5	21
		σ =1.02	1.05	-2.86%		
1900	2015.04.01	ε_r =52.8	53.3	-0.94%	±5	22
		σ =1.45	1.52	-4.61%		
2450	2015.04.01	ε_r =51.3	52.7	-2.66%	±5	22
		σ =1.96	1.95	0.51%		

System Checking

The manufacturer calibrates the probes annually. A system check measurement was made following the determination of the dielectric parameters of the tissue-equivalent liquid, using the dipole validation kit. A power level of 250mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom.



The system checking results (dielectric parameters and SAR values) are given in the table below.

System checking, Head Tissue-equivalent liquid:

f/MHz	Date Tested	SAR(W/kg), 1g	Target	Delta(%)	Tolerance (%)	Temp (ºC)
835	2015.03.31	9.32	9.35	0.32%	±10	21
1900	2015.04.01	39.04	39.4	0.91%	±10	22
2450	2015.04.01	52.4	52.3	0.19%	±10	22

System checking, Body Tissue-equivalent liquid:

f/MHz	Date Tested	SAR(W/kg), 1g	Target	Delta(%)	Tolerance (%)	Temp (ºC)
835	2015.03.31	9.36	9.46	-1.06%	±10	21
1900	2015.04.01	40.8	40.7	-0.25%	±10	22
2450	2015.04.01	48.4	50.8	-4.72%	±10	22

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

5.5. 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 centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

5.6. Test Position

Against Phantom Head

The Mobile phone shall be tested in the “ cheek” and “ tilted” position on left and right sides of the phantom.

Define of the “ cheek” position:

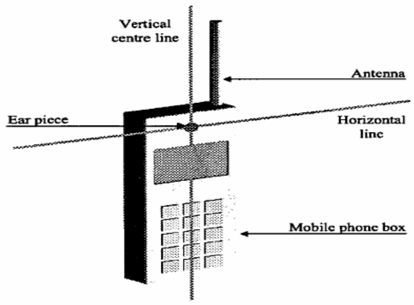
a) Position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M, RE and LE) and align the center of the ear piece with the line RE-LE.

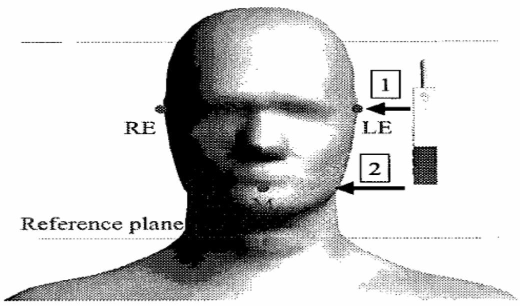
b) Translate the mobile phone box towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in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

Define of the “ tilted” position:

a) Position the device in the “ cheek” position described above.

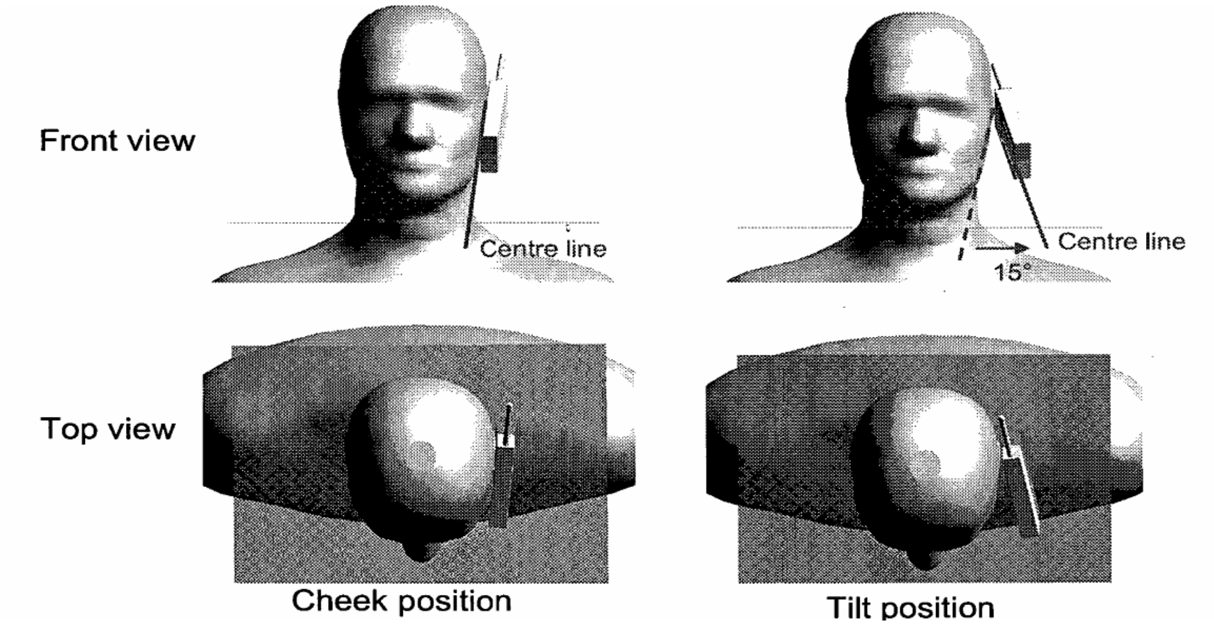
b) While maintaining the device the reference planes described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.





Define of the reference lines and points,

on the phone and on the phantom and initial position



“ Cheek” and “ tilted” position of the mobile phone on the left side

Body Worm Configuration

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. The distance between of the device and the phantom was kept 15mm.

5.7. Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan, a minimum of 5x5x7 points covering a volume of at least 30x30x30mm, was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

5.8. SAR Averaging Methods

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. The base for the evaluation is a “ cube” measurement in a volume of (30mm)3 (7x7x7 points). The maximum SAR value was averaged over the cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy5 are all based on the modified Quadratic Shepard’ s method.

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

6. MEASUREMENT UNCERTAINTY

6.1. Uncertainty for SAR Test

Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

Uncertainty Component	Tol. (%)	Prob Dist.	Div	ci (1g)	ci.ui(%) (1g)	vi
Measurement System						
Probe Calibration	±5.9	N	1	1	±5.9	∞
Axial Isotropy	±4.7	R	$\sqrt{3}$	0.7	±1.9	∞
Hemispherical Isotropy	±9.6	R	$\sqrt{3}$	0.7	±3.9	∞
Boundary Effect	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Linearity	±4.7	R	$\sqrt{3}$	1	±2.7	∞
System Detection Limits	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Readout Electronics	±0.3	N	1	1	±0.3	∞
Response Time	±0.8	R	$\sqrt{3}$	1	±0.5	∞
Integration Time	±2.6	R	$\sqrt{3}$	1	±1.5	∞
RF Ambient Conditions - Noise	±3.0	R	$\sqrt{3}$	1	±1.7	∞
RF Ambient Conditions - Reflections	±3.0	R	$\sqrt{3}$	1	±1.7	∞
Probe Positioner Mechanical Tolerance	±0.4	R	$\sqrt{3}$	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	±2.9	R	$\sqrt{3}$	1	±1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Test Sample Related						
Test Sample Positioning	±2.9	N	1	1	±2.9	145
Device Holder Uncertainty	±3.6	N	1	1	±3.6	5
Output Power Variation - SAR drift measurement	±5.0	R	$\sqrt{3}$	1	±2.9	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	±4.0	R	$\sqrt{3}$	1	±2.3	∞
Conductivity Target - tolerance	±5.0	R	$\sqrt{3}$	0.43	±1.2	∞
Conductivity - measurement uncertainty	±2.5	N	1	0.43	±1.1	∞
Permittivity Target - tolerance	±5.0	R	$\sqrt{3}$	0.49	±1.4	∞
Permittivity - measurement uncertainty	±2.5	N	1	0.49	±1.2	5
Combined Standard Uncertainty					±10.7	387
Expanded STD Uncertainty					±21.4	

6.2. Uncertainty for System Validation

Uncertainty Component	Uncert. value	Prob. Dist.	Div.	(ci) (1g)	Std. Unc. (1g)	(vi) veff
Probe Calibration	±6.55 %	N	1	1	±6.55 %	1
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	1	±2.7 %	1
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0	±0 %	1
Boundary E_ects	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
Linearity	±4.7 %	R	$\sqrt{3}$	1	±2.7 %	1
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
Modulation Response	±0 %	R	$\sqrt{3}$	1	±0 %	1
Readout Electronics	±0.3 %	N	1	1	±0.3 %	1
Response Time	±0 %	R	$\sqrt{3}$	1	±0 %	1
Integration Time	±0 %	R	$\sqrt{3}$	1	±0 %	1
RF Ambient Noise	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
RF Ambient Re ections	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	±0.5 %	1
Probe Positioning	±6.7 %	R	$\sqrt{3}$	1	±3.9 %	1
Max. SAR Eval.	±2.0 %	R	$\sqrt{3}$	1	±1.2 %	1
Dipole Related						
Deviation of exp. dipole	±5.5 %	R	$\sqrt{3}$	1	±3.2 %	1
Dipole Axis to Liquid Dist.	±2.0 %	R	$\sqrt{3}$	1	±1.2 %	1
Input power & SAR drift	±3.4 %	R	$\sqrt{3}$	1	±2.0 %	1
Phantom and Setup						
Phantom Uncertainty	±4.0 %	R	$\sqrt{3}$	1	±2.3 %	1
SAR correction	±1.9 %	R	$\sqrt{3}$	0.84	±0.9 %	1
Liquid Conductivity (meas.)	±2.5 %	N	1	0.71	±1.8 %	1
Liquid Permittivity (meas.)	±2.5 %	N	1	0.26	±0.7 %	1
Temp. unc. -Conductivity	±1.7 %	R	$\sqrt{3}$	0.71	±0.7 %	1
Temp. unc. -Permittivity	±0.3 %	R	$\sqrt{3}$	0.26	±0.0 %	∞
Combined Std. Uncertainty					±10.1 %	
Expanded STD Uncertainty					±20.1 %	

7. CONDUCTED POWER TEST RESULTS

GSM Conducted Power Measurement Results

Band: GSM850	Burst Conducted Power (dBm)			/	Average power (dBm)		
Channel	128	190	251		128	190	251
Frequency (MHz)	824.2	836.6	848.8		824.2	836.6	848.8
GSM (GMSK, 1 Tx slot)	32.49	32.60	32.58	-9.03dB	23.46	23.57	23.55
GPRS (GMSK, 1 Tx slot)	32.47	32.60	32.56	-9.03dB	23.44	23.57	23.53
GPRS (GMSK, 2 Tx slots)	31.49	31.60	31.55	-6.02dB	**25.47**	**25.58**	**25.53**
GPRS (GMSK, 3 Tx slots)	28.83	28.92	28.88	-4.26dB	24.57	24.66	24.62
GPRS (GMSK, 4 Tx slots)	27.96	28.01	27.89	-3.01dB	24.95	25.00	24.88

Band: GSM1900	Conducted Power (dBm)			/	Average power (dBm)		
Channel	512	661	810		512	661	810
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8
GSM (GMSK, 1 Tx slot)	29.74	29.80	29.65	-9.03dB	20.71	20.77	20.62
GPRS (GMSK, 1 Tx slot)	29.73	29.80	29.66	-9.03dB	20.70	20.77	20.63
GPRS (GMSK, 2 Tx slots)	28.74	28.80	28.69	-6.02dB	**22.72**	**22.78**	**22.67**
GPRS (GMSK, 3 Tx slots)	26.32	26.38	26.26	-4.26dB	22.06	22.12	22.00
GPRS (GMSK, 4 Tx slots)	25.64	25.60	25.65	-3.01dB	22.63	22.59	22.64

Remark:
1. Division Factors
To average the power, the division factor is as follows:
1Txslot = 1 transmit time slot out of 8 time slots
=> conducted power divided by (8/1) => -9.03 dB
2Txslots = 2 transmit time slots out of 8 time slots
=> conducted power divided by (8/2) => -6.02 dB
3Txslots = 3 transmit time slots out of 8 time slots
=> conducted power divided by (8/3) => -4.26 dB
4Txslots = 4 transmit time slots out of 8 time slots
=> conducted power divided by (8/4) => -3.01 dB
2. For Head SAR testing, GSM should be evaluated, therefore the EUT was set in GSM Voice for GSM850 and GSM1900 due to its highest frame-average power.
3. For Body worn mode SAR testing, GPRS should be evaluated, therefore the EUT was set in GPRS (GMSK, 2 Tx slots) for GSM850 and GSM1900 due to its highest frame-average power.

WCDMA Conducted Power Measurement Results

Band		WCDMA Band V	
Channel	**4,132**	**4,182**	**4,233**
Frequency (MHz)	**826.4**	**836.4**	**846.6**
RMC 12.2K	22.81	22.90	22.38
HSDPA Subtest-1	21.86	21.76	21.48
HSDPA Subtest-2	21.86	21.77	21.47
HSDPA Subtest-3	21.38	21.29	21.00
HSDPA Subtest-4	21.36	21.26	20.99
HSUPA Subtest-1	19.87	19.74	19.38
HSUPA Subtest-2	19.84	19.77	19.39
HSUPA Subtest-3	20.85	20.73	20.42
HSUPA Subtest-4	19.30	19.29	18.92
HSUPA Subtest-5	20.86	20.75	20.42

Remark:

1. Per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR.
2. Per KDB941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is <0.25dB higher than RMC, and Reported SAR with RMC12.2kbps setting is ≤1.2W/kg， HSDPA/HSUPA SAR evaluation can be excluded.

WLAN 2.4GHz Band Conducted Power

802.11b Average Power (dBm)					
Channel	Frequency(MHz)	Data Rate (bps)			
		1M bps	2M bps	5.5M bps	11M bps
CH 01	2,412	12.98	12.98	12.9	12.78
CH 06	2,437	12.93	12.87	12.78	12.67
CH 11	2,462	12.83	12.76	12.69	12.56

802.11g Average Power (dBm)									
Channel	Frequency(MHz)	Data Rate (bps)							
		6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
CH 01	2,412	8.69	8.67	8.66	8.58	8.46	8.43	8.35	8.23
CH 06	2,437	9.82	9.78	9.76	9.67	9.56	9.5	9.41	9.3
CH 11	2,462	8.92	8.87	8.85	8.78	8.65	8.58	8.51	8.38

802.11n-HT20 Average Power (dBm)									
Channel	Frequency(MHz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 01	2,412	8.59	8.56	8.48	8.36	8.33	8.25	8.13	7.91
CH 06	2,437	9.89	9.83	9.74	9.63	9.57	9.48	9.37	9.11
CH 11	2,462	8.72	8.65	8.58	8.45	8.38	8.31	8.18	7.91

802.11n-HT40 Average Power (dBm)									
Channel	Frequency(MHz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 03	2,422	6.10	5.99	5.87	5.85	5.84	5.76	5.64	5.53
CH 06	2,437	7.96	7.91	7.8	7.76	7.74	7.65	7.54	7.39
CH 09	2,452	6.08	5.94	5.81	5.76	5.74	5.67	5.54	5.41

Remark:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. 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. 2.4GHz WLAN SAR was tested on 802.11b 1Mbps.
3. Per KDB 248227 D01 v01r02, 11g, 11n-HT20 and 11n-HT40 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

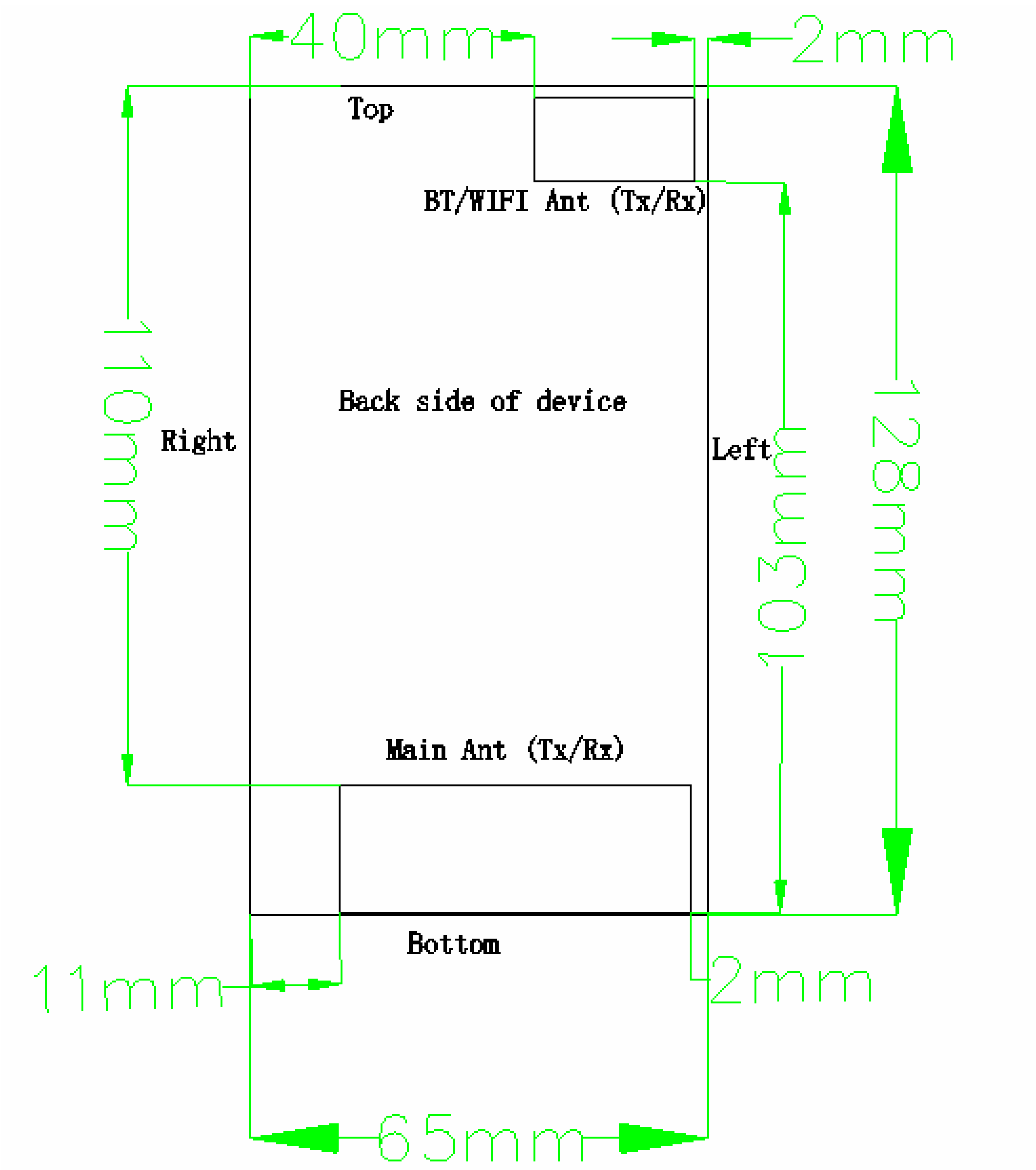
Bluetooth 2.4GHz Band Conducted Power

Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	0.19
CH 39	2,441	0.67
CH 78	2,480	0.34

BLE 2.4GHz Band Conducted Power

Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	-8.05
CH 19	2,440	-8.06
CH 39	2,480	-8.17

8. EUT ANTENNA LOCATIONS



Mobile Hotspot Sides for SAR Testing

Mode	Back Side	Front Side	Left Edge	Right Edge	Top Edge	Bottom Edge
GSM 850	Yes	Yes	Yes	Yes	N/A	Yes
GSM 1900	Yes	Yes	Yes	Yes	N/A	Yes
UMTS Band V	Yes	Yes	Yes	Yes	N/A	Yes
2.4GHz WLAN	Yes	Yes	Yes	N/A	Yes	N/A
Note: When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested.						

9. MEASUREMENT RESULTS

Remark:

1. Per KDB 447498 D01v05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
Reported SAR(W/kg)= Measured SAR(W/kg)* Scaling Factor
2. Per KDB 447498 D01v05, for each exposure position, if the mid channel or highest output channel reported SAR ≤0.8W/kg, other channels SAR testing are not necessary

9.1. GSM 850 SAR results

GSM850 Head

Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
GSM850	GSM Voice	Left Cheek	190	836.6	32.6	33	1.096	0.187	**0.205**
GSM850	GSM Voice	Left Tilted	190	836.6	32.6	33	1.096	0.125	0.137
GSM850	GSM Voice	Right Cheek	190	836.6	32.6	33	1.096	0.173	0.190
GSM850	GSM Voice	Right Tilted	190	836.6	32.6	33	1.096	0.142	0.156

GSM 850 Body

Distance 10mm

Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
GSM850	GSM Voice	Front	190	836.6	32.6	33	1.096	0.213	0.233
GSM850	GSM Voice	Back	190	836.6	32.6	33	1.096	0.386	0.423
Worst Case Position of Head With Headset									
GSM850	GSM Voice	Back	190	836.6	32.6	33	1.096	0.388	0.425

Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
GSM850	GPRS (GMSK, 2 Tx slots)	Front	190	836.6	31.6	30	1.096	0.386	0.423
GSM850	GPRS (GMSK, 2 Tx slots)	Back	190	836.6	31.6	30	1.096	0.550	**0.603**
GSM850	GPRS (GMSK, 2 Tx slots)	Bottom	190	836.6	31.6	30	1.096	0.079	0.087
GSM850	GPRS (GMSK, 2 Tx slots)	Left	190	836.6	31.6	30	1.096	0.303	0.332
GSM850	GPRS (GMSK, 2 Tx slots)	Right	190	836.6	31.6	30	1.096	0.337	0.369

Note:
1.The value with blue 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.

9.2. GSM 1900 SAR results

GSM1900 Head

Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
GSM1900	GSM Voice	Right Cheek	661	1880.0	29.8	30	1.047	0.171	0.179
GSM1900	GSM Voice	Right Tilted	661	1880.0	29.8	30	1.047	0.041	0.043
GSM1900	GSM Voice	Left Cheek	661	1880.0	29.8	30	1.047	0.066	0.069
GSM1900	GSM Voice	Left Tilted	661	1880.0	29.8	30	1.047	0.020	0.021

GSM 1900 Body

Distance 10mm

Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
GSM1900	GSM Voice	Front	661	1880.0	29.8	30	1.047	0.156	0.163
GSM1900	GSM Voice	Back	661	1880.0	29.8	30	1.047	0.306	0.320
Worst Case Position of Head With Headset									
GSM1900	GSM Voice	Bottom Side	661	1880.0	29.8	30	1.047	0.308	0.322

Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
GSM1900	GPRS (GMSK, 2 Tx slots)	Front	661	1880.0	28.8	29	1.047	0.163	0.171
GSM1900	GPRS (GMSK, 2 Tx slots)	Back	661	1880.0	28.8	29	1.047	0.352	0.369
GSM1900	GPRS (GMSK, 2 Tx slots)	Bottom	661	1880.0	28.8	29	1.047	0.302	0.316
GSM1900	GPRS (GMSK, 2 Tx slots)	Left	661	1880.0	28.8	29	1.047	0.030	0.031

GSM1900	GPRS (GMSK, 2 Tx slots)	Right	661	1880.0	28.8	29	1.047	0.107	0.112

Note:
1.The value with blue 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.

9.3. WCDMA 850 SAR results

WCDMA 850 Head

Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
WCDMA850	Voice	Right Cheek	4182	836.4	22.90	23	1.023	0.231	0.236
WCDMA850	Voice	Right Tilted	4182	836.4	22.90	23	1.023	0.135	0.138
WCDMA850	Voice	Left Cheek	4182	836.4	22.90	23	1.023	0.289	**0.296**
WCDMA850	Voice	Left Tilted	4182	836.4	22.90	23	1.023	0.132	0.135

WCDMA 850 Body

Distance 10mm

Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
WCDMA850	RMC12.2	Front	4182	836.4	22.90	23	1.023	0.372	0.381
WCDMA850	RMC12.2	Back	4182	836.4	22.90	23	1.023	0.547	**0.560**
WCDMA850	RMC12.2	Bottom	4182	836.4	22.90	23	1.023	0.088	0.090
WCDMA850	RMC12.2	Left	4182	836.4	22.90	23	1.023	0.364	0.372
WCDMA850	RMC12.2	Right	4182	836.4	22.90	23	1.023	0.310	0.317

Note:
1.The value with blue 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.

9.4. WIFI SAR results

WIFI Head

Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR	Reported SAR (W/kg)

								(W/kg)	
WIFI 2.4GHz	11b	Left Cheek	6	2437	12.93	13	1.016	0.008	0.008
WIFI 2.4GHz	11b	Left Tilted	6	2437	12.93	13	1.016	0.007	0.007
WIFI 2.4GHz	11b	Right Cheek	6	2437	12.93	13	1.016	0.021	**0.021**
WIFI 2.4GHz	11b	Right Tilted	6	2437	12.93	13	1.016	0.017	0.017

WIFI Body
Distance 10mm

Band	**Mode**	**Test Position**	**Ch.**	**Freq. (MHz)**	**Average Power (dBm)**	**Tune-Up Limit (dBm)**	**Scaling Factor**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
WIFI 2.4GHz	11b	Front	6	2437	12.93	13	1.016	0.004	0.004
WIFI 2.4GHz	11b	Back	6	2437	12.93	13	1.016	0.009	**0.009**
WIFI 2.4GHz	11b	Top	6	2437	12.93	13	1.016	0.004	0.004
WIFI 2.4GHz	11b	Left	6	2437	12.93	13	1.016	0.007	0.007

Note:
1. The value with blue 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-SAR is not required for 802.11b/n channels when the maximum average output power is less than ¼ dB higher than measured on the corresponding 802.11g channels.

9.5. Repeated SAR results

Remark:

1 According to KDB 865664 D01v01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ⩾0.8W/kg.

2 KDB 865664 D01v01, if the deviation among the repeated measurement is ⩽20% and the measured SAR<1.45W/kg, only one repeated measurement is required.

3 The variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

Band	**Mode**	**Test Position**	**Ch.**	**Freq. (MHz)**	**Average Power (dBm)**	**Tune-Up Limit (dBm)**	**Scaling Factor**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**	**Ratio**
--										
--										

Measured SAR of all frequency band are lower than 0.8W/kg, repeated SAR is not required .

10. SIMULTANEOUS TRANSMISSION SAR ANALYSIS

Mode	Wireless Technology	Frequency Band
Data	Bluetooth	2.4GHz
Data	BLE	2.4GHz
Voice/Data	GSM/GPRS	850 1900
Voice/Data	WCDMA	Band V
DATA	WIFI	2.4GHz

	Position	Applicable Combination
Simultaneous Transmission	Body-worn Head	WWAN + WLAN 2.4GHz Band WWAN + Bluetooth

Remark:

1 GSM/WCDMA share the same antenna, and cannot transmit simultaneously

2 The reported SAR summation is calculated based on the same configuration and test position.

3 Bluetooth SAR is estimated per KDB 447498 D01v05 based on the formula below.

i) (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. Per FCC KDB publication 447498, when the test separation distance is <5mm, a distance of 5mm is applied to determine estimated SAR.

ii) 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.

10mm

Wireless Interface	Bluetooth
Tune-up Maximum power (dBm)	1
Rounded Power in mW	1
Distance mm	10
Frequency GHz	2.45
Estimated SAR for simultaneous transmission analysis	0.026

5mm

Wireless Interface	Bluetooth
Tune-up Maximum power (dBm)	1
Rounded Power in mW	1
Distance mm	5
Frequency GHz	2.45
Estimated SAR for simultaneous transmission analysis	0.053

5 According to KDB 447498 D01v05, simultaneous transmission SAR is compliant if,

(i) Scalar SAR summation < 1.6W/kg.

(ii) 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.

If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.

(iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

Simultaneously transmission Analysis of the highest reported SAR

Head

	WWAN (PCE)		**Bluetooth (DSS)**	**WWAN+ Bluetooth (W/kg)**	**SPLSR≤ 0.04**	**Simultaneous transmission SAR test exclusion**
Position	**WWAN Band**	**Max. WWAN SAR (W/kg)**	**Estimated Bluetooth SAR (W/kg)**			
Left cheek	WCDMA Band V	0.296	0.053	0.349	-	Excluded

	WWAN (PCE)		**WIFI 2.4G (DTS)**	**WWAN+ DTS (W/kg)**	**SPLSR≤ 0.04**	**Simultaneous transmission SAR test exclusion**
Position	**WWAN Band**	**Max. WWAN SAR (W/kg)**	**Max DTSSAR (W/kg)**			
Left cheek	WCDMA Band V	0.296	0.021	0.317	-	Excluded

Body worn 10mm

	WWAN (PCE)		**Bluetooth (DSS)**	**WWAN+ Bluetooth (W/kg)**	**SPLSR≤ 0.04**	**Simultaneous transmission SAR test exclusion**
Position	**WWAN Band**	**Max. WWAN SAR (W/kg)**	**Estimated Bluetooth SAR (W/kg)**			
Back	GSM850	0.603	0.026	0.629	-	Excluded

	WWAN (PCE)		**WIFI 2.4G (DTS)**	**WWAN+ DTS (W/kg)**	**SPLSR≤ 0.04**	**Simultaneous transmission SAR test exclusion**
Position	**WWAN Band**	**Max. WWAN SAR (W/kg)**	**Max DTSSAR (W/kg)**			
Back	GSM850	0.603	0.009	0.612	-	Excluded

APPENDIX A: SYSTEM CHECKING SCANS

SystemPerformanceCheck-D835 Head

Date: 2015.03.31

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d141

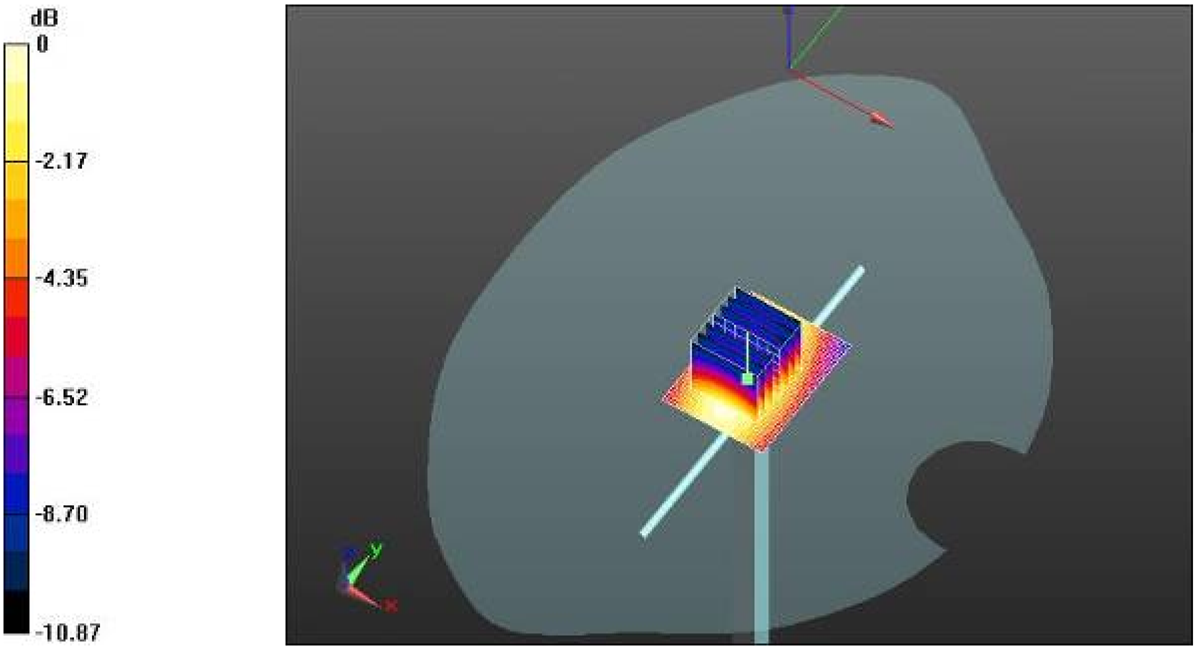
Communication System: CW; Communication System Band: Not Specified; Frequency: 835 MHz;Communication System PAR: 0 dB
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 41.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(6.55, 6.55, 6.55); Calibrated: 2014.07.22.;
- Electronics: DAE4 Sn876; Calibrated: 2015.03.09.
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.50 W/kg
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 49.769 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.434 mW/g
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.51 mW/g

Maximum value of SAR (measured) = 2.50 W/kg



0 dB = 2.50 W/kg

SystemPerformanceCheck-D835 Body

Date: 2015.03.31

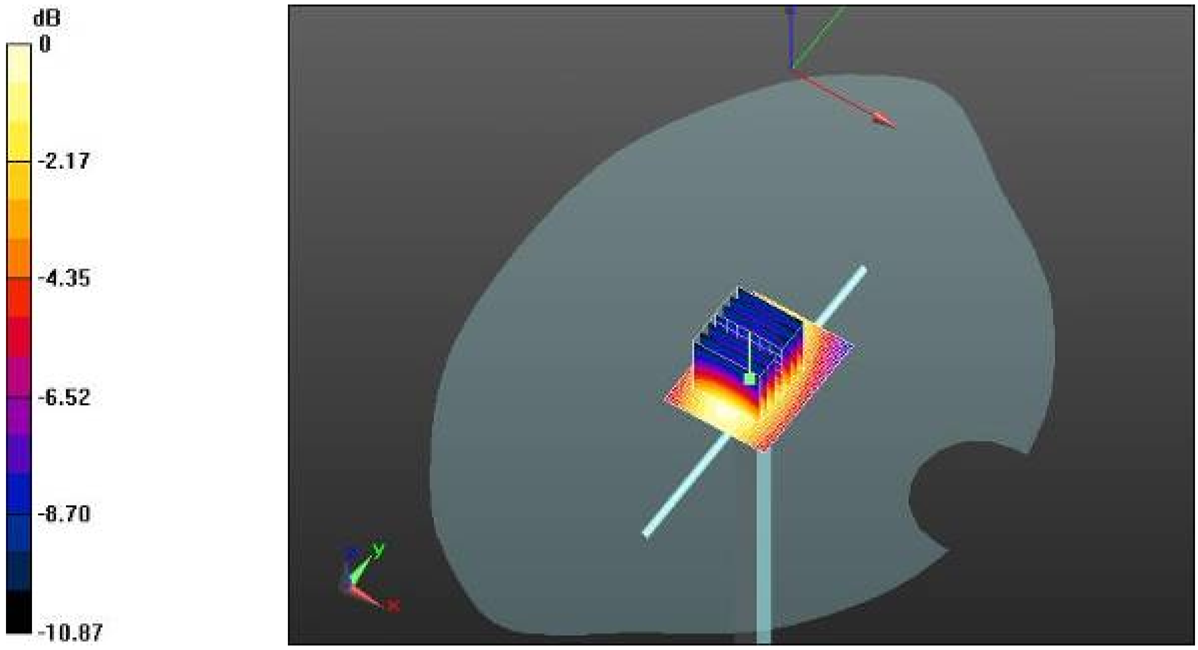
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d141

Communication System: CW; Communication System Band: Not Specified; Frequency: 835 MHz;Communication System PAR: 0 dB
Medium parameters used: f = 835 MHz; σ = 1.02 mho/m; ε_r = 55.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(6.75, 6.75, 6.75); Calibrated: 2014.07.22.;
- Electronics: DAE4 Sn876; Calibrated: 2015.03.09.
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.52 W/kg
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 49.854 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.434 mW/g
SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.54 mW/g
Maximum value of SAR (measured) = 2.51 W/kg



0 dB = 2.51 W/kg

SystemPerformanceCheck-D1900 Head

Date :2015.04.01.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d162

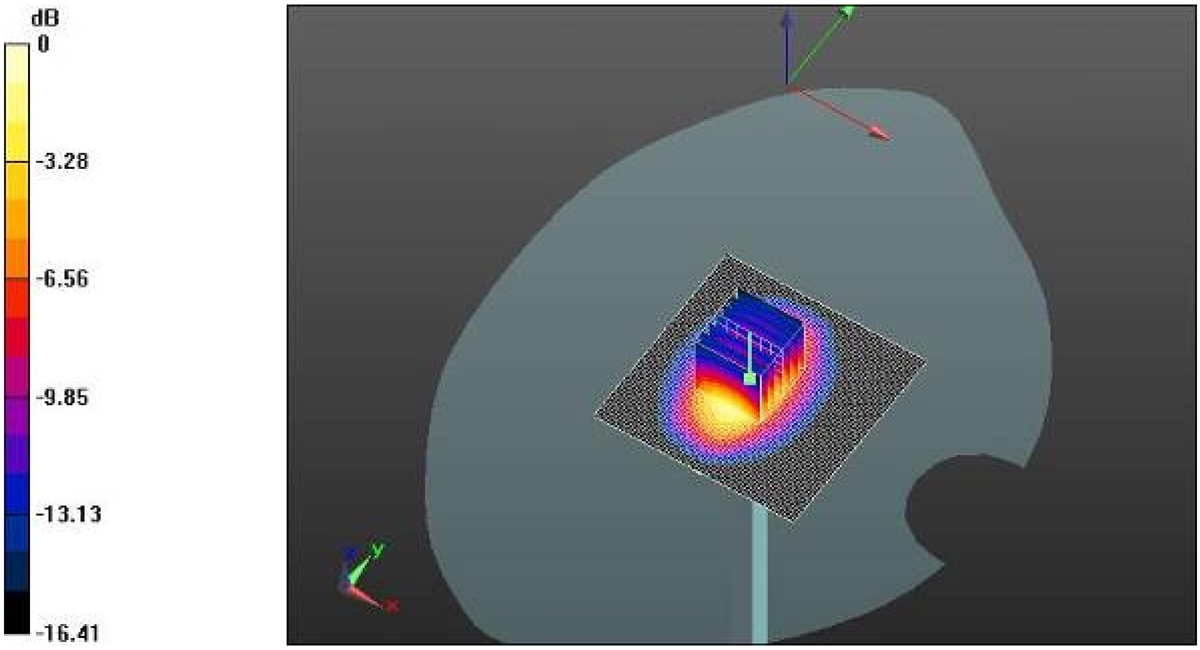
Communication System: CW; Communication System Band: Not Specified; Frequency: 1900 MHz;Communication System PAR: 0 dB
Medium parameters used: f = 1900 MHz; σ = 1.43 mho/m; ε_r = 40.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(5.41, 5.41, 5.41); Calibrated: 2014.07.22.;
- Electronics: DAE4 Sn876; Calibrated: 2015.03.09.
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.8 W/kg
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 85.692 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.506 mW/g
SAR(1 g) = 9.76 mW/g; SAR(10 g) = 6.09 mW/g

Maximum value of SAR (measured) = 14.7 W/kg



0 dB = 14.7 W/kg

SystemPerformanceCheck-D1900 Body

Date: 2015.04.01.

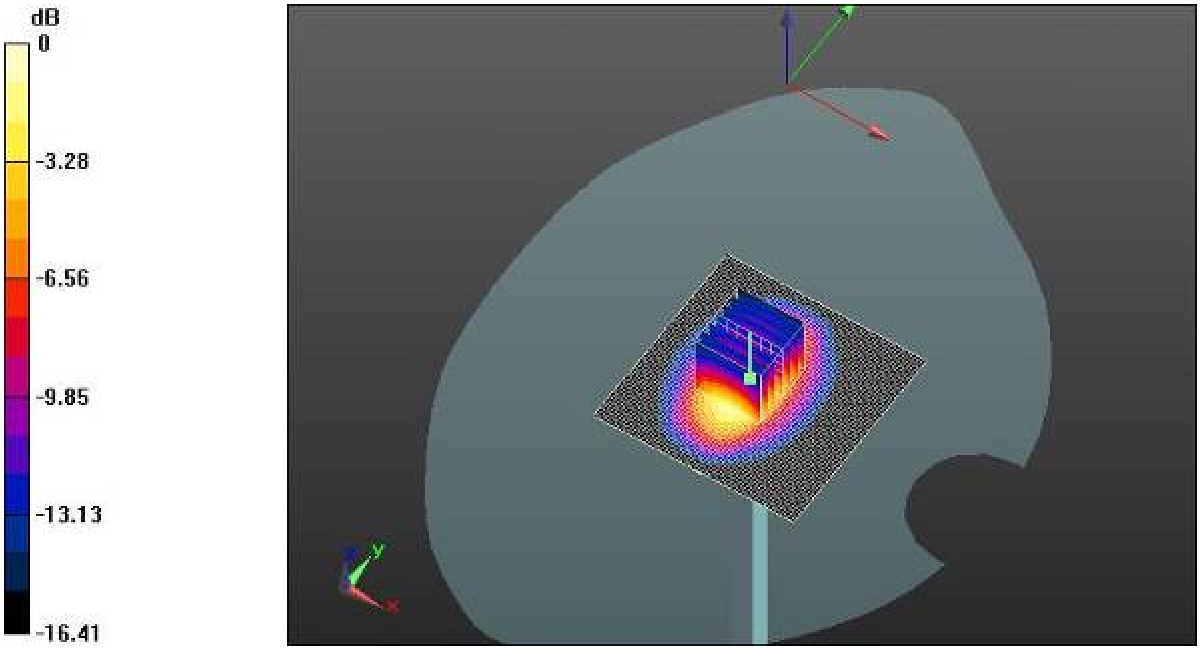
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d162

Communication System: CW; Communication System Band: Not Specified; Frequency: 1900 MHz;Communication System PAR: 0 dB
Medium parameters used: f = 1900 MHz; σ = 1.45 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(5.12, 5.12, 5.12); Calibrated: 2014.07.22.;
- Electronics: DAE4 Sn876; Calibrated: 2015.03.09.
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504
- Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.5 W/kg
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 85.872 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.503 mW/g
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.29 mW/g
Maximum value of SAR (measured) = 14.6 W/kg



0 dB = 14.6 W/kg

SystemPerformanceCheck-D2450 Head

Date: 2015.04.01.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:818

Communication System: CW; Communication System Band: Not Specified; Frequency: 2450 MHz;Communication System PAR: 0 dB
Medium parameters used: f = 2450 MHz; σ = 1.74 mho/m; ε_r = 39.0; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

DASY5 Configuration:Probe:

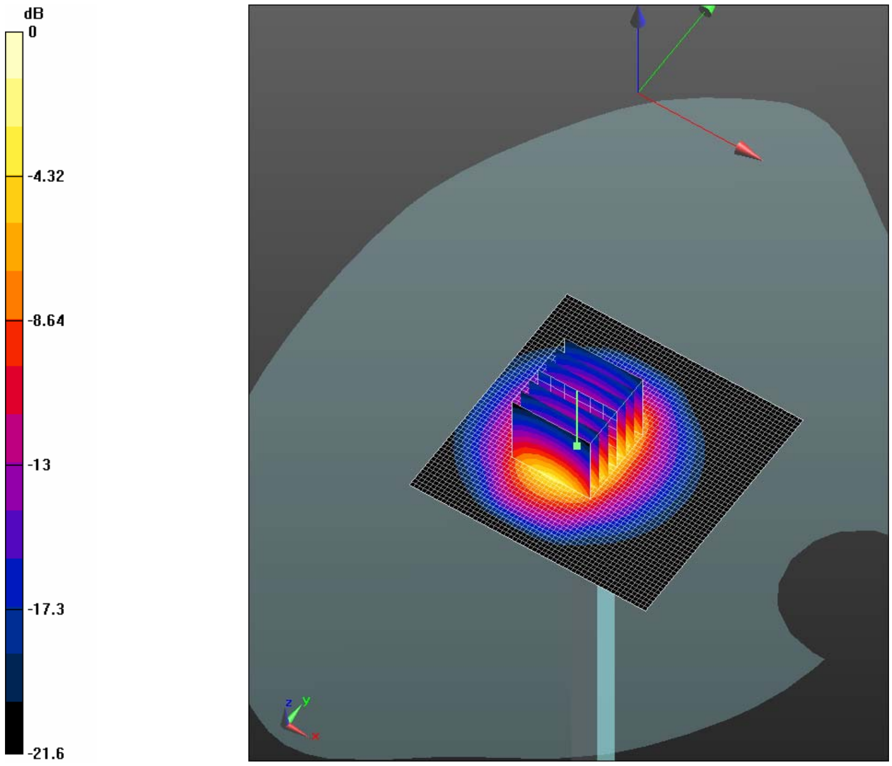
ES3DV3 - SN3203; ConvF(5.07, 5.07,5.07); Calibrated: 2014.12.19.;

Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 18.2 W/kg
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 82.205 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 24.541 mW/g
SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.11 mW/g
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.3 W/kg

SystemPerformanceCheck-D2450 Body

Date: 2015.04.01.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:818

Communication System: CW; Communication System Band: Not Specified; Frequency: 2450 MHz;Communication System PAR: 0 dB
Medium parameters used: f = 2450 MHz; σ = 1.96 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

DASY5 Configuration:Probe:

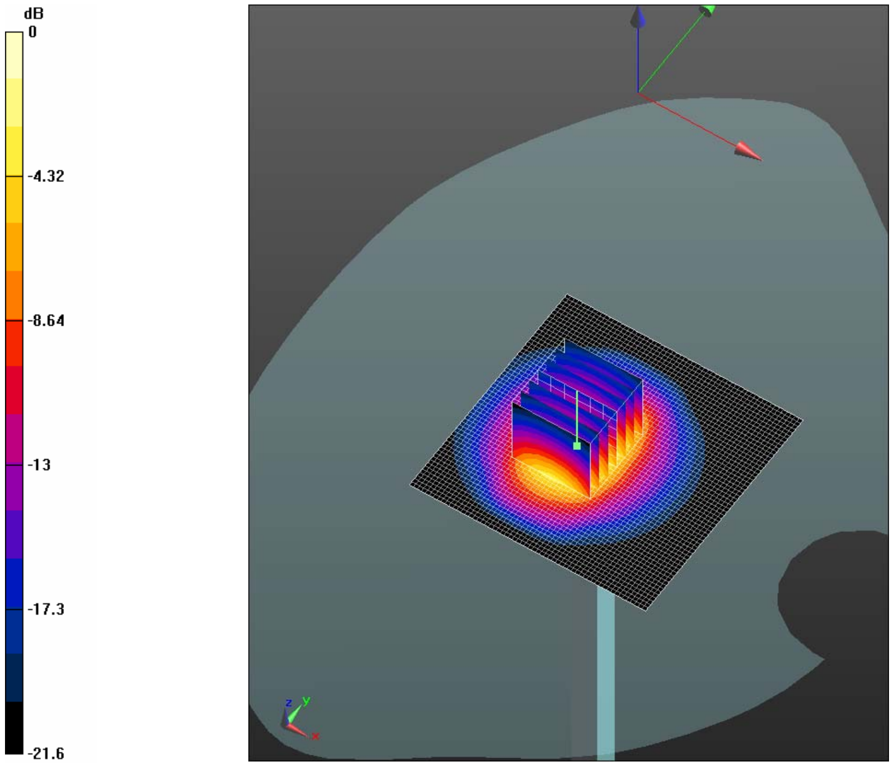
ES3DV3 - SN3203; ConvF(4.72, 4.72,4.72); Calibrated: 2014.12.19.;

Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504

Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 18.3 W/kg
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 82.205 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 24.691 mW/g
SAR(1 g) = 12.1 mW/g; SAR(10 g) = 5.71 mW/g
Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 18.4 W/kg

APPENDIX B: System Validation

Per KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. SAR measurement systems are validated according to procedures in KDB 865664 D01v01. The validation status is documented according to the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters. When multiple SAR system is used, the validation status of each SAR system is needed to be documented separately according to the associated system components.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters are shown as below.

Date	Probe S/N	Tested Freq MHz	Tissue	CW			Mod. Validation		
				Sensitivity	Linearity	Isotropy	Mod	Duty Factor	Peak to Average Power Ration
2014-11.17	3203	835	Body	Pass	Pass	Pass	GMSK	Pass	N/A
2014-11-16	3203	1900	Body	Pass	Pass	Pass	GMSK	Pass	N/A
2014-11-16	3203	2450	Body	Pass	Pass	Pass	OFDM	Pass	N/A

Date	Probe S/N	Tested Freq MHz	Tissue	CW			Mod. Validation		
				Sensitivity	Linearity	Isotropy	Mod	Duty Factor	Peak to Average Power Ration
2014-11.22	3881	835	Body	Pass	Pass	Pass	GMSK	Pass	N/A
2014-11-23	3881	1900	Body	Pass	Pass	Pass	GMSK	Pass	N/A
2014-11-23	3881	2450	Body	Pass	Pass	Pass	OFDM	Pass	N/A

APPENDIX C: MEASUREMENT SCANS

Date: 2015.03.31.

Maxim pro GSM850 Head Left Cheek Mid

Medium: HSL900

Communication System: Left Cheek-Mid; Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:5.99791

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.89 mho/m; ε_r = 41.478; ρ = 1000 kg/m^3

Phantom section: Left Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(9.41, 9.41, 9.41); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

GSM 850 Left cheek/Mid/Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 9.592 V/m; Power Drift = -0.05 dB

Fast SAR: SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.130 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.198 W/kg

GSM 850 Left cheek/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

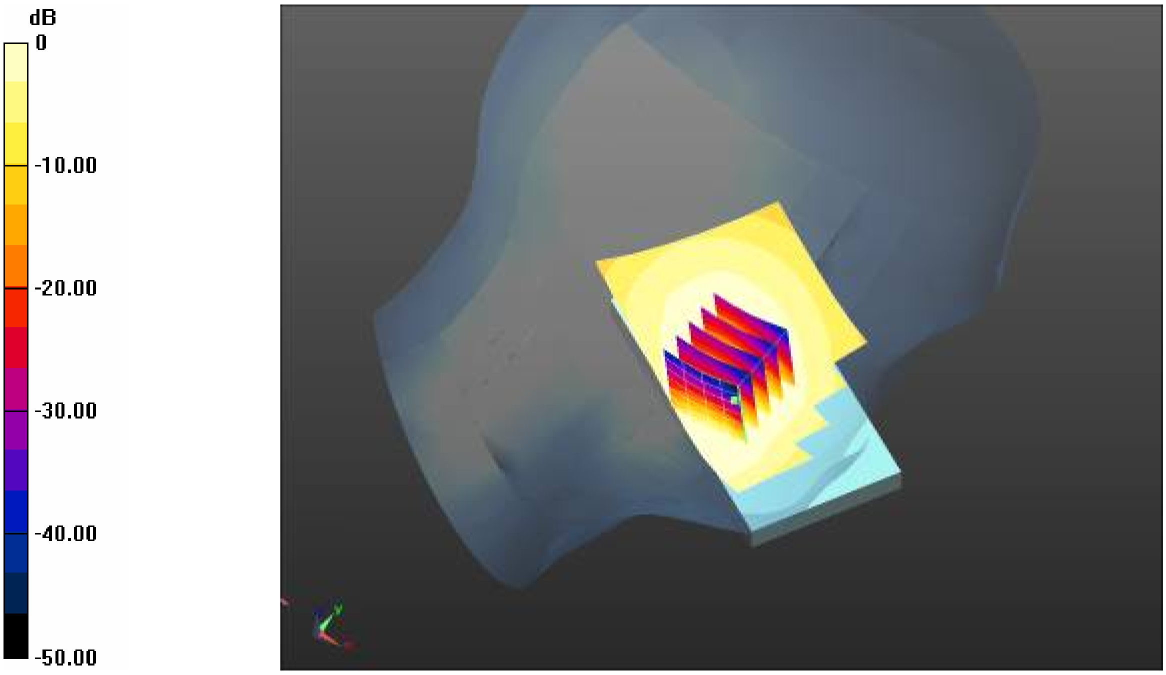
Reference Value = 9.592 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.231 mW/g

SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.146 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.195 W/kg



0 dB = 0.198 W/kg = -14.07 dB W/kg

Date: 2015.03.31.

Maxim pro GPRS850 Body Rear Mid

Medium: MSL900

Communication System: GPRS FDD (TDMA, GSMK); Communication System Band: GSM 850 (824.0 – 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:5.01187

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 55.858; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 – SN3881; ConvF(9.34, 9.34, 9.34); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

GPRS 850_Facedown/Mid/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 9.592 V/m; Power Drift = -0.05 dB

Fast SAR: SAR(1 g) = 0.542 mW/g; SAR(10 g) = 0.381 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.569 W/kg

GPRS 850_Facedown/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

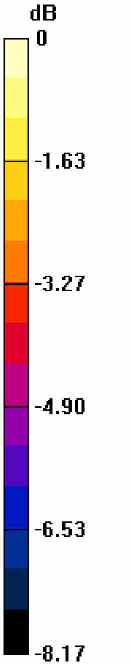
Reference Value = 9.592 V/m; Power Drift = -0.05 dB

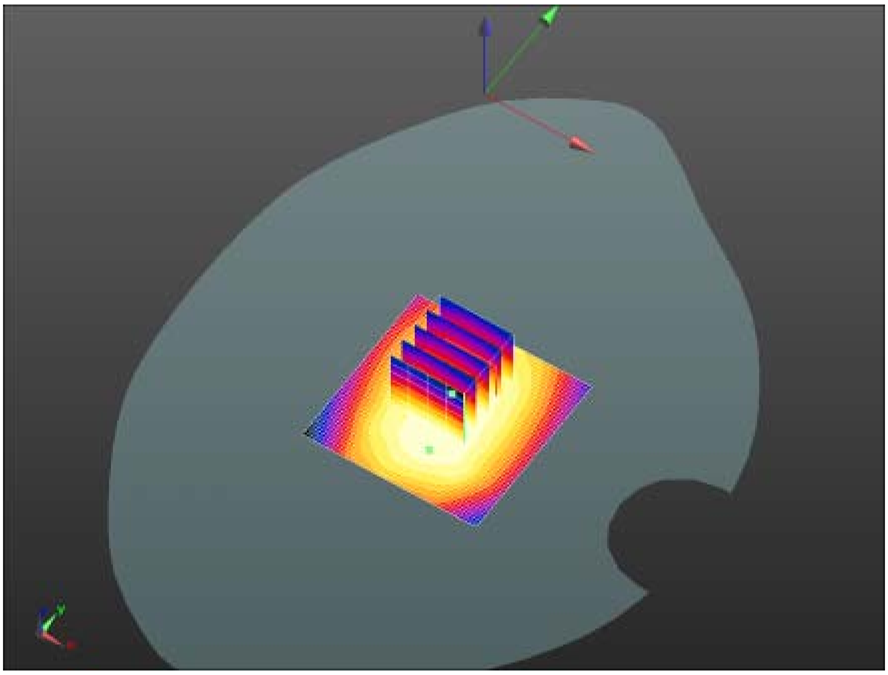
Peak SAR (extrapolated) = 0.677 mW/g

SAR(1 g) = 0.550 mW/g; SAR(10 g) = 0.423 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.573 W/kg





0 dB = 0.569 W/kg = -4.90 dB W/kg

Date: 2015.03.31.

Maxim pro GSM850 Body Rear Mid

Medium: MSL900

Communication System: Generic GSM; Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:8.30042

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 55.858; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

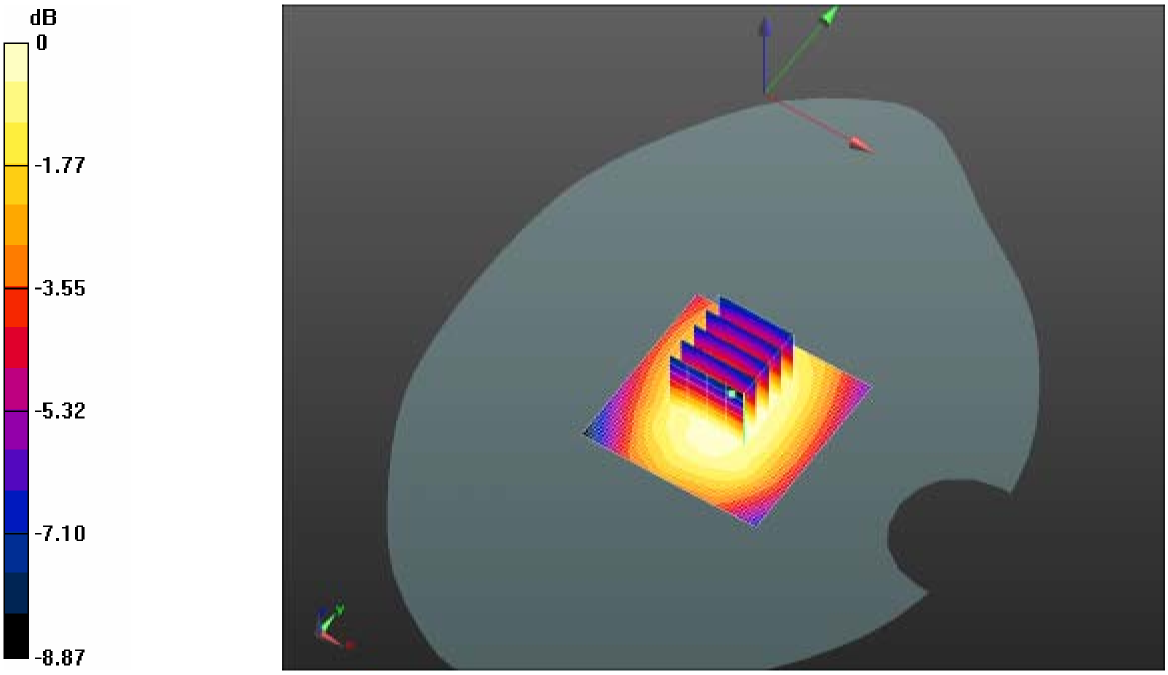
DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(9.34, 9.34, 9.34); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

GSM 850_Back 15mm/Mid/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 9.592 V/m; Power Drift = -0.05 dB
Fast SAR: SAR(1 g) = 0.391 mW/g; SAR(10 g) = 0.274 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.411 W/kg

GSM 850_Back 15mm/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.592 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.471 mW/g
SAR(1 g) = 0.386 mW/g; SAR(10 g) = 0.299 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.405 W/kg



0 dB = 0.411 W/kg = -7.71 dB W/kg

Date: 2015.03.31.

Maxim pro GSM850(Ear) Body Rear Mid

Medium: MSL900

Communication System: Generic GSM; Communication System Band: GSM 850 (824.0 – 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:8.30042

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 55.858; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 – SN3881; ConvF(9.34, 9.34, 9.34); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

GSM 850_Back 15mm/Mid 2/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 17.887 V/m; Power Drift = -0.13 dB

Fast SAR: SAR(1 g) = 0.394 mW/g; SAR(10 g) = 0.272 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.418 W/kg

GSM 850_Back 15mm/Mid 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

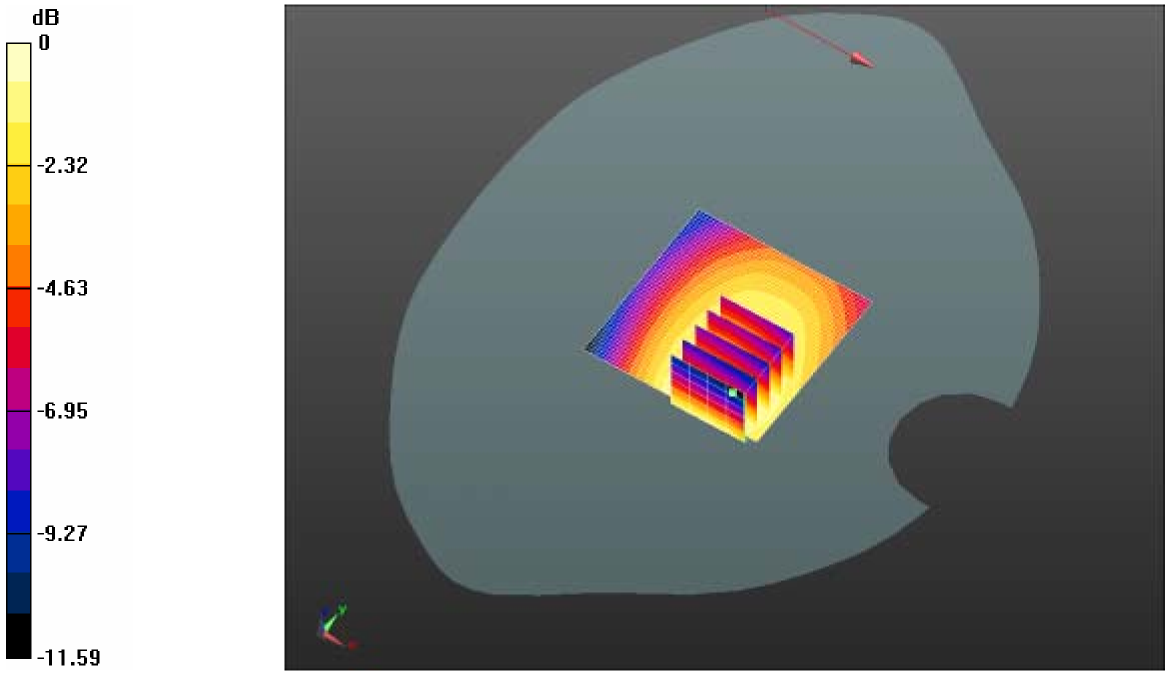
Reference Value = 17.887 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.576 mW/g

SAR(1 g) = 0.388 mW/g; SAR(10 g) = 0.274 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.413 W/kg



0 dB = 0.418 W/kg = -7.58 dB W/kg

Date: 2015.04.01.

Maxim pro GSM1900 Head Left Cheek Mid

Medium: HSL1900

Communication System: Generic GSM; Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:8.30042

Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 39.74; ρ = 1000 kg/m^3

Phantom section: Left Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(8.09, 8.09, 8.09); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

1900_Left GSM Head/1900 GSM Cheek-Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 4.024 V/m; Power Drift = 0.05 dB

Fast SAR: SAR(1 g) = 0.157 mW/g; SAR(10 g) = 0.090 mW/g

Maximum value of SAR (interpolated) = 0.176 W/kg

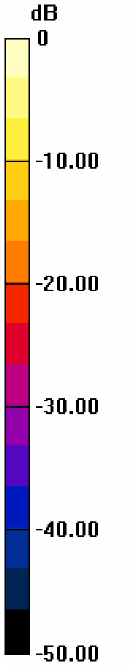
1900_Left GSM Head/1900 GSM Cheek-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

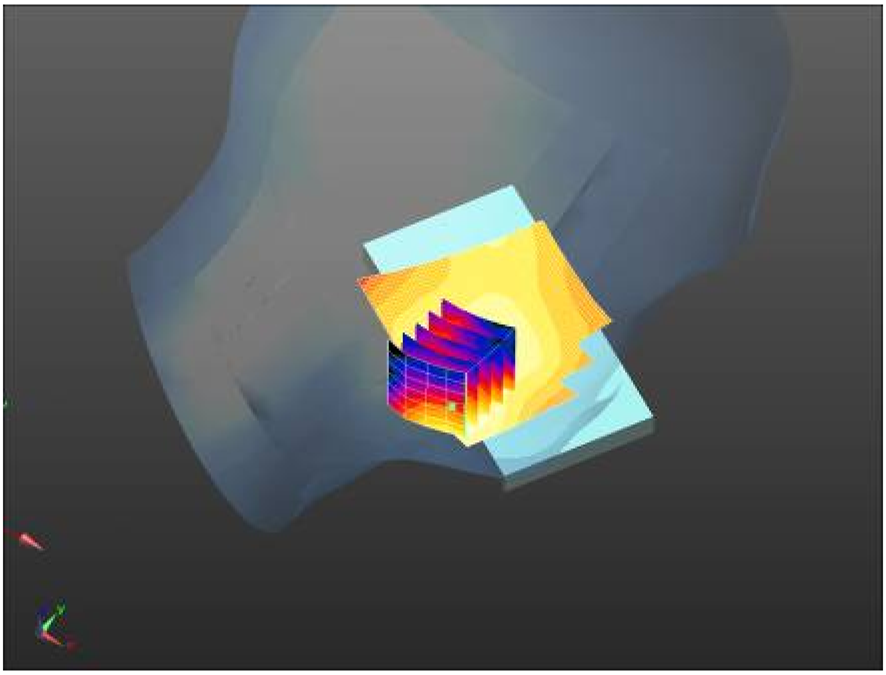
Reference Value = 4.024 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.308 mW/g

SAR(1 g) = 0.171 mW/g; SAR(10 g) = 0.089 mW/g

Maximum value of SAR (measured) = 0.186 W/kg





0 dB = 0.176 W/kg = -15.11 dB W/kg

Date: 2015.04.01.

Maxim pro GSM1900 Body Rear Mid

Medium: MSL1900

Communication System: Generic GSM; Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:8.30042

Medium parameters used: f = 1880 MHz; σ = 1.57 mho/m; ε_r = 51.14; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(8.25, 8.25, 8.25); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

1900_GSM1900/GSM1900 Back Mid/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 9.756 V/m; Power Drift = -0.00 dB

Fast SAR: SAR(1 g) = 0.283 mW/g; SAR(10 g) = 0.162 mW/g

Maximum value of SAR (interpolated) = 0.317 W/kg

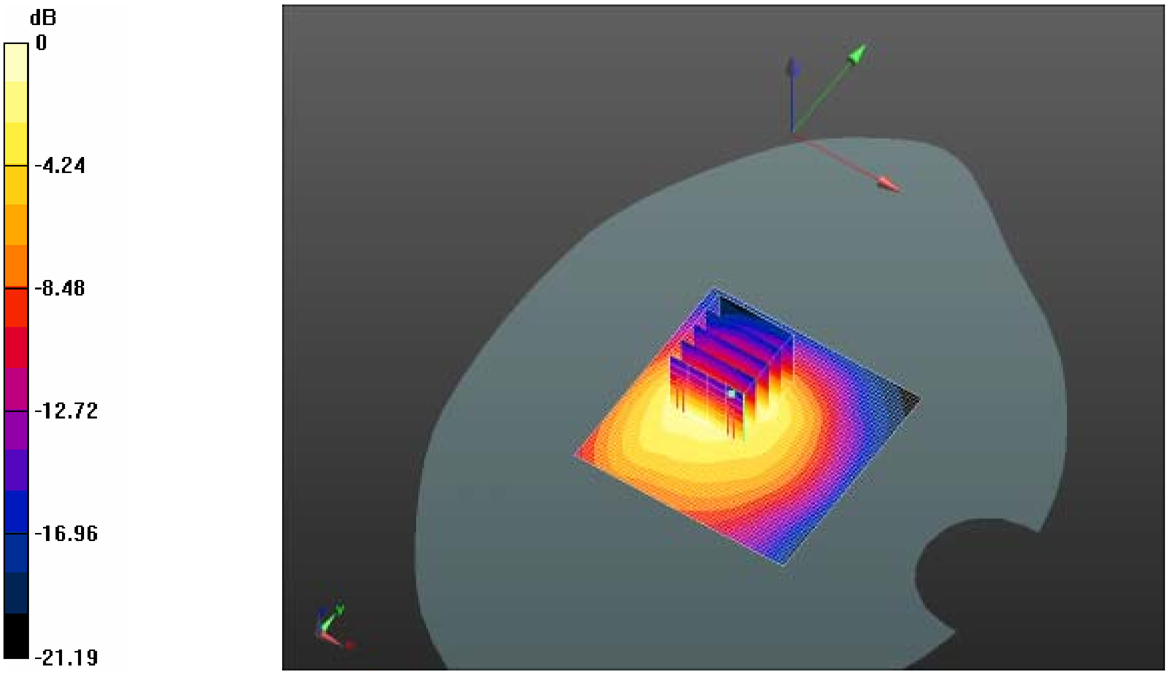
1900_GSM1900/GSM1900 Back Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.756 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 0.608 mW/g

SAR(1 g) = 0.306 mW/g; SAR(10 g) = 0.152 mW/g

Maximum value of SAR (measured) = 0.337 W/kg



0 dB = 0.317 W/kg = -9.99 dB W/kg

Date: 2015.04.01.

Maxim pro GSM1900(Ear) Body Rear Mid

Medium: MSL1900

Communication System: Generic GSM; Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:8.30042

Medium parameters used: f = 1880 MHz; σ = 1.57 mho/m; ε_r = 51.14; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(8.25, 8.25, 8.25); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

1900_GSM1900/GSM1900 Back Mid with headset/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 9.757 V/m; Power Drift = -0.04 dB

Fast SAR: SAR(1 g) = 0.281 mW/g; SAR(10 g) = 0.161 mW/g

Maximum value of SAR (interpolated) = 0.316 W/kg

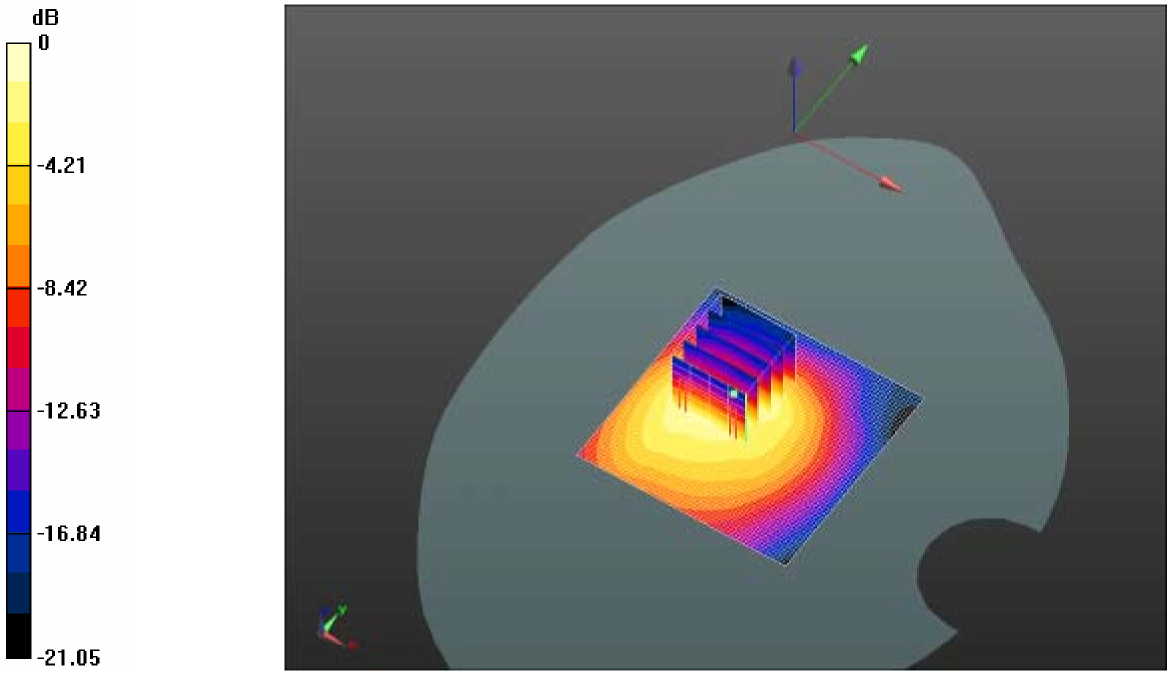
1900_GSM1900/GSM1900 Back Mid with headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.757 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.625 mW/g

SAR(1 g) = 0.308 mW/g; SAR(10 g) = 0.153 mW/g

Maximum value of SAR (measured) = 0.338 W/kg



0 dB = 0.316 W/kg = -10.02 dB W/kg

Date: 2015.04.01.

Maxim pro GPRS1900 Body Rear Mid

Medium: MSL1900

Communication System: GPRS FDD(TDMA,GSMK); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1850.2 MHz;Duty Cycle: 1:5.01187

Medium parameters used: f = 1850.2 MHz; σ = 1.53 mho/m; ε_r = 51.24; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4－SN3881; ConvF(8.25, 8.25, 8.25); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

1900_GPRS/GPRS1900 Facedown-Mid/Area Scan (101x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 10.870 V/m; Power Drift = 0.06 dB

Fast SAR: SAR(1 g) = 0.350 mW/g; SAR(10 g) = 0.198 mW/g

Maximum value of SAR (interpolated) = 0.408 W/kg

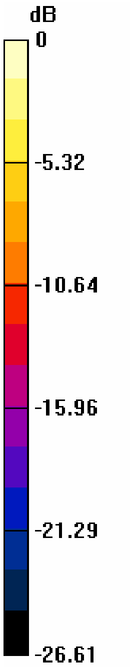
1900_GPRS/GPRS1900 Facedown-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

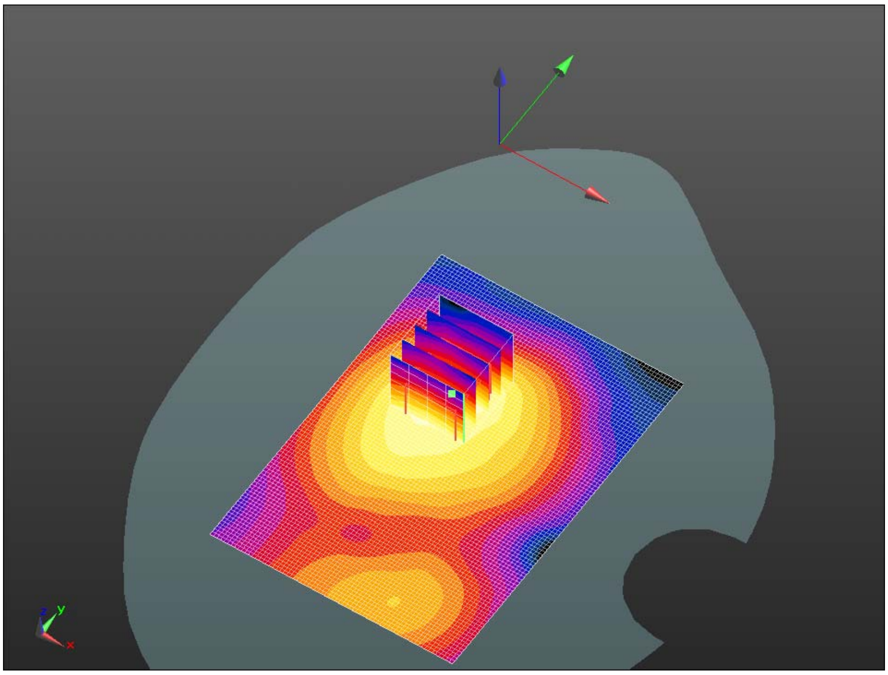
Reference Value = 10.870 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.694 mW/g

SAR(1 g) = 0.352 mW/g; SAR(10 g) = 0.181 mW/g

Maximum value of SAR (measured) = 0.370 W/kg





0 dB = 0.408 W/kg = -7.80 dB W/kg

Date: 2015.03.31.

Maxim pro WCDMA BAND5 Head Left Cheek Mid

Medium: HSL900

Communication System: UMTS-FDD; Communication System Band: Band 5, UTRA/FDD (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.89 mho/m; ε_r = 41.478; ρ = 1000 kg/m^3

Phantom section: Left Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(9.41, 9.41, 9.41); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

UMTS Band 5_left head cheek/Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 17.969 V/m; Power Drift = 0.12 dB

Fast SAR: SAR(1 g) = 0.296 mW/g; SAR(10 g) = 0.203 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.313 W/kg

UMTS Band 5_left head cheek/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

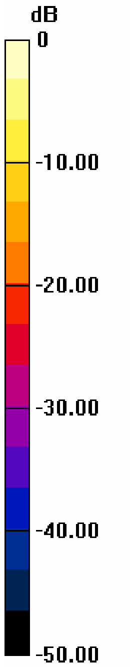
Reference Value = 17.969 V/m; Power Drift = 0.12 dB

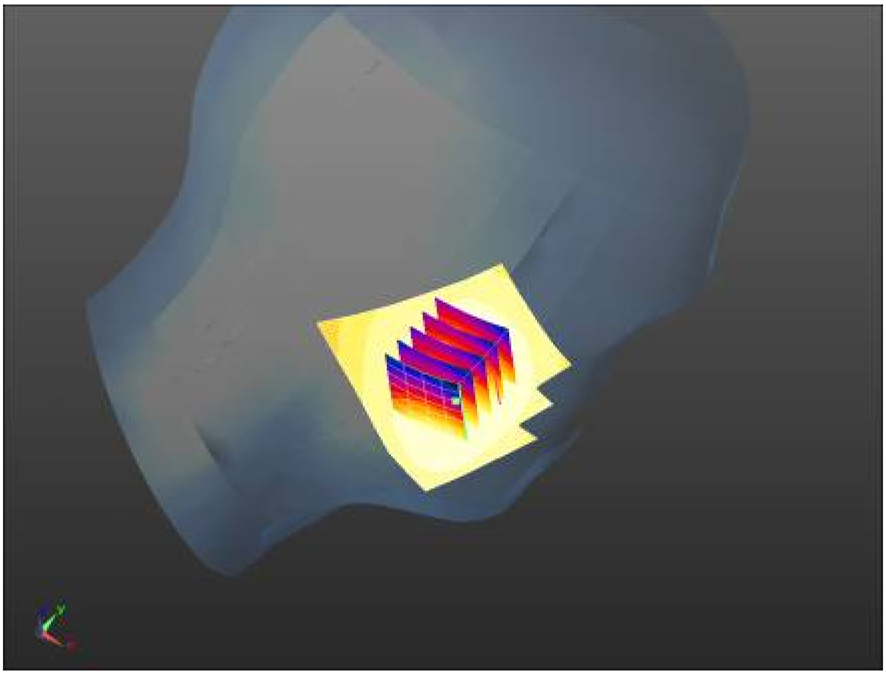
Peak SAR (extrapolated) = 0.367 mW/g

SAR(1 g) = 0.289 mW/g; SAR(10 g) = 0.220 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.303 W/kg





0 dB = 0.313 W/kg = -10.08 dB W/kg

Date: 2015.03.31.

Maxim pro WCDMA BAND5 Body Rear Mid

Medium: MSL900

Communication System: UMTS-FDD; Communication System Band: Band 5, UTRA/FDD (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 55.858; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(9.34, 9.34, 9.34); Calibrated: 2014.07.22.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

UMTS Band 5_body Back/Mid/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 17.969 V/m; Power Drift = 0.12 dB

Fast SAR: SAR(1 g) = 0.549 mW/g; SAR(10 g) = 0.386 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.577 W/kg

UMTS Band 5_body Back/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

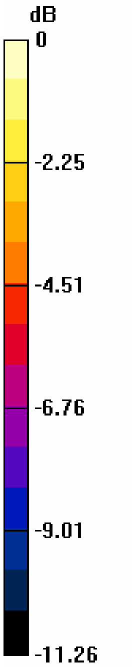
Reference Value = 17.969 V/m; Power Drift = 0.12 dB

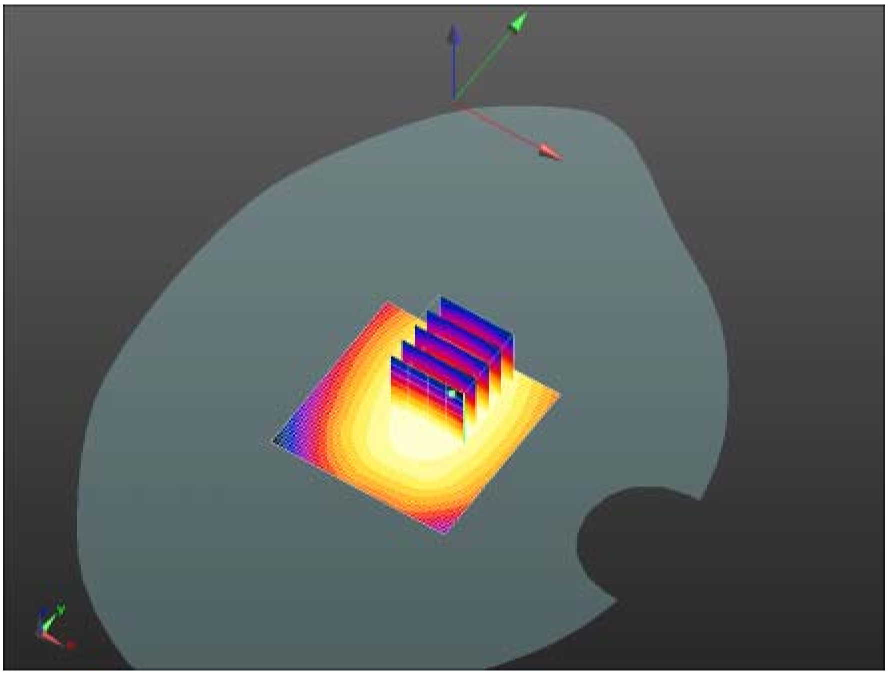
Peak SAR (extrapolated) = 0.664 mW/g

SAR(1 g) = 0.547 mW/g; SAR(10 g) = 0.419 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.571 W/kg





0 dB = 0.577 W/kg = -4.77 dB W/kg

Date: 2015.04.01.

Maxim pro WiFi 802.11b Head Right Cheek Mid

Medium: HSL2450

Communication System: WiFi (802.11a/b/g/n); Communication System Band: 802.11b; Frequency: 2442 MHz;Duty Cycle: 1:2.29034

Medium parameters used (interpolated): f = 2442 MHz; σ = 1.831 mho/m; ε_r = 37.997; ρ = 1000 kg/m^3

Phantom section: Right Section

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

DASY5 Configuration:Probe: ES3DV3 - SN3203; ConvF(4.55, 4.55, 4.55); Calibrated: 2014.12.19.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

802.11b-rightHead/right Cheek-Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 1.202 V/m; Power Drift = 0.15 dB

Fast SAR: SAR(1 g) = 0.019 mW/g; SAR(10 g) = 0.00944 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.0216 W/kg

802.11b-rightHead/right Cheek-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

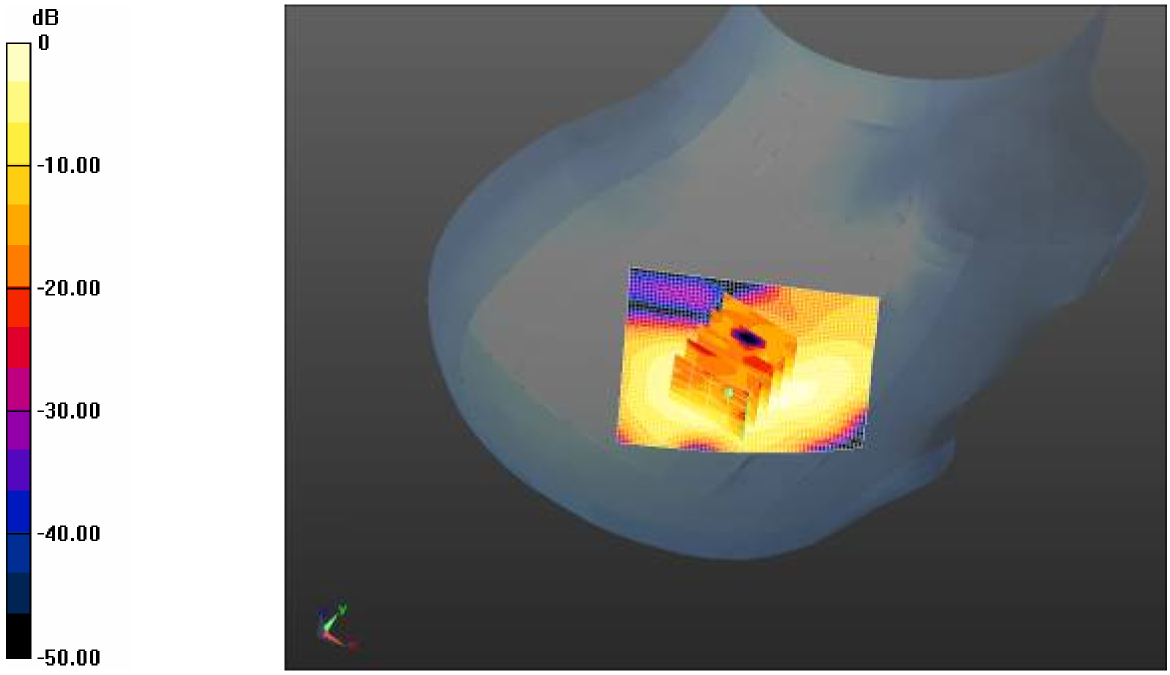
Reference Value = 1.202 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.048 mW/g

SAR(1 g) = 0.021 mW/g; SAR(10 g) = 0.00867 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.0274 W/kg



0 dB = 0.0216 W/kg = -33.29 dB W/kg

Date: 2015.04.01.

Maxim pro WiFi 802.11b Body Rear Mid

Medium: MSL2450

Communication System: WiFi (802.11a/b/g/n); Communication System Band: 802.11b; Frequency: 2442 MHz;Duty Cycle: 1:2.29034
Medium parameters used (interpolated): f = 2442 MHz; σ = 1.999 mho/m; ε_r = 50.981; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:Probe: ES3DV3 - SN3203; ConvF(4.47, 4.47, 4.47); Calibrated: 2014.12.19.; Electronics: DAE4 Sn876; Calibrated: 2015.03.09.

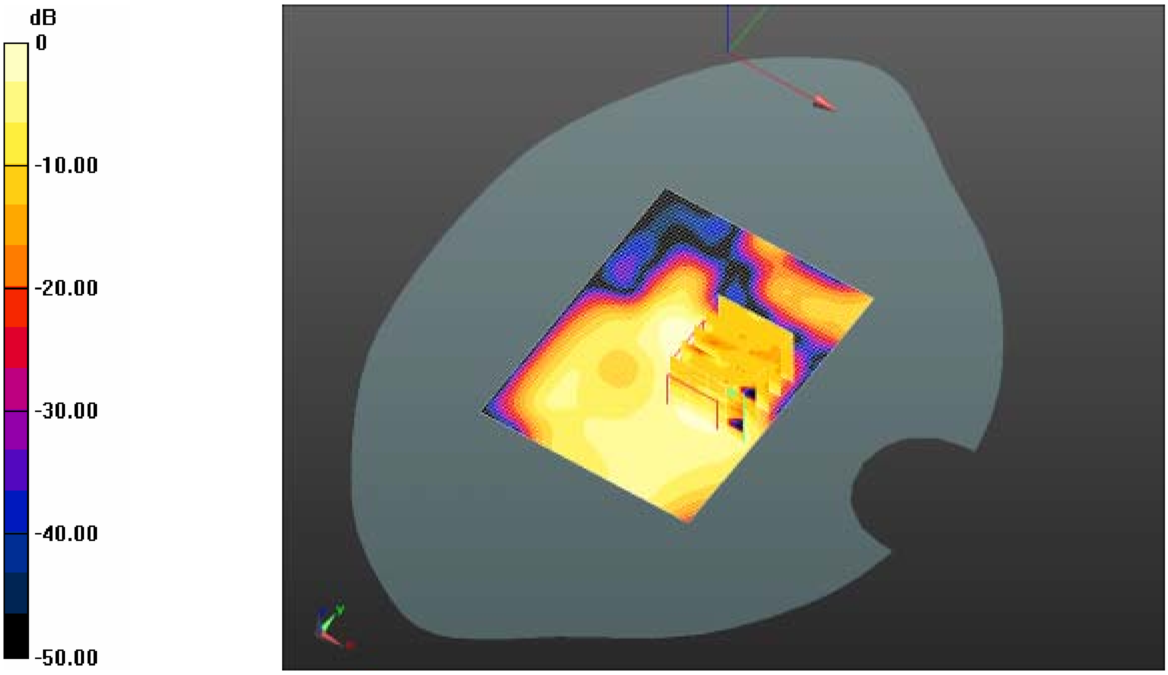
802.11b 2/Facedown-Mid/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 1.877 V/m; Power Drift = 0.13 dB
Fast SAR: SAR(1 g) = 0.010 mW/g; SAR(10 g) = 0.00519 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0132 W/kg

802.11b 2/Facedown-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.877 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.023 mW/g
SAR(1 g) = 0.00914 mW/g; SAR(10 g) = 0.00447 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.0101 W/kg



0 dB = 0.0132 W/kg = -37.61 dB W/kg

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

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

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

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

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

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

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CALIBRATION
No. L0570

Client **AUDEN** **Certificate No: Z14-97164**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3203
Calibration Procedure(s)	TMC-OS-E-02-195 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	December 19, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101547	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101548	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Reference10dBAttenuator	18N50W-10dB	13-Mar-14(TMC,No.JZ14-1103)	Mar-16
Reference20dBAttenuator	18N50W-20dB	13-Mar-14(TMC,No.JZ14-1104)	Mar-16
Reference Probe EX3DV4	SN 3617	28-Aug-14(SPEAG,No.EX3-3617_Aug14)	Aug-15
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-14 (CTTL, No.J14X02145)	Jun-15
Network Analyzer E5071C	MY46110673	15-Feb-14 (TMC, No.JZ14-781)	Feb-15

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

Issued: December 20, 2014

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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 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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect 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 (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;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to 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±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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Probe ES3DV3

SN: 3203

Calibrated: December 19, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3203

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	1.39	1.37	1.19	±10.8%
DCP(mV)[B]	103.9	100.8	104.3	

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	298.4	±2.3%
		Y	0.0	0.0	1.0		292.8	
		Z	0.0	0.0	1.0		272.7	

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

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

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DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3203

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
900	41.5	0.97	6.55	6.55	6.55	0.32	1.66	±12%
1810	40.0	1.40	5.20	5.20	5.20	0.67	1.27	±12%
2450	39.2	1.80	4.55	4.55	4.55	0.90	1.10	±12%

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

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DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3203

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
900	55.0	1.05	6.20	6.20	6.20	0.55	1.38	±12%
1810	53.3	1.52	4.88	4.88	4.88	0.46	1.60	±12%
2450	52.7	1.95	4.47	4.47	4.47	0.59	1.55	±12%

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

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

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

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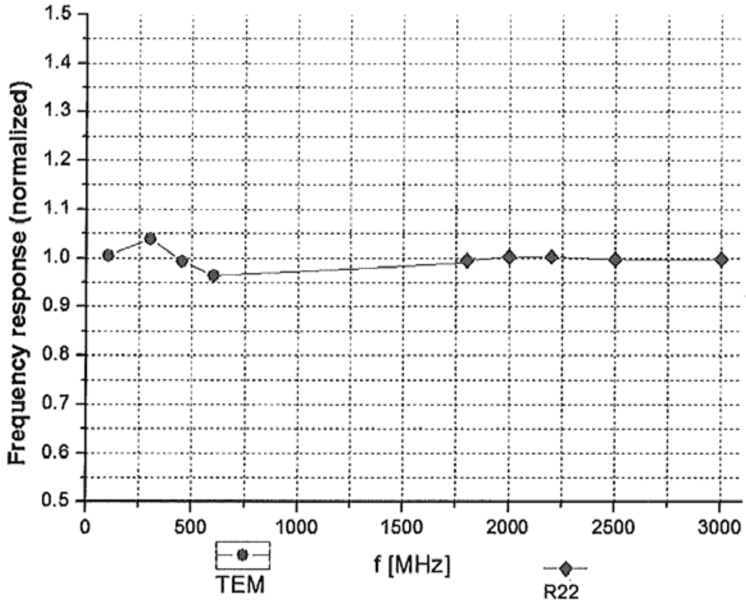
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

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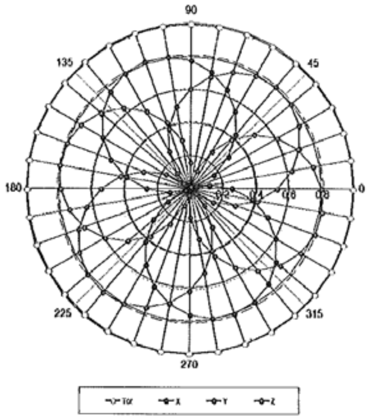
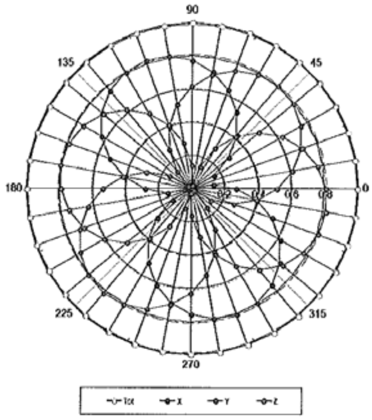
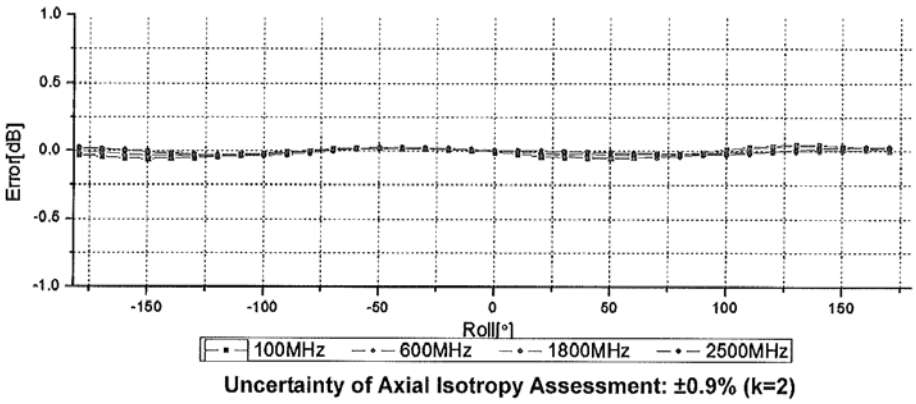
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





Uncertainty of Axial Isotropy Assessment: ±0.9% (k=2)

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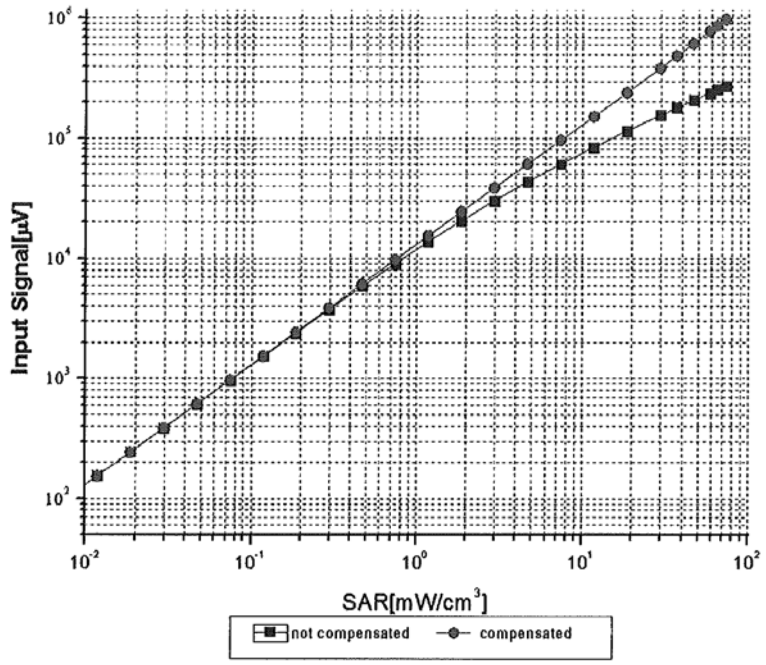
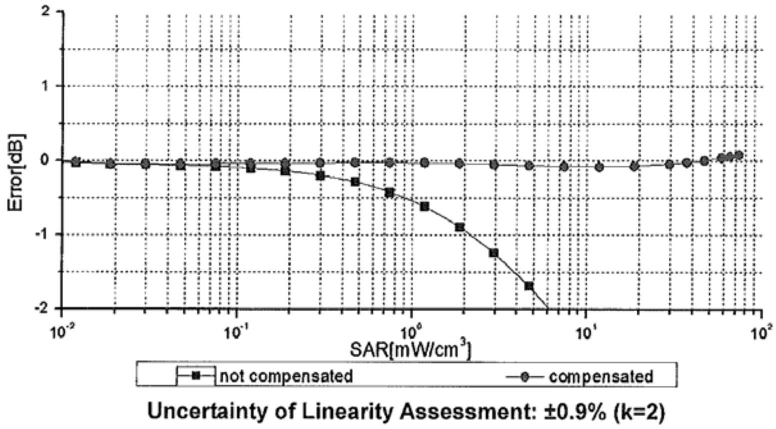
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





Uncertainty of Linearity Assessment: ±0.9% (k=2)

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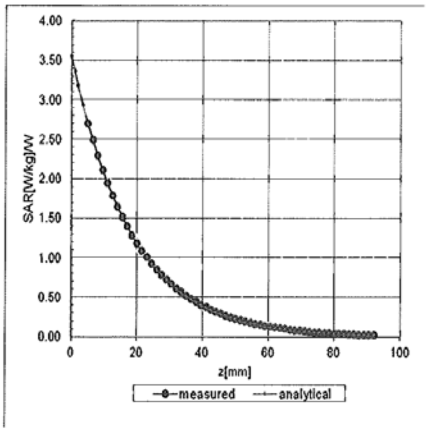
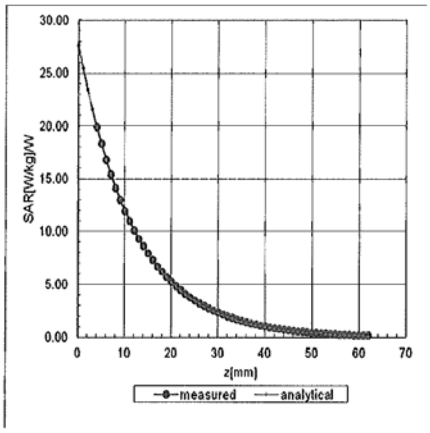
Conversion Factor Assessment

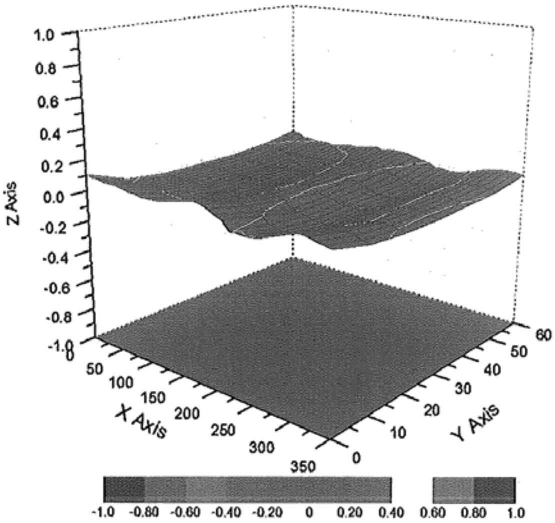
f=900 MHz, WGLS R9(H_convF)



f=1810 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

In Collaboration with
speag
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3203

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	175.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm

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

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 **SMQ (Auden)**

Certificate No: **D835V2-4d141_Sep12**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d141
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 24, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: September 24, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.35 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.12 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

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

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.25 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6 Ω - 2.7 jΩ
Return Loss	- 28.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω - 1.9 jΩ
Return Loss	- 34.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 27, 2012

DASY5 Validation Report for Head TSL

Date: 24.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

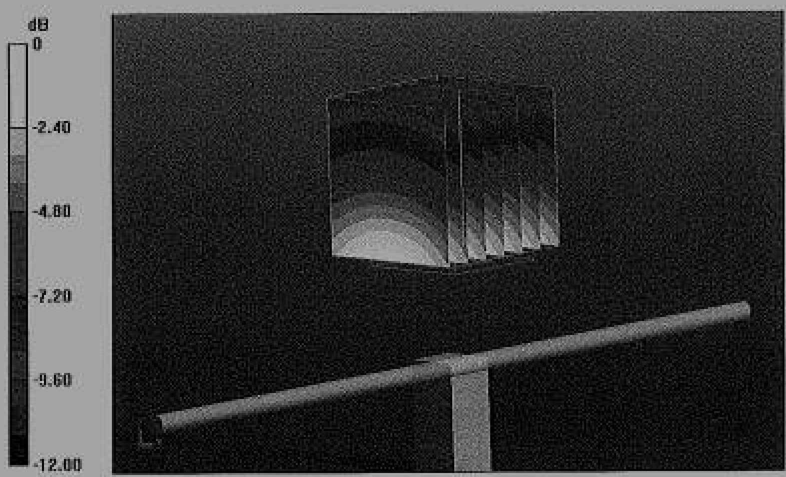
DUT: Dipole 835 MHz; Type: D835V2; Se[redacted]D835V2 - SN: 4d141

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.9$ mho/m; $\varepsilon_r = 41.3$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

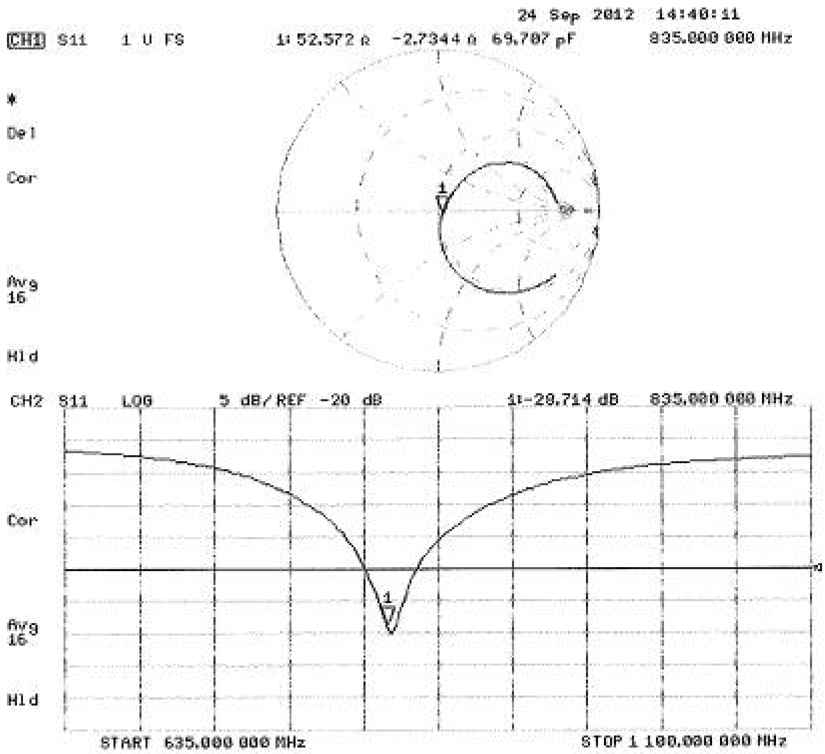
- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.647 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.447 mW/g
SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.53 mW/g
Maximum value of SAR (measured) = 2.71 W/kg



0 dB = 2.71 W/kg = 8.66 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141

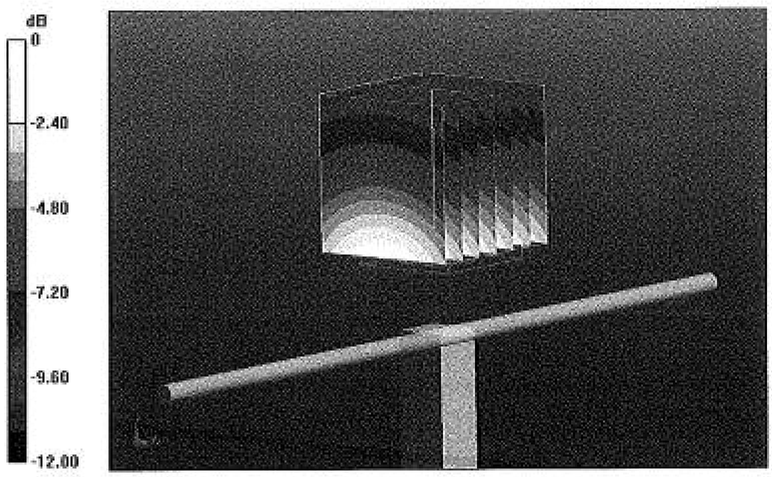
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

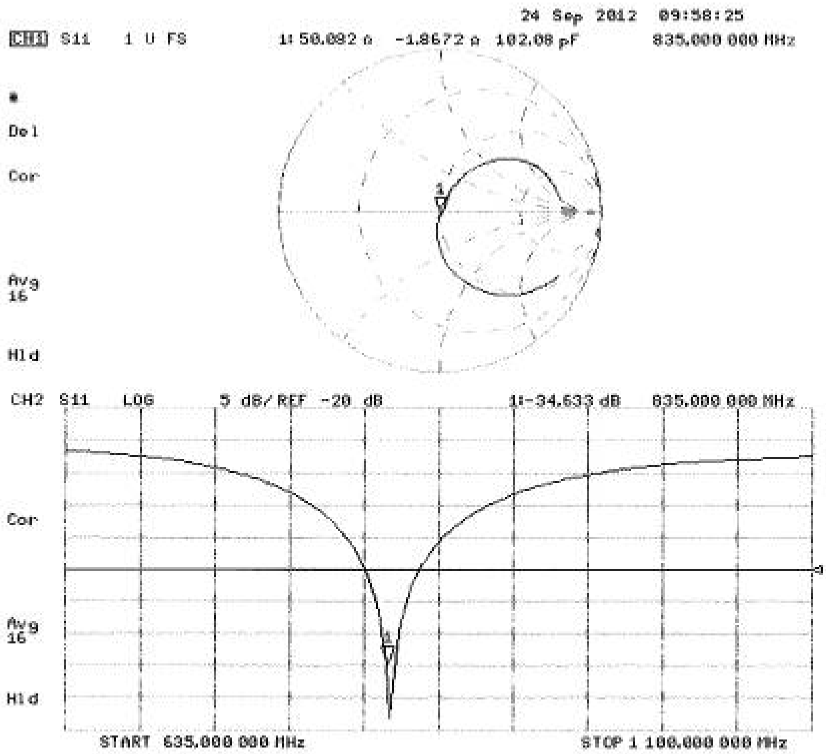
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.345 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.541 mW/g
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g
Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 9.10 dB W/kg

Impedance Measurement Plot for Body TSL



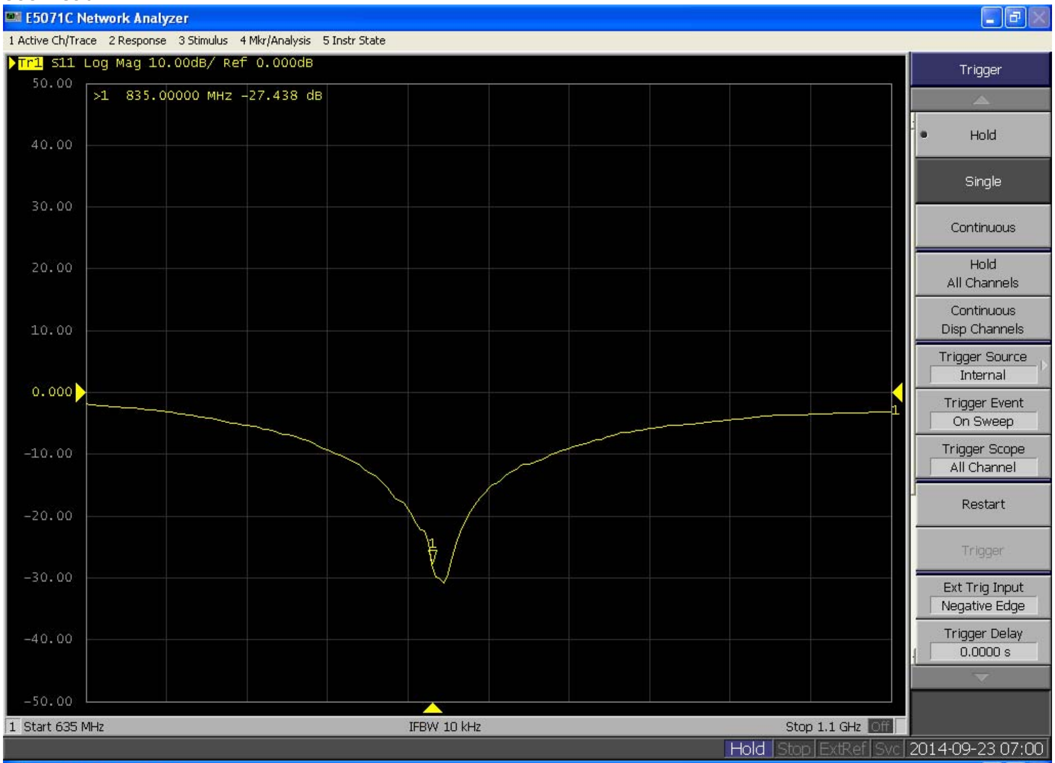
D835V2, serial No. 4d141 Extended Dipole Calibrations

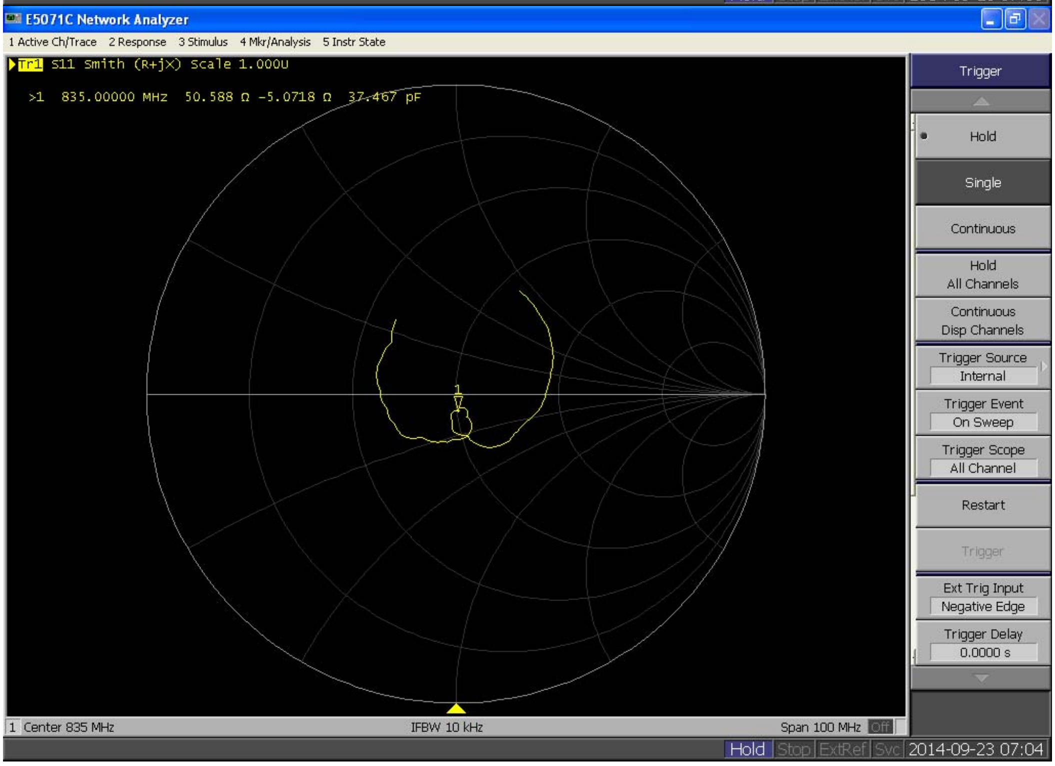
Referring to KDB 865664, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Justification of the extended calibration

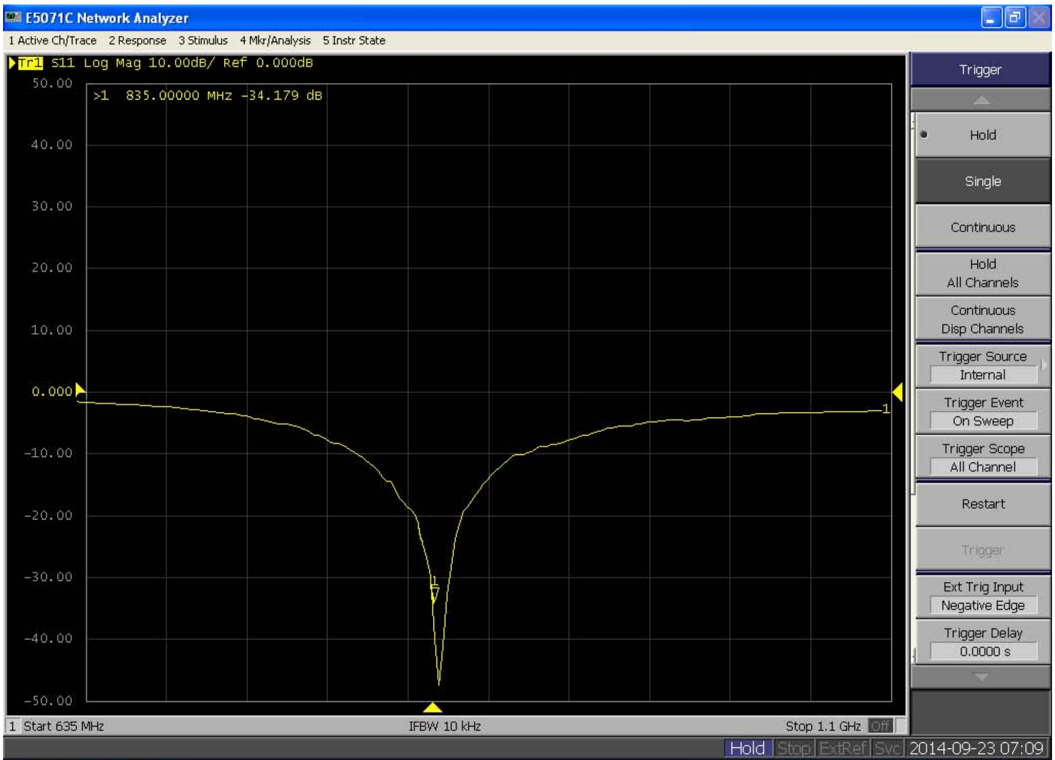
r	835 Head					
Date of Measurement	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2012-9-24	-28.714		52.572		-2.7344	
2014-9-23	-27.483	4.29%	50.588	-1.98	-5.0718	-2.34
	835 Body					
	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2012-9-24	-34.633		50.082		-1.8672	
2014-9-23	-34.179	1. 31%	50. 835	0.753	-5. 7180	-3.8508

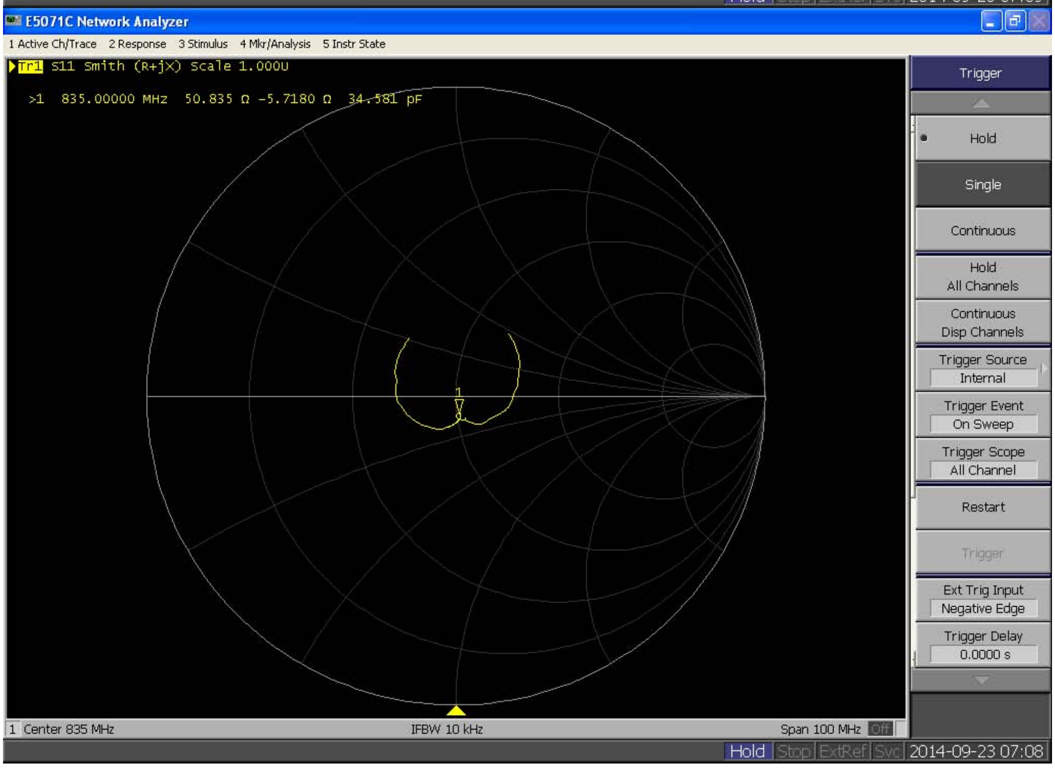
835 Head


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 835.00000 MHz -27.438 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 635 MHz
IFBW 10 kHz
Stop 1.1 GHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:00


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Smith (R+jX) Scale 1.000U
>1 835.00000 MHz 50.588 Ω -5.0718 Ω 37.467 pF
1 Center 835 MHz
IFBW 10 kHz
Span 100 MHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:04

835 Body


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 835.00000 MHz -34.179 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 635 MHz
IFBW 10 kHz
Stop 1.1 GHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:09


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Smith (R+jX) Scale 1.000U
>1 835.00000 MHz 50.835 Ω -5.7180 Ω 34.581 pF
1 Center 835 MHz
IFBW 10 kHz
Span 100 MHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:08

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

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

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

Accreditation No.: **SCS 108**

Client **SMQ (Auden)**

Certificate No: **D1900V2-5d162_Sep12**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d162
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 21, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: September 21, 2012

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

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.6 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.69 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.4 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.13 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.7 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	1.54 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**40.7 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.45 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.2 Ω + 4.0 jΩ
Return Loss	- 26.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω + 5.0 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 20, 2011

DASY5 Validation Report for Head TSL

Date: 21.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162

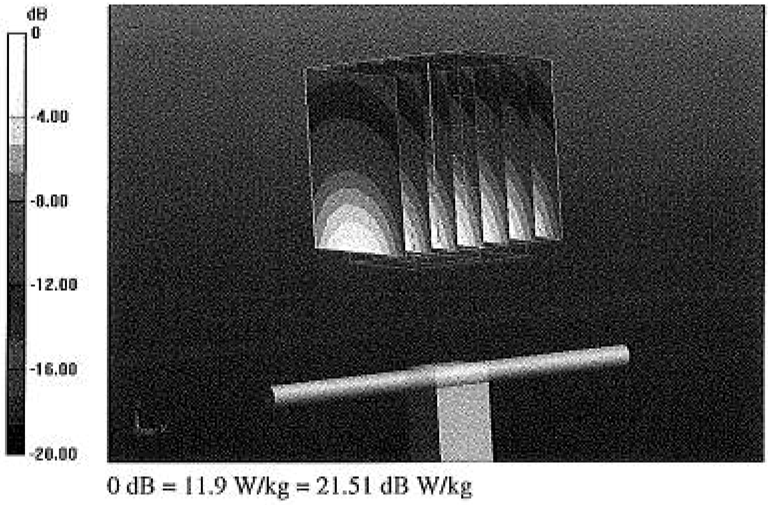
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.37 mho/m; ε_r = 40.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

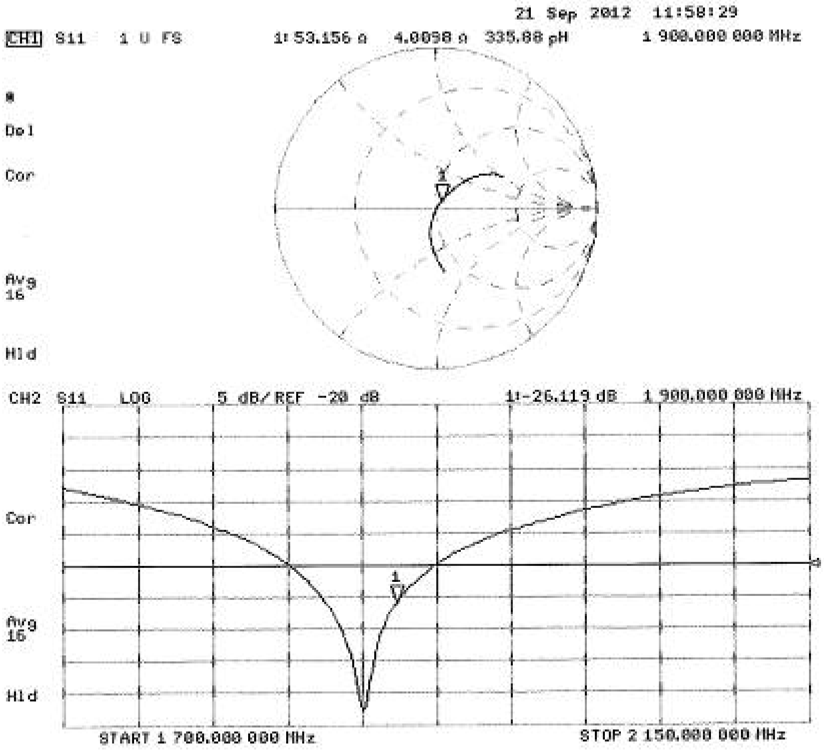
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.423 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 17.236 mW/g
SAR(1 g) = 9.69 mW/g; SAR(10 g) = 5.13 mW/g
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 21.51 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162

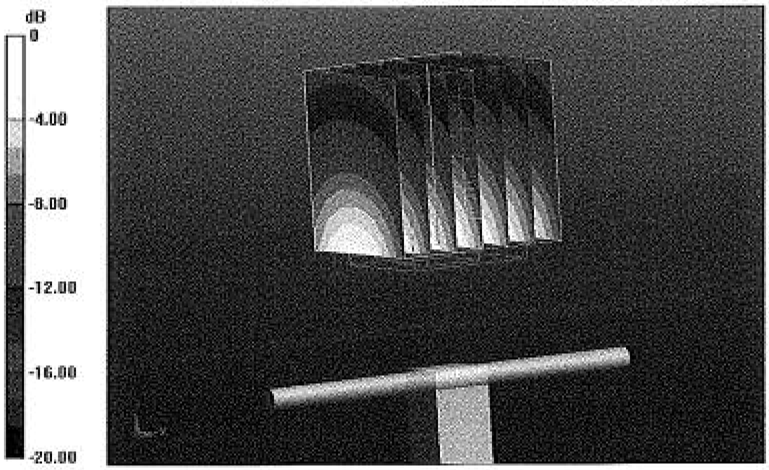
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.54 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

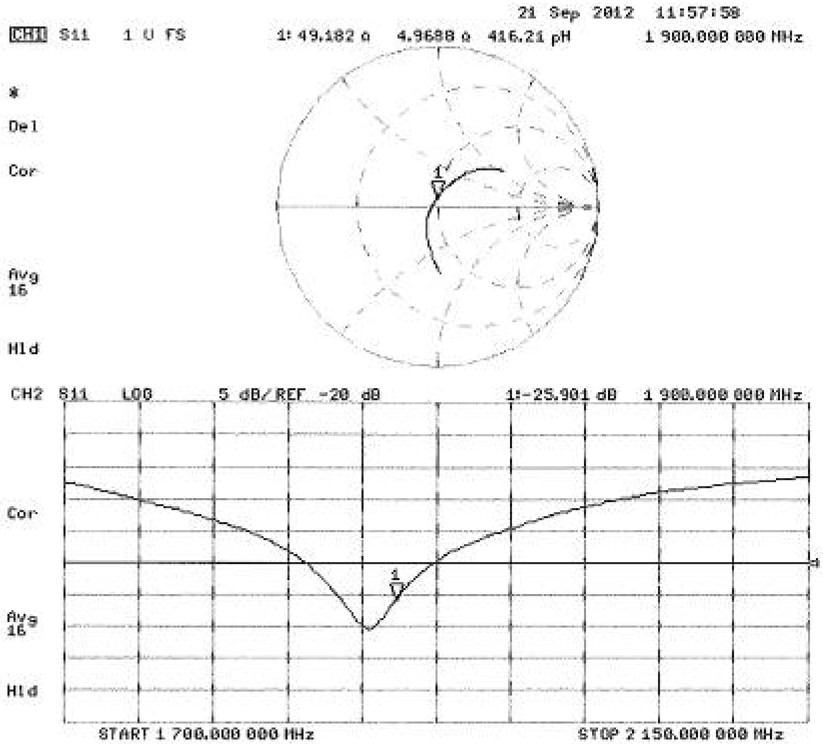
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.423 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.979 mW/g
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.45 mW/g
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 22.21 dB W/kg

Impedance Measurement Plot for Body TSL



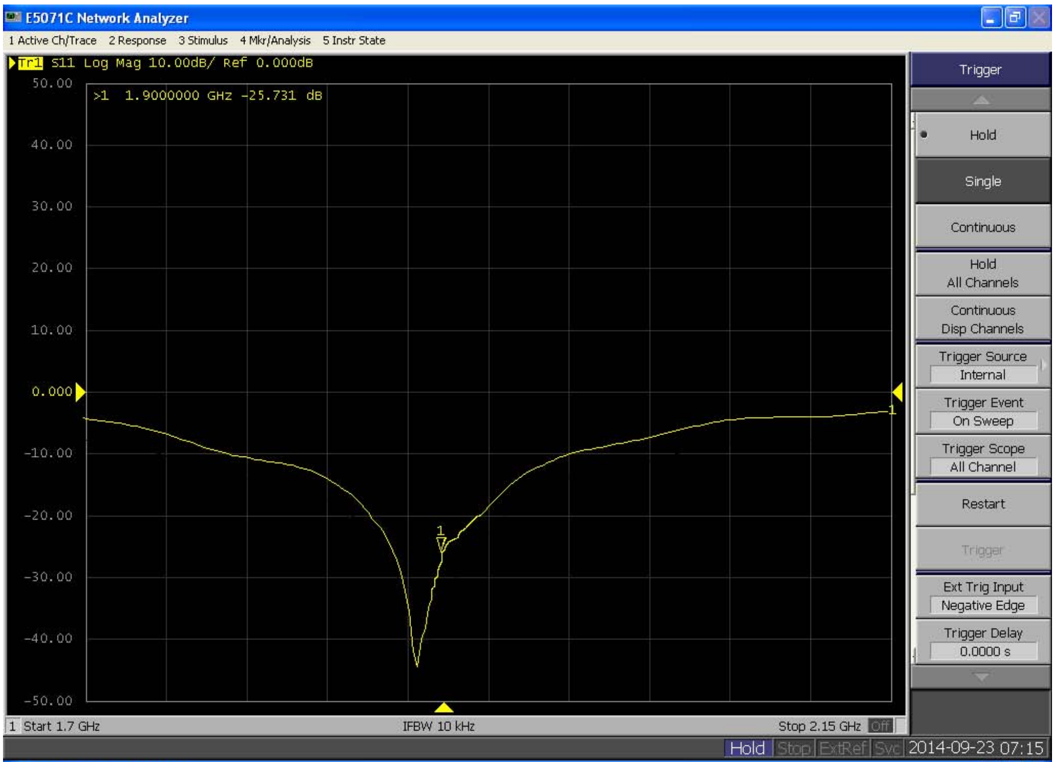
D1900V2, serial No. 5d162 Extended Dipole Calibrations

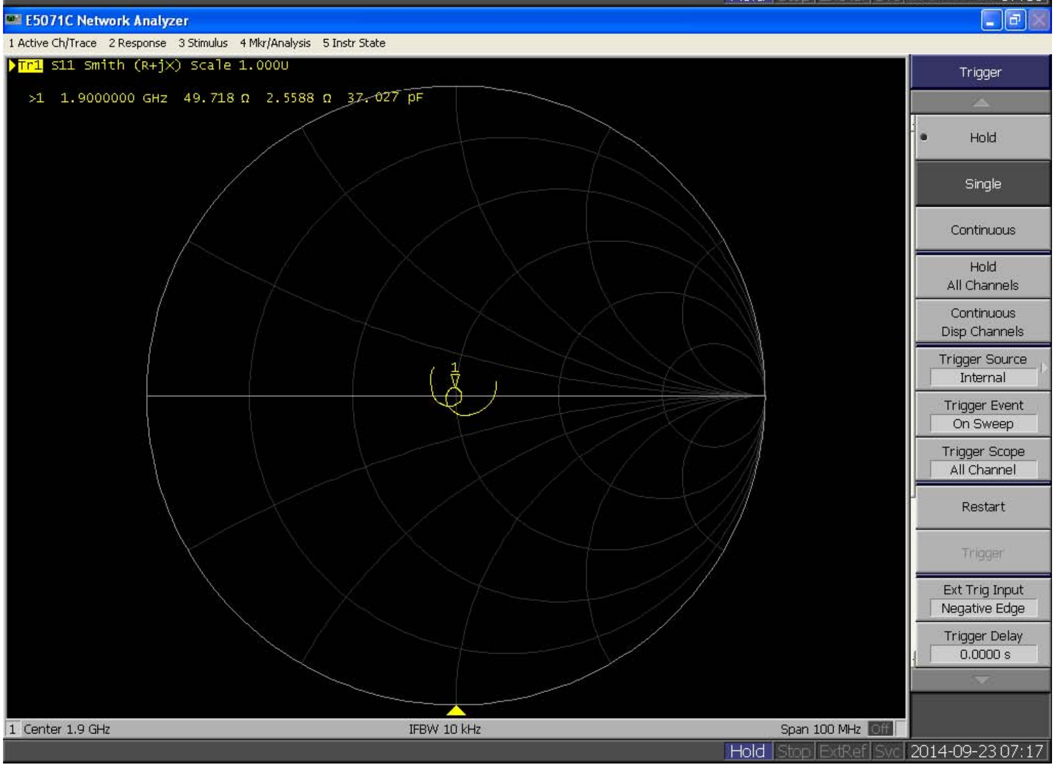
Referring to KDB 865664, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Justification of the extended calibration

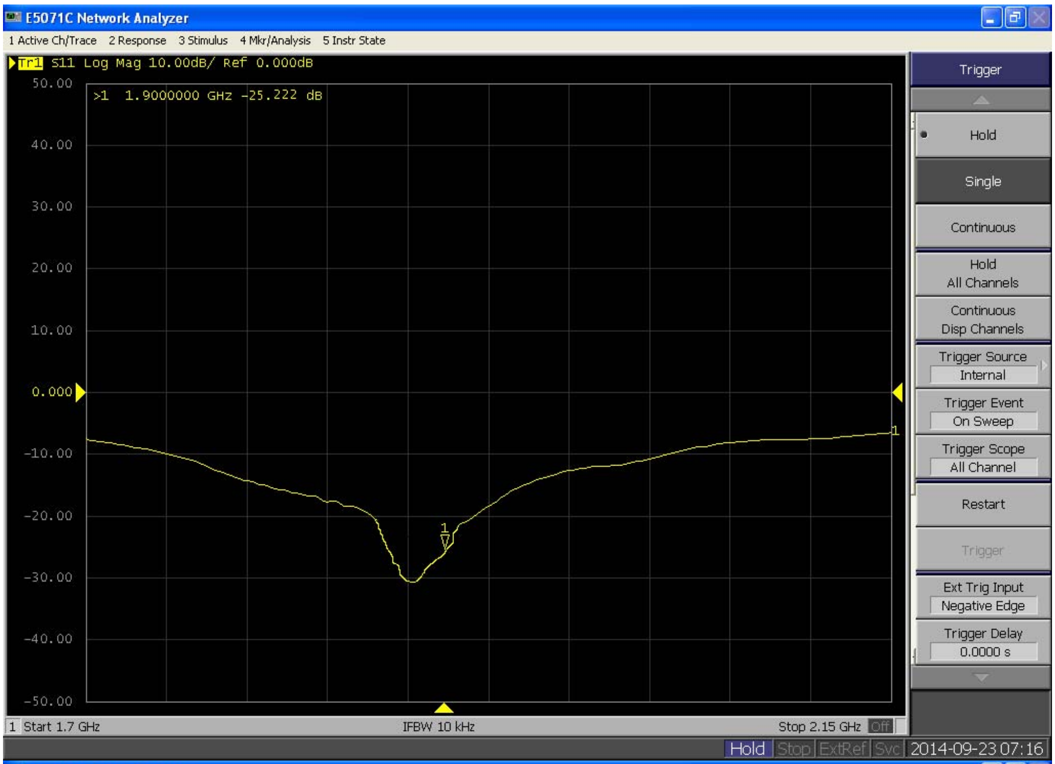
r	1900 Head					
Date of Measurement	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2012-9-21	-26.119		53.156		4.0098	
2014-9-23	-25.731	-1.49	49.718	-3.438	2.5588	-1.451
	1900 Body					
	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2012-9-21	-28.393		52.982		2.543	
2014-9-23	-25.222	-11.17	50.354	-2.628	4.9850	2.442

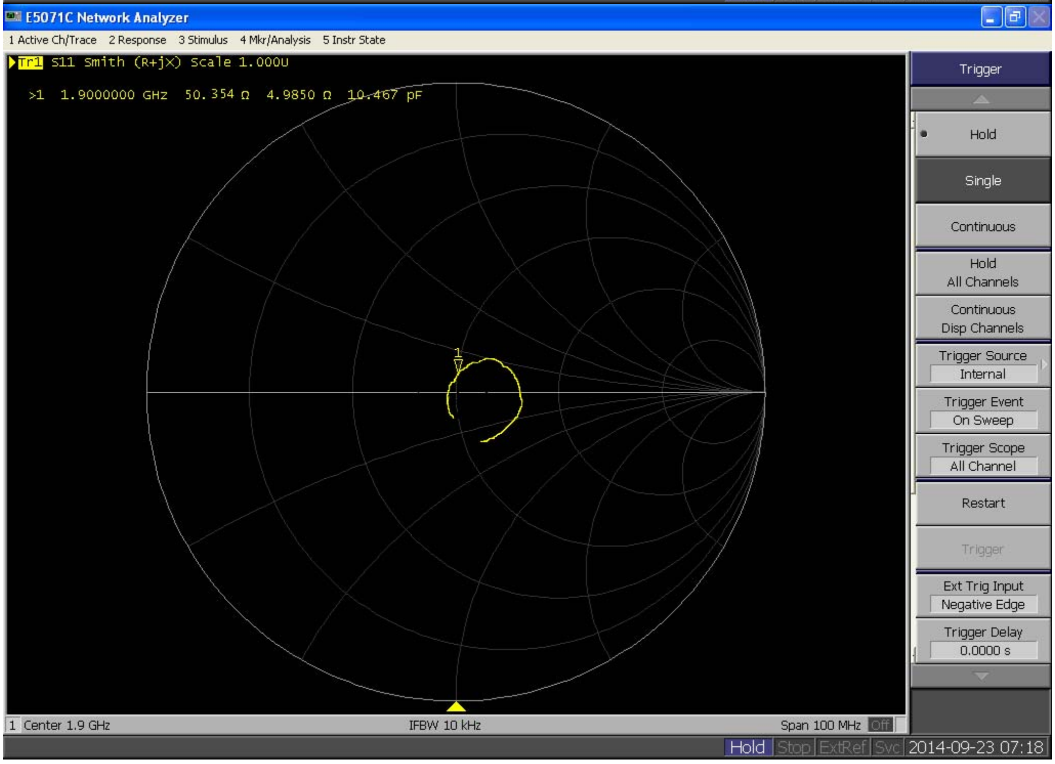
1900 Head


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 1.9000000 GHz -25.731 dB
1 Start 1.7 GHz
IFBW 10 kHz
Stop 2.15 GHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:15


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Smith (R+jX) Scale 1.000U
>1 1.9000000 GHz 49.718 Ω 2.5588 Ω 37.027 pF
1 Center 1.9 GHz
IFBW 10 kHz
Span 100 MHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:17

1900 Body


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 1.9000000 GHz -25.222 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 1.7 GHz
IFBW 10 kHz
Stop 2.15 GHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:16


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Smith (R+jX) Scale 1.000U
>1 1.9000000 GHz 50.354 Ω 4.9850 Ω 10.467 pF
1 Center 1.9 GHz
IFBW 10 kHz
Span 100 MHz
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
Hold Stop ExtRef Svc 2014-09-23 07:18

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

S Schweizerischer Kalibrierdienst
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Servizio svizzero di taratura
S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **SMQ (Auden)**

Certificate No: **D2450V2-818_Oct12**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 818

Calibration procedure(s): QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: October 18, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: October 18, 2012

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.8 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω + 2.5 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω + 4.4 jΩ
Return Loss	- 27.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.165 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 11, 2008

DASY5 Validation Report for Head TSL

Date: 18.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

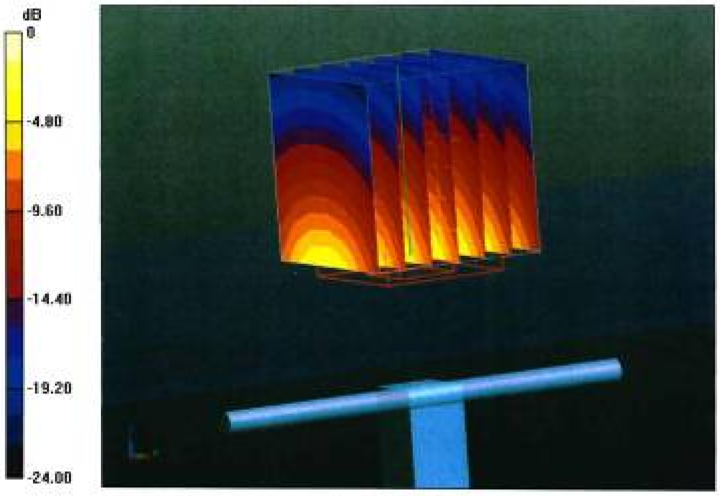
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

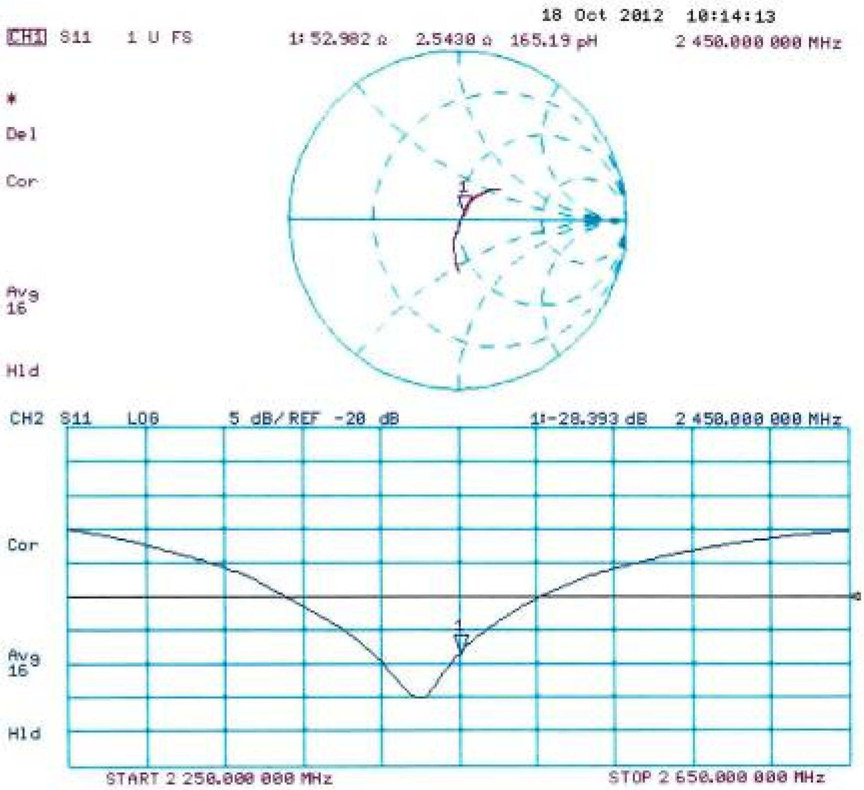
- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.551 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.19 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

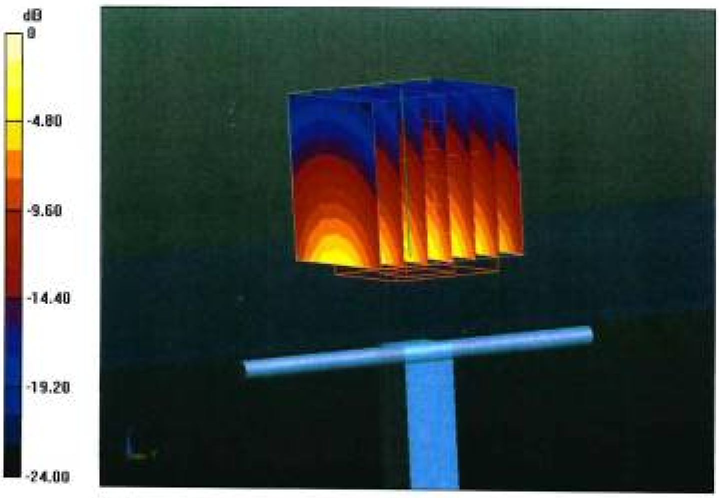
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

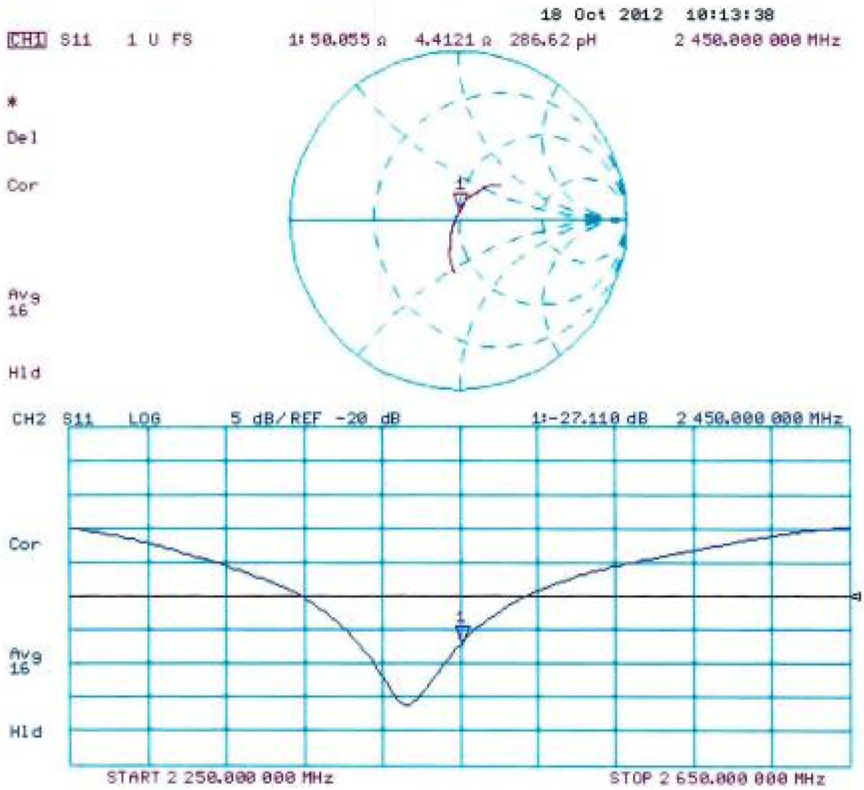
- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.079 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.03 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Body TSL



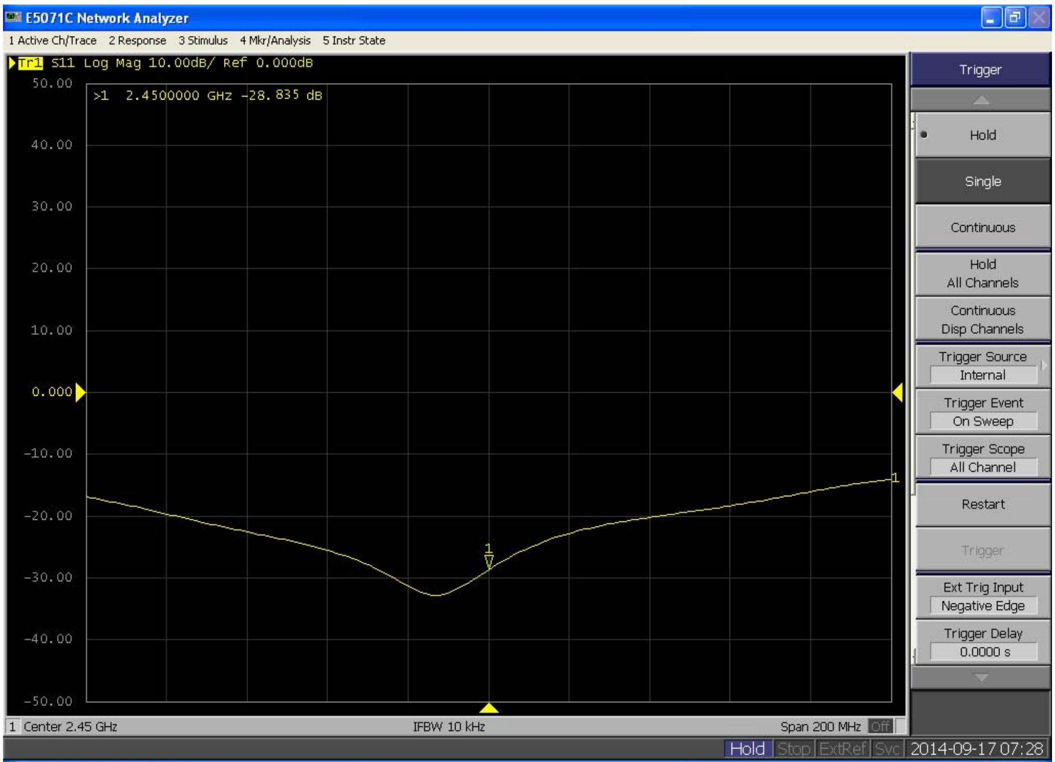
D2450V2, serial No. 818 Extended Dipole Calibrations

Referring to KDB 865664, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

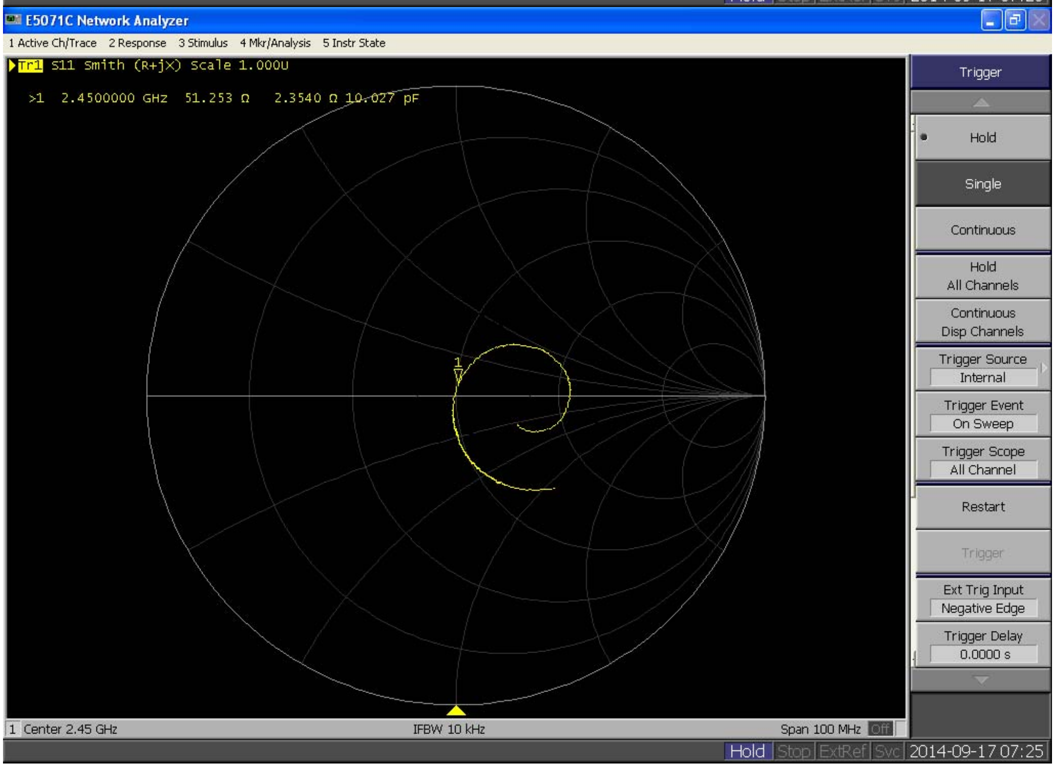
Justification of the extended calibration

r	2450 Head					
Date of Measurement	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2012-10-18	-28.393		52.982		2.543	
2014-9-17	-28.835	-0.68	51.253	-1.67	2.3540	-0.41
	2450 Body					
	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2012-10-18	-27.110		50.055		4.4121	
2014-09-17	-26. 459	2.40	51.714	1.66	5. 4346	1.02

2450 Head

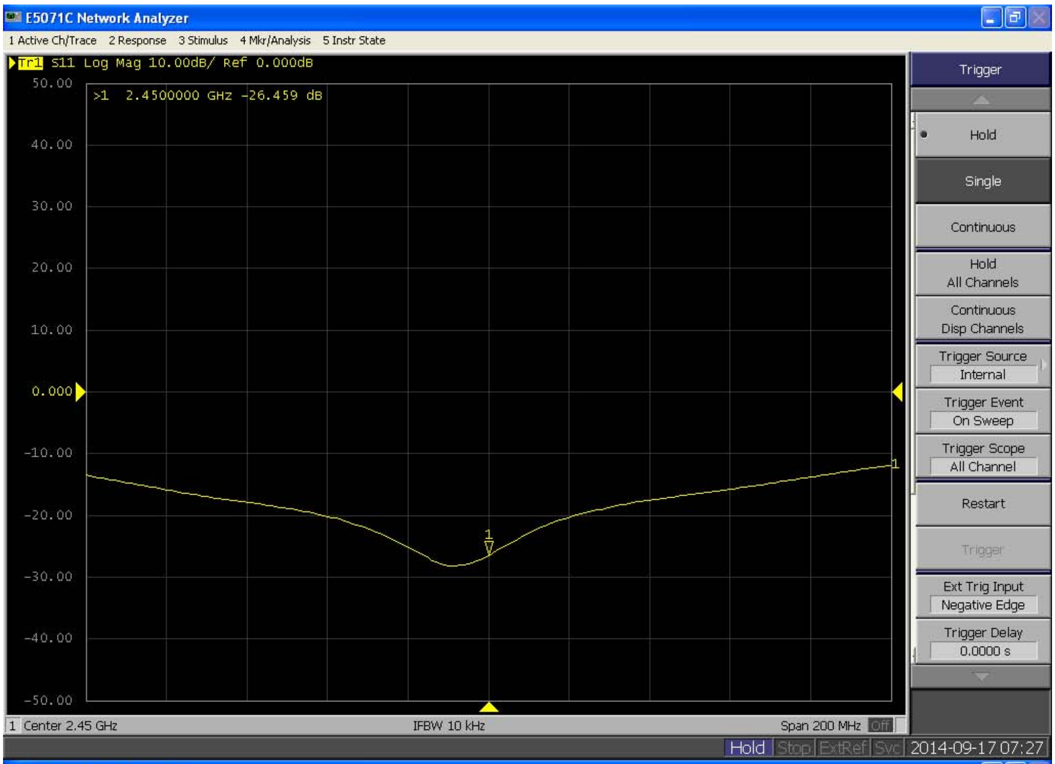


E5071C Network Analyzer
1 Active Ch/Trace
2 Response
3 Stimulus
4 Mkr/Analysis
5 Instr State
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 2.4500000 GHz -28.835 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
1 Center 2.45 GHz
IFBW 10 kHz
Span 200 MHz
Off
Hold
Stop
ExtRef
Svc
2014-09-17 07:28



E5071C Network Analyzer
1 Active Ch/Trace
2 Response
3 Stimulus
4 Mkr/Analysis
5 Instr State
Tr1 S11 Smith (R+jX) Scale 1.000U
>1 2.4500000 GHz 51.253 Ω 2.3540 Ω 10.027 pF
Trigger
Hold
Single
Continuous
Hold All Channels
Continuous Disp Channels
Trigger Source Internal
Trigger Event On Sweep
Trigger Scope All Channel
Restart
Trigger
Ext Trig Input Negative Edge
Trigger Delay 0.0000 s
1 Center 2.45 GHz
IFBW 10 kHz
Span 100 MHz
Off
Hold
Stop
ExtRef
Svc
2014-09-17 07:25

2450 Body


E5071C Network Analyzer
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Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
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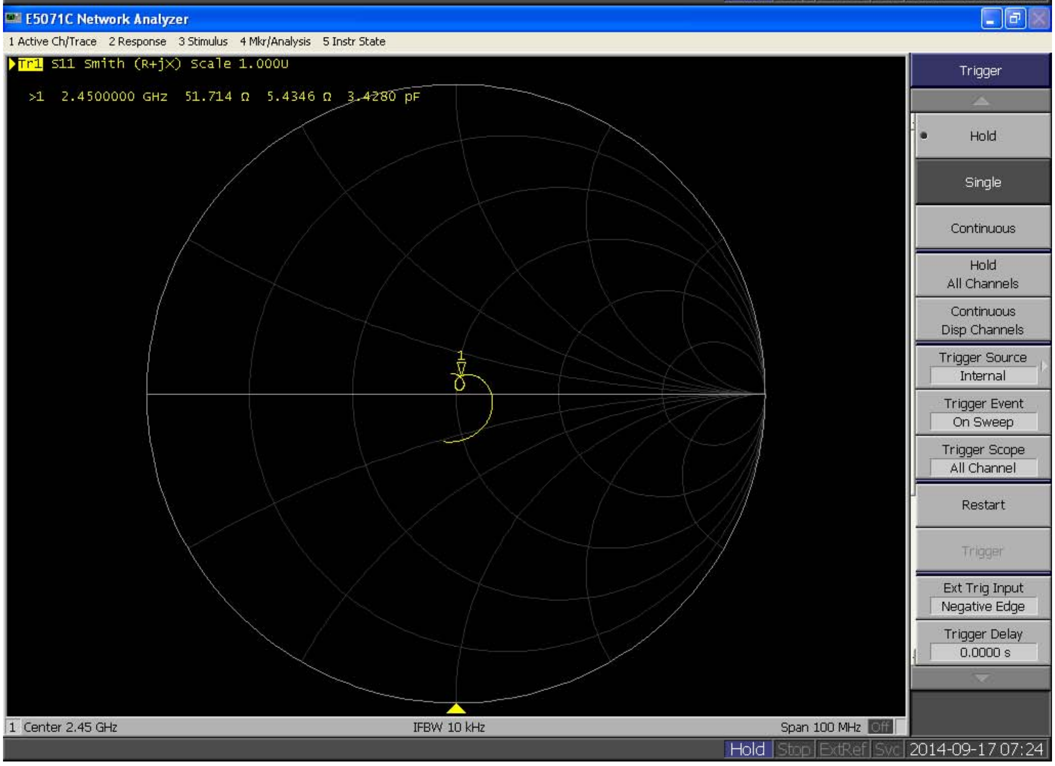
1 Center 2.45 GHz
IFBW 10 kHz
Span 200 MHz
Hold
2014-09-17 07:27


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S11 Smith (R+jX) Scale 1.000U
>1 2.4500000 GHz 51.714 Ω 5.4346 Ω 3.4280 pF
1 Center 2.45 GHz
IFBW 10 kHz
Span 100 MHz
Hold
2014-09-17 07:24