ANSI/IEEE Std. C95.1-1992
In accordance with the requirements of FCC Report and Order: ET Docket 93-62；FCC 47 CFR Part 2 (2.1093)

FCC SAR TEST REPORT

For

Product Name: smartphone
Brand Name: N/A
Model No.: RLTP4028-BLACK
Series Model: V41
Test Report Number: C150706S01-SF

Issued for

Shenzhen Vastking Electronic Co.,LTD.
2/F, Building 6, ZhengZhong Industrial Park, Qiaotou Community, Fuyong, Baoan, Shenzhen, China

Issued by

Compliance Certification Services Inc.
Kun Shan Laboratory
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Revision History

Revision	REPORT NO.	Date	Page Revised	Contents
Original	C150706S01-SF	July 22, 2015	N/A	N/A
01	C150706S01-SF	July 30, 2015	32	Update The Tune-up Maximum Power form
	C150706S01-SF	July 30, 2015	4	Add EUT related description
02	C150706S01-SF	August 4, 2015	6	Add Remark comments
03	C150706S01-SF	August 6, 2015	27,28	Update WCDMA Band II output power form and Change involves the relevant information
			22	Update section 12.2 liquid measurement results Form
04	C150706S01-SF	August 7, 2015	38,44	Update test plots page 13,14 test data and SAR report relevant information.
05	C150706S01-SF	August 12, 2015	33	Update section 12.2 SAR test configuration information.
06	C150706S01-SF	August 13, 2015	All report	Add body support 5 mm test from the test data and related information

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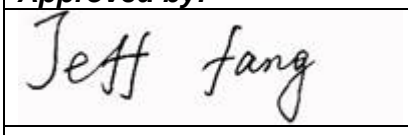
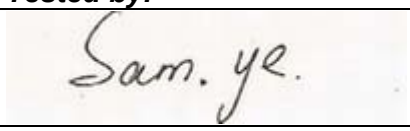
1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Product Name:	smartphone
Brand Name:	N/A
Model Name.:	RLTP4028-BLACK
Series Model:	V41
Devices supporting GPRS/EDGE:	Class B
Description Test Modes(worst case):	The product has two SIM, SIM 1 and SIM 2 sharing a chipset does not support simultaneous work, only supports a single transmitter SIM1 or SIM 2, using SIM 1, SIM 2 will be suspended until select SIM 2, stop using the SIM 1, SIM 2 only would working. SIM 1 is worse configuration.
Device Category:	Protable DEVICES
Exposure Category:	GENERAL POPULATION/UNCONTROLLED EXPOSURE
Date of Test:	July 10, 2015 to July 20, 2015 & August 12, 2015 to August 13, 2015
Applicant: Address:	**Shenzhen Vastking Electronic Co.,LTD.** 2/F, Building 6, ZhengZhong Industrial Park, Qiaotou Community, Fuyong, Baoan, Shenzhen, China
Manufacturer: Address:	**Shenzhen Vastking Electronic Co.,LTD.** 2/F, Building 6, ZhengZhong Industrial Park, Qiaotou Community, Fuyong, Baoan, Shenzhen, China
Application Type:	Certification

APPLICABLE STANDARDS AND TEST PROCEDURES	
STANDARDS AND TEST PROCEDURES	**TEST RESULT**
ANSI/IEEE C95.1-1992	No non-compliance noted
Deviation from Applicable Standard	
None	

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in KDB 865664 The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:	***Tested by:***
	
Jeff.fang RF Manager Compliance Certification Services Inc.	Sam.ye Test Engineer Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product Name:	smartphone	
Brand Name:	N/A	
Model Name.:	RLTP4028-BLACK	
Series Model:	V41	
Model Discrepancy:	All the model are the same circuit and RF module,except the model name and colour.	
FCC ID:	2AFA3RLTP4028	
Software version	MB0MBA4C1-1(WUZHU)	
Hardware version	HQD_D133_271_0000_4.4.2_1.1_0721_T05	
IMEI:	359454784981884	
Power reduction:	NO	
DTM Description:	N/A	
Device Category:	Production unit	
Frequency Range:	GSM 850: 824.2 ~ 848.8 MHz GSM1900: 1850.2 ~ 1909.8 MHz WCDMA Band II:1852.4~1907.6MHz WCDMA Band IV:1712.4~1752.6MHz WCDMA Band V:826.4~846.6 MHz WLAN 2.4G: 2412 ~ 2462 MHz Bluetooth: 2402 ~ 2480 MHz	
Max. Reported SAR(1g):	Head: GSM 850: 0.046 W/kg GSM 1900: 0.297 W/kg WCDMA Band II: 0.622 W/kg WCDMA Band IV: 0.361 W/kg WCDMA Band V: 0.049 W/kg	Body: GSM 850: 0.354 W/kg GSM1900: 1.049 W/kg WCDMA Band II: 1.251 W/kg WCDMA Band IV: 1.223 W/kg WCDMA Band V: 0.198 W/kg
Modulation Technique:	GSM/GPRS: GMSK EDGE:8PSK RMC/AMR: QPSK WCDMA: QPSK,16QAM Release version: WCDMA:R99 HSDPA:Rel.7 HSUPA:Rel.6 IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: DSSS (CCK, DQPSK,DBPSK)+OFDM (QPSK, BPSK, 16-QAM, 64-QAM) IEEE 802.11n: OFDM(MCS 0-7) Bluetooth 3.0+EDR: GFSK + π/4DQPSK+8DPSK BLE 4.0: GFSK	
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi enabled devices. Mobile Hotspot (Wi-Fi 2.4 GHz)	
Accessories:	Battery(rating): Capacitance: 1500 mAh Rated Voltage: 3.7 V	

Antenna Specification:	GSM&WCDMA: PIFA Antenna Wifi&Bluetooth: PIFA Antenna
Operating Mode:	Maximum continuous output
Remark： The product details information please refer to the product specification	

3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/Kg for an uncontrolled environment and 8.0 W/Kg for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992.

4. TEST METHODOLOGY

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

☒ FCC 47 CFR Part 2 (2.1093)
☒ ANSI/IEEE C95.1-1992
☒ KDB 248227 D01v02r01 SAR Measurement Procedures for 802.11 a/b/g Transmitters
☒ KDB 447498 D01v05r02 General RF Exposure Guidance v05
☒ KDB 648474 D04v01r02 Handset SAR
☒ KDB 865664 D01v01r03 SAR Measurement 100 MHz to 6 GHz
☒ KDB 865664 D02v01r01 RF Exposure Reporting
☒ KDB 941225 D01v03 3G SAR Procedures
☒ KDB 941225 D06v02 Hot Spot SAR

5. TEST CONFIGURATION

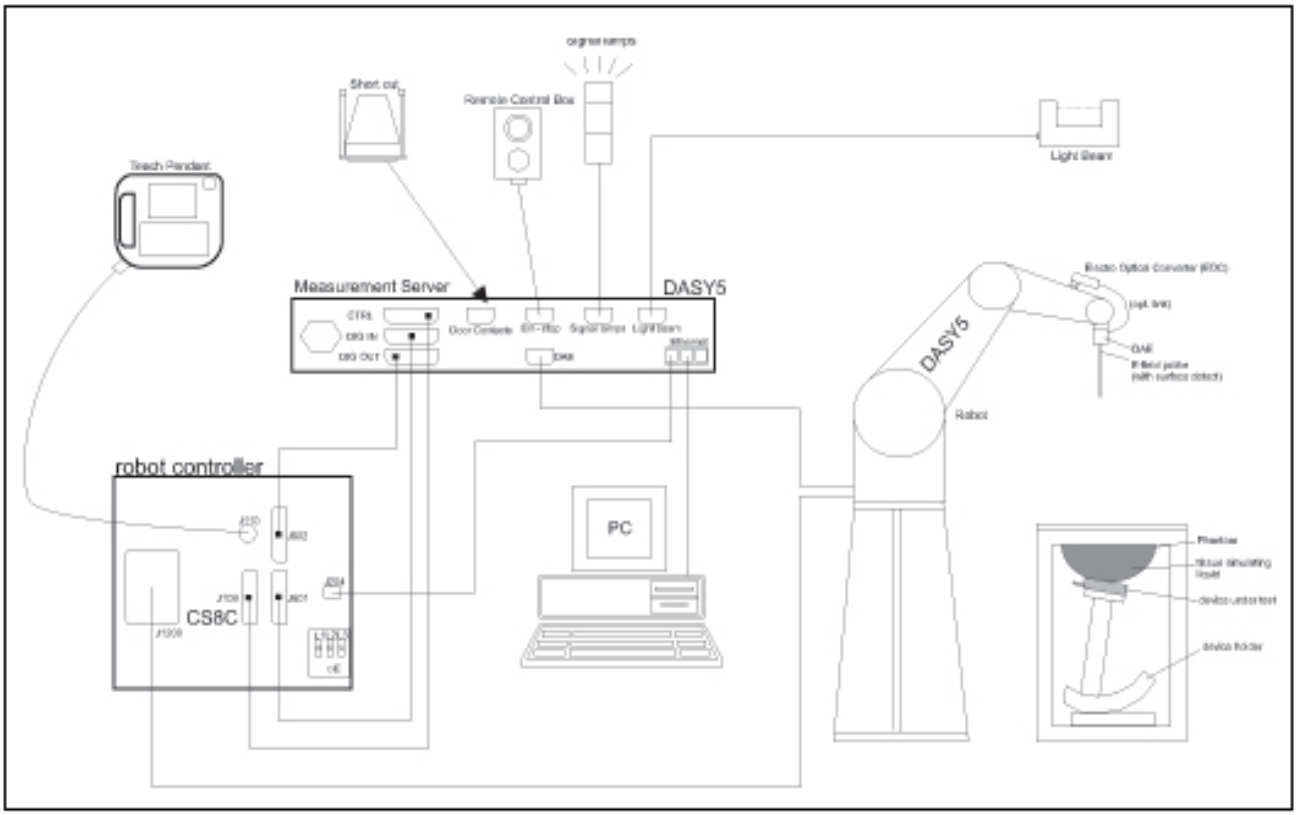
For WWAN SAR testing The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting For WLAN SAR testing, WLAN engineering test software installed on the EUT can provide continuous transmitting RF signal and duty cycle is 100%.

6. DOSIMETRIC ASSESSMENT SETUP

These measurements were performed with the automated near-field scanning system DASY 5 from ATTENNESSA. The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the E-field PROBE EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEE P1528 and CENELEC EN 62209.

6.1 MEASUREMENT SYSTEM DIAGRAM



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

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

6.2 SYSTEM COMPONENTS

	The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV celeron, 128MB chip-disk and 128 MB RAM. The necessary circuits for communication with either the DAE4(or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
	The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.
Data Acquisition Electronics (DAE)	

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz.
Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in HSL (rotation normal to probe axis)

Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 µW/g)

Dimensions: Overall length: 337 mm (Tip: 9 mm)
Tip diameter: 2.5 mm (Body: 10 mm)
Distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

Interior of probe

SAM Twin Phantom

Construction:

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50360 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

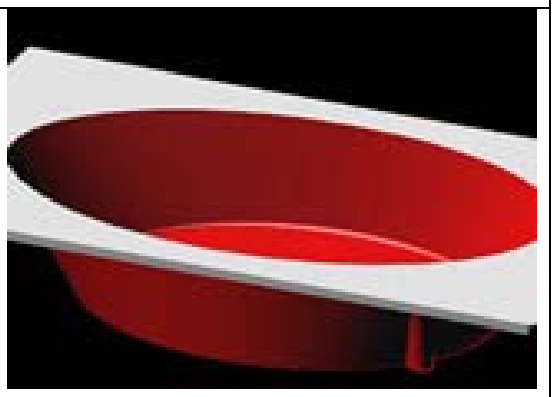
Filling Volume: Approx. 25 liters

Dimensions: Height: 850mm; Length: 1000mm; Width: 750mm

SAM Phantom (ELI4 v4.0)

Description Construction:

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles



Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

Filling Volume: Approx. 25 liters

Dimensions: Major ellipse axis: 600 mm

Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

System Validation Kits for SAM Twin Phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor. **Frequency:** 900,1800,2450,5800 MHz **ReTune loss:** > 20 dB at specified validation position **Power capability:** > 100 W (f < 1GHz); > 40 W (f > 1GHz) **Dimensions:** D835V2: dipole length: 161 mm; overall height: 340 mm D1800V2: dipole length: 72.5 mm; overall height: 300 mm D1900V2: dipole length: 67.7 mm; overall height: 300 mm D2450V2: dipole length: 51.5 mm; overall height: 290 mm D5GHzV2: dipole length: 20.6 mm; overall height: 300mm	
System Validation Kits for ELI4 phantom	
Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor. **Frequency:** 900, 1800, 2450, 5800 MHz **ReTune loss:** > 20 dB at specified validation position **Power capability:** > 100 W (f < 1GHz); > 40 W (f > 1GHz) **Dimensions:** D835V2: dipole length: 161 mm; overall height: 340 mm D1800V2: dipole length: 72.5 mm; overall height: 300 mm D1900V2: dipole length: 67.7 mm; overall height: 300 mm D2450V2: dipole length: 51.5 mm; overall height: 290 mm D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm	

7. EVALUATION PROCEDURES

DATA EVALUATION

The DASY 5 post processing software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY 5 components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

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

with V_i = Compensated signal of channel i (i = x, y, z)
U_i = Input signal of channel i (i = x, y, z)
cf = Crest factor of exciting field (DASY 5 parameter)
dcp_i = Diode compression point (DASY 5 parameter)

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

E-field probes: $$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes: $$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
$\mu V/(V/m)^2$ for E0field Probes
$ConvF$ = Sensitivity enhancement in solution
aij = Sensor sensitivity factors for H-field probes
f = Carrier frequency (GHz)
Ei = Electric field strength of channel i in V/m
Hi = Magnetic field strength of channel i in A/m

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

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm^3

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

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm^2

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m

SAR EVALUATION PROCEDURES

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

- **Power Reference Measurement**

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

- **Area Scan**

  The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY 5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

- **Zoom Scan**

  Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

  The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY 5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

  The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

SPATIAL PEAK SAR EVALUATION

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY 5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Boundary effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b exp(-\frac{z}{a}) cos(\pi \frac{z}{\lambda})$$

Since the decay of the boundary effect dominates for small probes ($a << \lambda$), the cos-term can be omitted. Factors *Sb* (parameter Alpha in the DASY 5 software) and *a* (parameter Delta in the DASY 5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30_ to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY 5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

8. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 30 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (1g)}$	Std. Unc. (1-g)	$v_{i\ or\ Veff}$
Measurement System						
Probe Calibration (*k*=1)	6.00	Normal	1	1	6.00	∞
Probe Isotropy	4.70	Rectangular	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.88	∞
Boundary Effect	2.00	Rectangular	√3	1	1.15	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.73	∞
Probe Positioner	0.40	Rectangular	√3	1	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1.67	∞
Max. SAR Evaluation	2.00	Rectangular	√3	1	1.15	∞
Test sample Related						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Power drift	5	Rectangular	√3	1	2.89	∞
Power Scaling	0	Rectangular	√3	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	6.1	Rectangular	√3	1	3.52	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	√3	0.64	1.85	∞
Liquid Conductivity (meas)	4.08	Rectangular	√3	0.78	1.84	∞
Liquid Permittivity (target)	5	Rectangular	√3	0.6	1.73	∞
Liquid Permittivity (meas)	-4.17	Rectangular	√3	0.26	-0.63	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	1.53	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.05	∞
Combined Std. Uncertainty		RSS			11.58	361
Expanded STD Uncertainty		*k*=2			23.17%	
Expanded STD Uncertainty		*k*=2			1.81dB	

Measurement uncertainty for 30 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (1g)}$	Std. Unc. (1-g)	$v_{i\ or\ Veff}$
Measurement System						
Probe Calibration (*k*=1)	6.00	Normal	1	1	6.0	∞
Axial Isotropy	4.70	Rectangular	√3	0.7	1.9	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.9	∞
Boundary Effect	1.00	Rectangular	√3	1	0.6	∞
Linearity	4.70	Rectangular	√3	1	2.7	∞
System Detection Limit	1.00	Rectangular	√3	1	0.6	∞
Readout Electronics	0.30	Normal	1	1	0.3	∞
Response Time	0.80	Rectangular	√3	0	0.0	∞
Integration Time	2.60	Rectangular	√3	0	0.0	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.7	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.7	∞
Probe Positioner	0.40	Rectangular	√3	1	0.2	∞
Probe Positioning	2.90	Rectangular	√3	1	1.7	∞
Max. SAR Evaluation	1.00	Rectangular	√3	1	0.6	∞
System validation source (dipole)						
Deviation of experimental dipole from numerical dipole	5	Normal	1	1	5.0	∞
Dipole axis to liquid distance	2	Rectangular	√3	1	1.2	∞
Input power and SAR drift	4.7	Rectangular	√3	1	2.7	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	4	Rectangular	√3	1	2.3	∞
SAR correction	1.9	Rectangular	1	0.84	1.6	∞
Liquid Conductivity (meas)	4.08	Rectangular	1	0.78	3.18	∞
Liquid Permittivity (meas)	-4.17	Rectangular	1	0.23	-0.96	∞
Temp. unc. - Conductivity	1.7	Rectangular	√3	0.78	0.77	∞
Temp. unc. - Permittivity	0.3	Rectangular	√3	0.23	0.04	∞
Combined Std. Uncertainty		RSS			11.2	361
Expanded STD Uncertainty		*k*=2			22.38%	
Expanded STD Uncertainty		*k*=2			1.75dB	

Measurement uncertainty for 30 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (1g)}$	Std. Unc. (1-g)	$v_{i\ or\ Veff}$
Measurement System						
Probe Calibration (*k*=1)	6.00	Normal	1	1	6.00	∞
Probe Isotropy	4.70	Rectangular	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.88	∞
Boundary Effect	2.00	Rectangular	√3	1	1.15	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.73	∞
Probe Positioner	0.40	Rectangular	√3	1	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1.67	∞
Max. SAR Evaluation	2.00	Rectangular	√3	1	1.15	∞
Test sample Related						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Power drift	5	Rectangular	√3	1	2.89	∞
Power Scaling	0	Rectangular	√3	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	6.1	Rectangular	√3	1	3.52	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	√3	0.64	1.85	∞
Liquid Conductivity (meas)	3.42	Rectangular	√3	0.78	1.54	∞
Liquid Permittivity (target)	5	Rectangular	√3	0.6	1.73	∞
Liquid Permittivity (meas)	-4.08	Rectangular	√3	0.26	-0.61	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	1.53	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.05	∞
Combined Std. Uncertainty		RSS			11.54	361
Expanded STD Uncertainty		*k*=2			23.08%	
Expanded STD Uncertainty		*k*=2			1.80dB	

Measurement uncertainty for 30 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (1g)}$	Std. Unc. (1-g)	$v_{i\ or\ Veff}$
Measurement System						
Probe Calibration (*k*=1)	6.00	Normal	1	1	6.0	∞
Axial Isotropy	4.70	Rectangular	√3	0.7	1.9	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.9	∞
Boundary Effect	1.00	Rectangular	√3	1	0.6	∞
Linearity	4.70	Rectangular	√3	1	2.7	∞
System Detection Limit	1.00	Rectangular	√3	1	0.6	∞
Readout Electronics	0.30	Normal	1	1	0.3	∞
Response Time	0.80	Rectangular	√3	0	0.0	∞
Integration Time	2.60	Rectangular	√3	0	0.0	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.7	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.7	∞
Probe Positioner	0.40	Rectangular	√3	1	0.2	∞
Probe Positioning	2.90	Rectangular	√3	1	1.7	∞
Max. SAR Evaluation	1.00	Rectangular	√3	1	0.6	∞
System validation source (dipole)						
Deviation of experimental dipole from numerical dipole	5	Normal	1	1	5.0	∞
Dipole axis to liquid distance	2	Rectangular	√3	1	1.2	∞
Input power and SAR drift	4.7	Rectangular	√3	1	2.7	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	4	Rectangular	√3	1	2.3	∞
SAR correction	1.9	Rectangular	1	0.84	1.6	∞
Liquid Conductivity (meas)	3.42	Rectangular	1	0.78	2.67	∞
Liquid Permittivity (meas)	-4.08	Rectangular	1	0.23	-0.94	∞
Temp. unc. - Conductivity	1.7	Rectangular	√3	0.78	0.77	∞
Temp. unc. - Permittivity	0.3	Rectangular	√3	0.23	0.04	∞
Combined Std. Uncertainty		RSS			11.1	361
Expanded STD Uncertainty		*k*=2			22.10%	
Expanded STD Uncertainty		*k*=2			1.73dB	

Table: Worst-case uncertainty for DASY5 assessed according to IEEE1528-2003.
The budge is valid for the frequency range 30 MHz to 3G Hz and represents a worst-case analysis.

9. EXPOSURE LIMIT

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Note: Whole-Body SAR is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

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

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 W/kg

10. EUT ARRANGEMENT

Please refer to IEEE1528-2003 illustration below.

10.1 ANTHROPOMORPHIC HEAD PHANTOM

Figure 7-1a shows the front, back and side views of SAM. The point "M" is the reference point for the center of mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERPs are 15 mm posterior to the entrance to ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 7-1b. The plane passing through the two ear reference points and M is defined as the Reference Plane. The line N-F (Neck-Front) perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 7-1c). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines should be marked on the external phantom shell to facilitate handset positioning. Posterior to the N-F line, the thickness of the phantom shell with the shape of an ear is a flat surface 6 mm thick at the ERPs. Anterior to the N-F line, the ear is truncated as illustrated in Figure 7-1b. The ear truncation is introduced to avoid the handset from touching the ear lobe, which can cause unstable handset positioning at the cheek.

Figure 7-1a
Front, back and side view of SAM (model for the phantom shell)

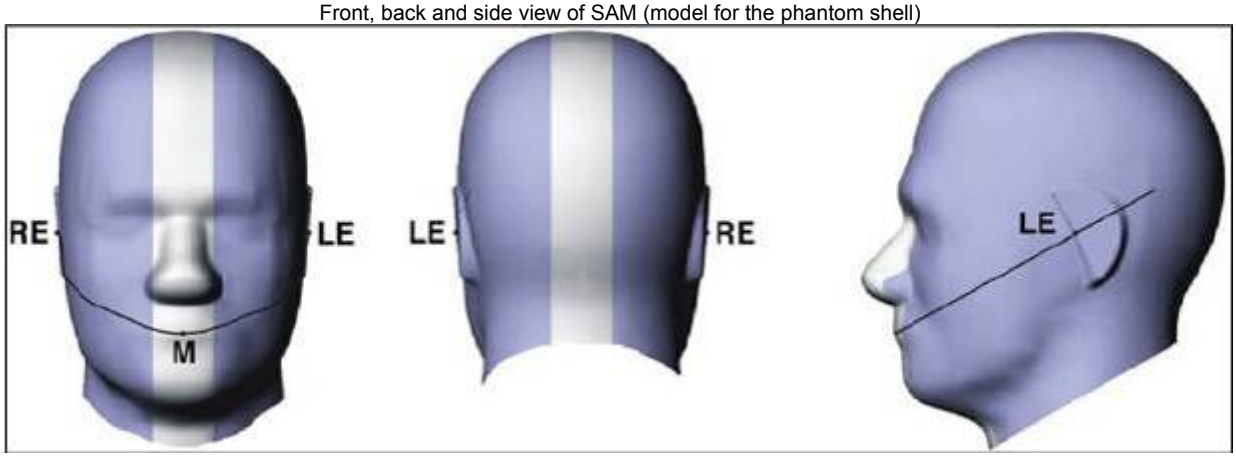


Figure 7-1b
Close up side view of phantom showing the ear region

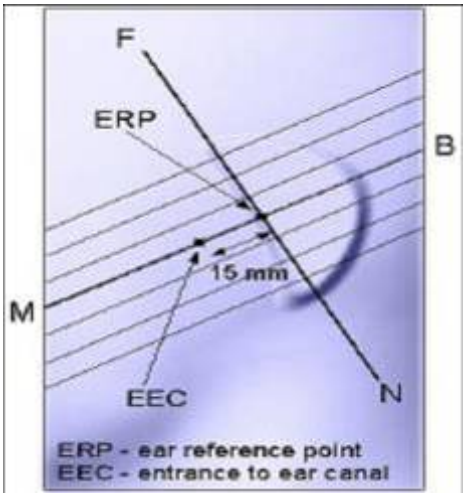


Figure 7-1c
Side view of the phantom showing relevant markings and the 7 cross sectional plane locations

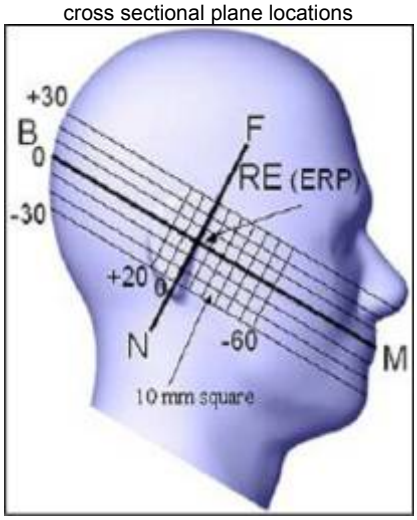


Figure 7-1b
Close up side view of phantom showing the ear region

Figure 7-1c
Side view of the phantom showing relevant markings and the 7 cross sectional plane locations

10.2 DEFINITION OF THE "CHEEK/TOUCH" POSITION

The "cheek" or "touch" position is defined as follows:

a. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover. (If the handset can also be used with the cover closed both configurations must be tested.)

b. Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width wt of the handset at the level of the acoustic output (point A on Figures 7-2a and 7-2b), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 7-2a). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 7-2b), especially for clamshell handsets, handsets with flip pieces, and other irregularly-shaped handsets.

c. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 7-2c), such that the plane defined by the vertical center line and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.

d. Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the pinna.

e. e) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).

f. Rotate the handset around the vertical centerline until the handset (horizontal line) is symmetrical with respect to the line NF.

g. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the handset contact with the pinna, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the pinna (cheek). See Figure 7-2c. The physical angles of rotation should be noted.

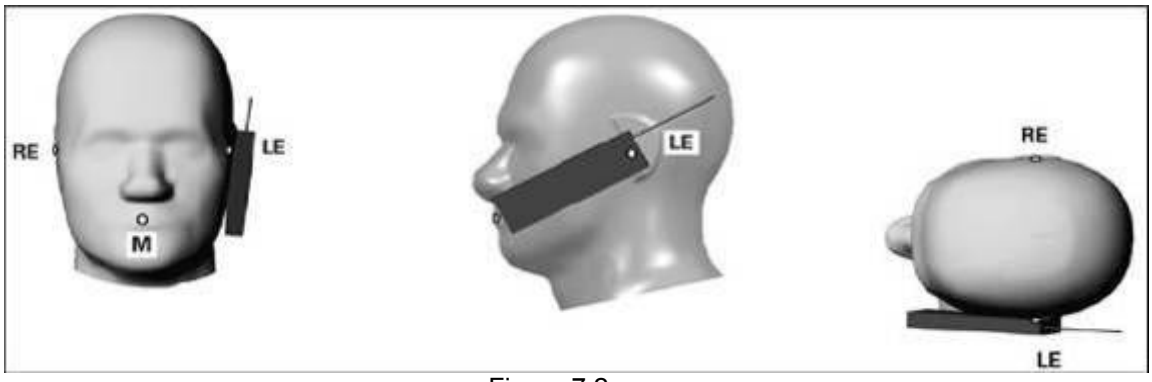


Figure 7.2c
Phone "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

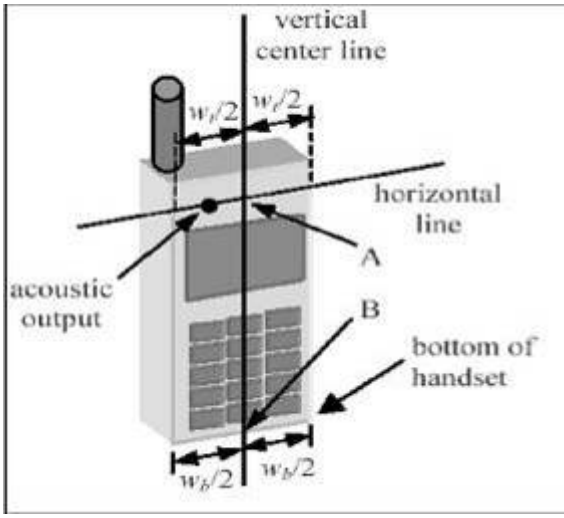


Figure 7.2a

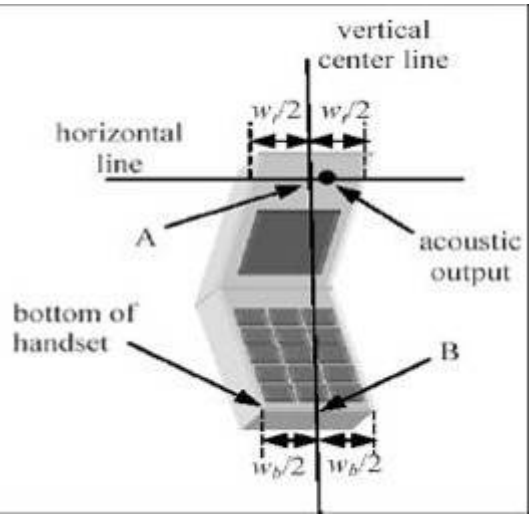


Figure 7.2b

10.3 DEFINITION OF THE "TILTED" POSITION

The "tilted" position is defined as follows:

a. Repeat steps (a) – (g) of 7.2 to place the device in the "cheek position."

b. While maintaining the orientation of the handset move the handset away from the pinna along the line passing through RE and LE in order to enable a rotation of the handset by 15 degrees.

c. Rotate the handset around the horizontal line by 15 degrees.

d. While maintaining the orientation of the handset, move the handset towards the phantom on a line passing through RE and LE until any part of the handset touches the ear. The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna (e.g., the antenna with the back of the phantom head), the angle of the handset should be reduced. In this case, the tilted position is obtained if any part of the handset is in contact with the pinna as well as a second part of the handset is contact with the phantom (e.g., the antenna with the back of the head).

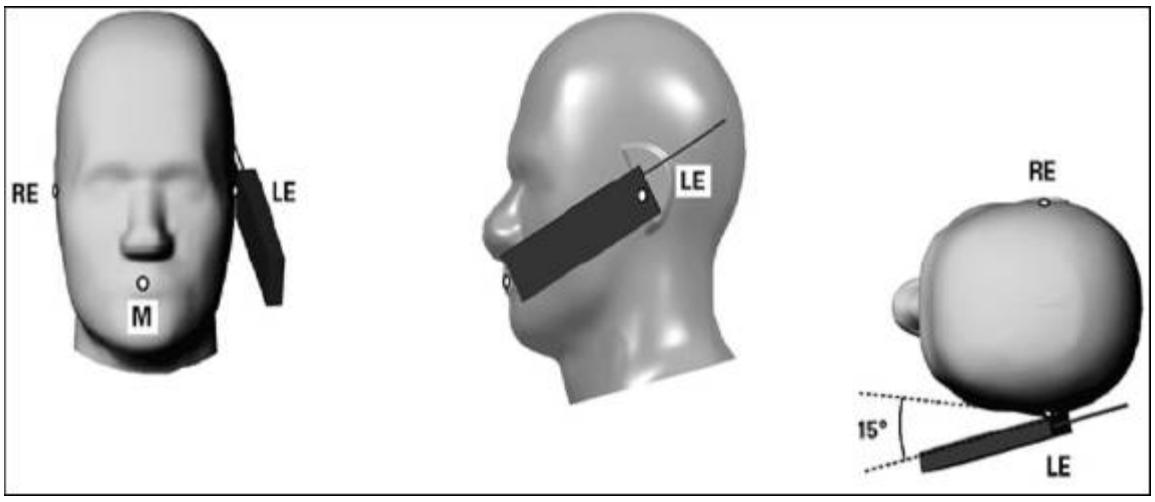


Figure 7-3
Phone "tilted" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

11. MEASUREMENT RESULTS

11.1 TEST LIQUIDS CONFIRMATION

SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

KDB865664 D01 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

The head and Body tissue dielectric parameters recommended by the KDB865664 D01 have been incorporated in the following table.

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

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

11.2 LIQUID MEASUREMENT RESULTS

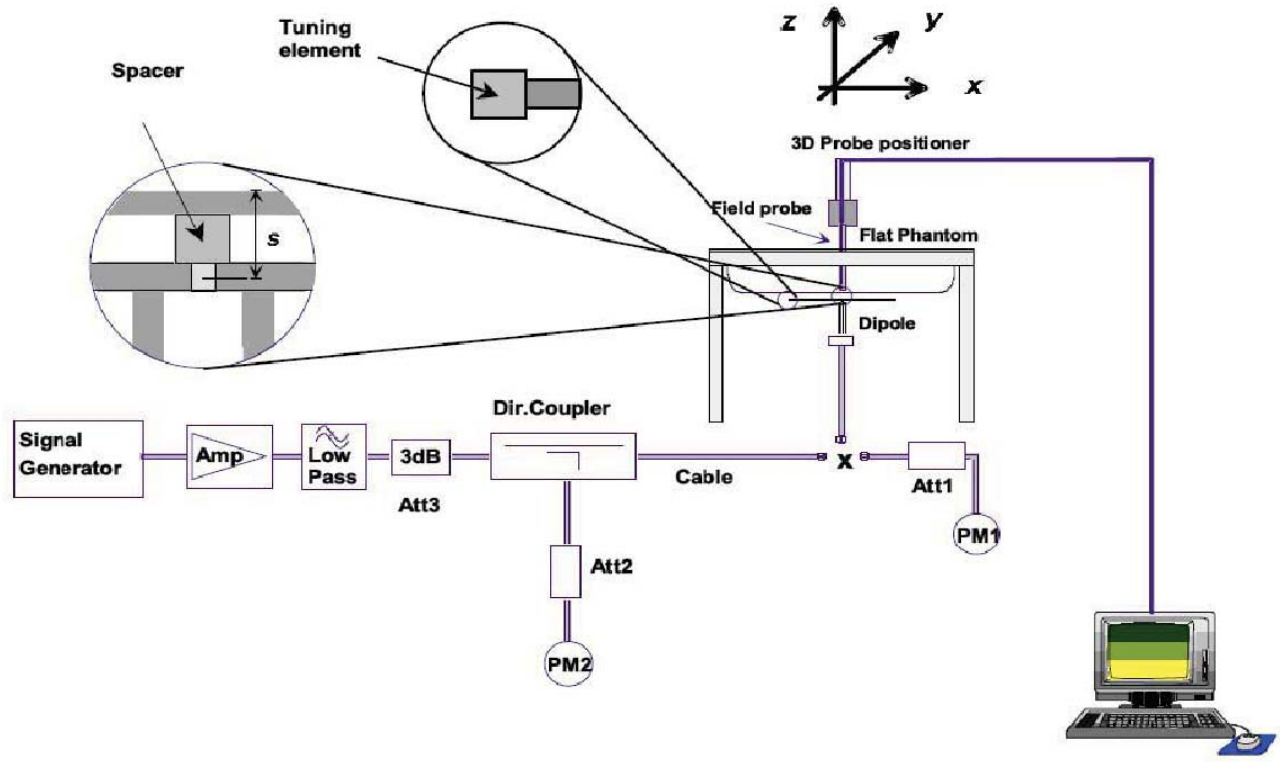
The following table show the measuring results for simulating liquid:

Liquid Type	Liquid Temp. (°C)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Head 836.6	21.5	Permitivity(ε)	41.50	42.87	3.31	± 5	2015-7-10
		Conductivity(σ)	0.90	0.92	2.00	± 5	
Head1850.2	21.5	Permitivity(ε)	40.00	39.63	-0.94	± 5	2015-7-12
		Conductivity(σ)	1.40	1.35	-3.86	± 5	
Head1852.4	21.5	Permitivity(ε)	40.00	39.62	-0.96	± 5	2015-7-12
		Conductivity(σ)	1.40	1.35	-3.79	± 5	
Head1753	21.5	Permitivity(ε)	40.03	38.83	-3.01	± 5	2015-7-20
		Conductivity(σ)	1.39	1.39	-0.08	± 5	
Head826.5	21.5	Permitivity(ε)	41.51	42.95	3.48	± 5	2015-7-10
		Conductivity(σ)	0.90	0.91	1.09	± 5	
Body824.2	21.5	Permitivity(ε)	55.24	55.53	0.53	± 5	2015-7-10
		Conductivity(σ)	0.97	0.98	1.52	± 5	
Body1850.2	21.5	Permitivity(ε)	53.28	52.34	-1.75	± 5	2015-7-12
		Conductivity(σ)	1.53	1.53	-0.49	± 5	
Body1880	21.5	Permitivity(ε)	53.29	52.38	-1.71	± 5	2015-7-12
		Conductivity(σ)	1.53	1.55	1.15	± 5	
Body1910	21.5	Permitivity(ε)	53.31	52.32	-1.85	± 5	2015-7-12
		Conductivity(σ)	1.52	1.57	3.36	± 5	
Body1852.4	21.5	Permitivity(ε)	53.28	52.37	-1.70	± 5	2015-7-12
		Conductivity(σ)	1.53	1.53	-0.35	± 5	
Body1908	21.5	Permitivity(ε)	53.31	52.32	-1.85	± 5	2015-7-12
		Conductivity(σ)	1.52	1.57	3.26	± 5	
Body1712.4	21.5	Permitivity(ε)	53.52	51.36	-4.03	± 5	2015-7-20
		Conductivity(σ)	1.46	1.49	2.02	± 5	
Body1732.6	21.5	Permitivity(ε)	53.46	51.32	-4.00	± 5	2015-7-20
		Conductivity(σ)	1.48	1.51	2.46	± 5	
Body1753	21.5	Permitivity(ε)	53.40	51.26	-4.01	± 5	2015-7-20
		Conductivity(σ)	1.49	1.54	2.99	± 5	
Body826.5	21.5	Permitivity(ε)	55.23	55.52	0.52	± 5	2015-7-10
		Conductivity(σ)	0.97	0.99	1.70	± 5	

Liquid Type	Liquid Temp. (°C)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Body824.2	21.5	Permitivity(ε)	55.24	53.37	-3.37	± 5	2015-8-12
		Conductivity(σ)	0.97	0.97	-0.13	± 5	
Body1850.2	21.5	Permitivity(ε)	53.28	52.50	-1.45	± 5	2015-8-13
		Conductivity(σ)	1.53	1.52	-0.55	± 5	
Body1880	21.5	Permitivity(ε)	53.29	52.50	-1.47	± 5	2015-8-13
		Conductivity(σ)	1.53	1.55	1.15	± 5	
Body1910	21.5	Permitivity(ε)	53.31	52.45	-1.61	± 5	2015-8-13
		Conductivity(σ)	1.52	1.57	3.42	± 5	
Body1852.4	21.5	Permitivity(ε)	53.28	52.52	-1.42	± 5	2015-8-13
		Conductivity(σ)	1.53	1.53	-0.41	± 5	
Body1908	21.5	Permitivity(ε)	53.31	52.45	-1.61	± 5	2015-8-13
		Conductivity(σ)	1.52	1.57	3.32	± 5	
Body1712.4	21.5	Permitivity(ε)	53.52	51.34	-4.08	± 5	2015-8-12
		Conductivity(σ)	1.46	1.49	1.75	± 5	
Body1732.6	21.5	Permitivity(ε)	53.46	51.30	-4.03	± 5	2015-8-12
		Conductivity(σ)	1.48	1.51	2.25	± 5	
Body1753	21.5	Permitivity(ε)	53.40	51.24	-4.04	± 5	2015-8-12
		Conductivity(σ)	1.49	1.53	2.72	± 5	
Body826.5	21.5	Permitivity(ε)	55.23	53.39	-3.32	± 5	2015-8-12
		Conductivity(σ)	0.97	0.97	0.15	± 5	

11.3 SYSTEM PERFORMANCE CHECK

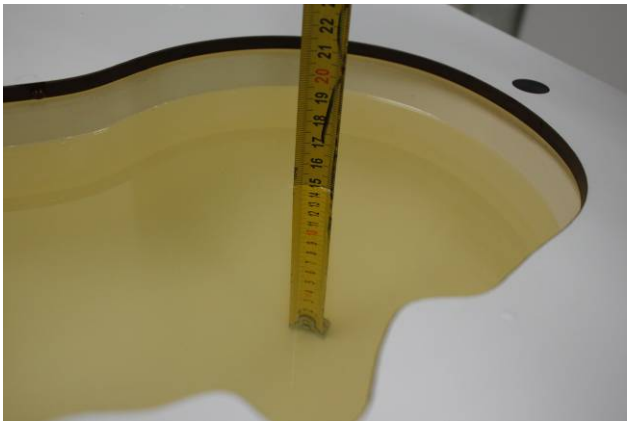
The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.
System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

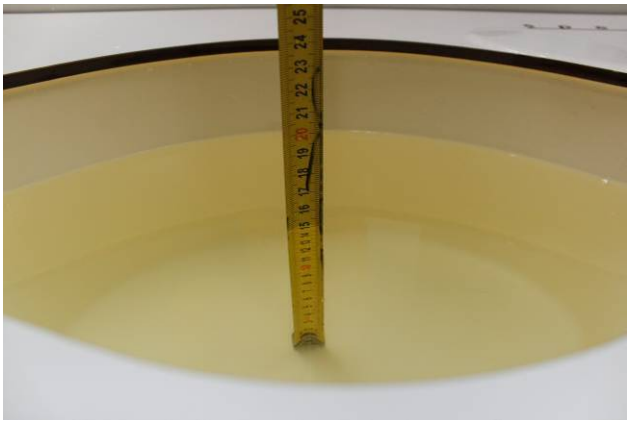


SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with head and body simulating liquid of the following parameters.
- The DASY5 system withan E-fileld probe EX3DV4 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx= 5 mm, dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole input power was 250mW±3%.
- The results are normalized to 1 W input power.

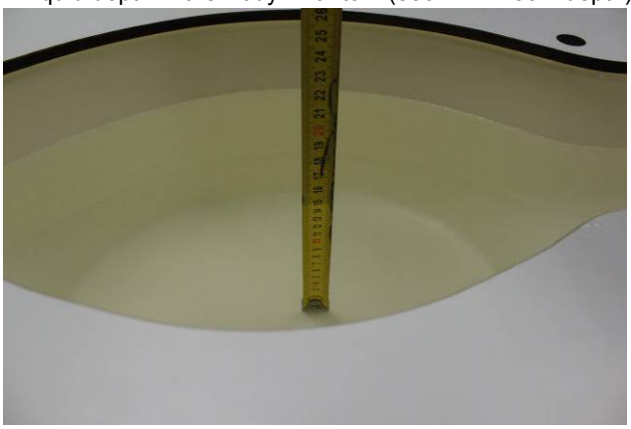
Depth of Liquid





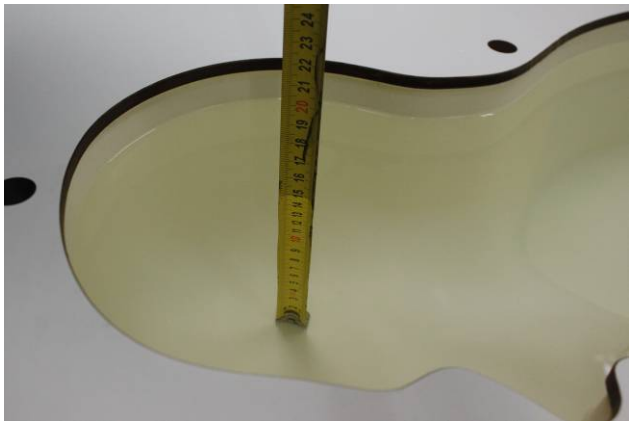
Liquid depth in the head Phantom (835 MHz 15cm depth

Liquid depth in the Body Phantom (835 MHz 15cm depth)

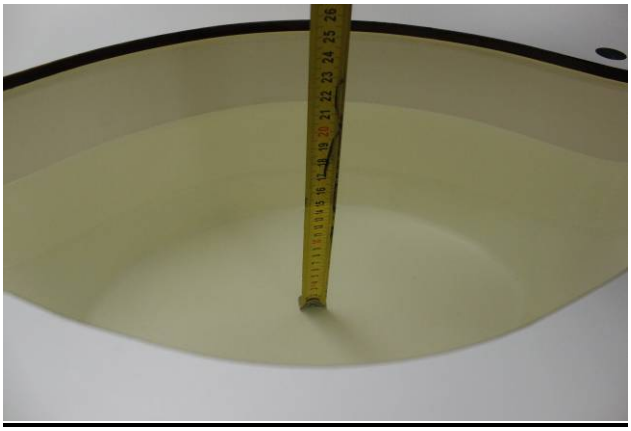


Liquid depth in the head Phantom (1800 MHz 15cm depth)

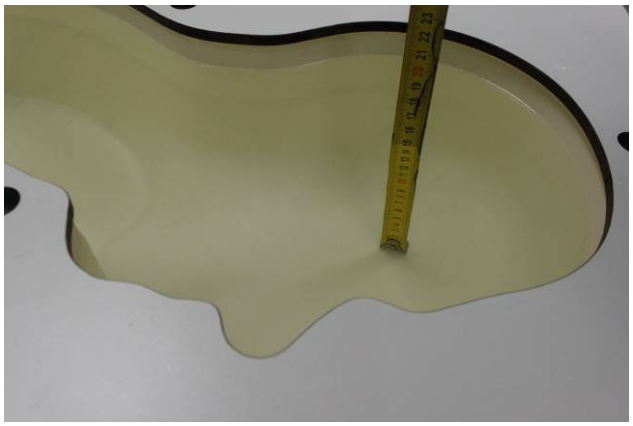
Liquid depth in the Body Phantom (1800 MHz 15cm depth)



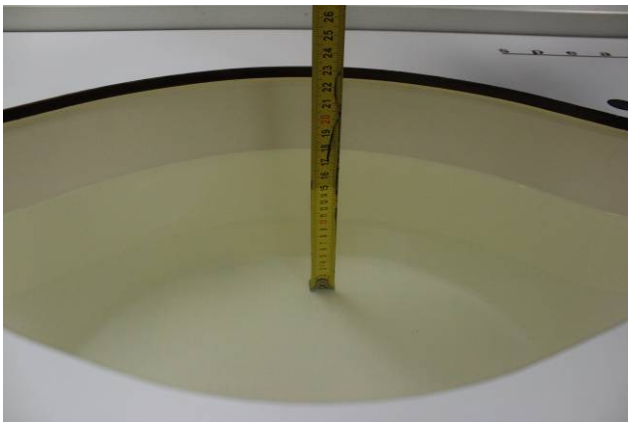
Liquid depth in the head Phantom (1900 MHz 15cm depth)



Liquid depth in the Body Phantom (1900 MHz 15cm depth)



Liquid depth in the head Phantom (2450 MHz 15cm depth)



Liquid depth in the Body Phantom (2450 MHz 15cm depth)

The following table gives the recipes for tissue simulating liquids.

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency	water	sugar	cellulose	Salt	bactericide	DGBE	conductivity	permittivity
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800,1900,2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
For Body								
835	50.6	48.2	0.2	0.9	0.1	0	0.97	55.2
1800,1900,2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

alt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

<Tissue Dielectric Parameter Check Results>

Liquid Type	Ambient Temp. (° C)	Liquid Temp. (°C)	Input Power (W)	Measured SAR_{1g} (W/Kg)	1W Target SAR_{1g}(W/Kg)	1W Normalized SAR_{1g}(W/Kg)	Deviation (%)	Limited (%)	Date
Head835	22	21.5	0.25	2.27	9.50	9.08	-4.42	± 10	2015-7-10
Body835	22	21.5	0.25	2.37	9.53	9.48	-0.52	± 10	2015-7-10
Head1800	22	21.5	0.25	9.29	38.60	37.16	-3.73	± 10	2015-7-20
Body1800	22	21.5	0.25	10.30	39.30	41.20	4.83	± 10	2015-7-20
Head1900	22	21.5	0.25	10.10	40.40	40.40	0.00	± 10	2015-7-12
Body1900	22	21.5	0.25	10.90	40.50	43.60	7.65	± 10	2015-7-12

Liquid Type	Ambient Temp. (° C)	Liquid Temp. (°C)	Input Power (W)	Measured SAR_{1g} (W/Kg)	1W Target SAR_{1g}(W/Kg)	1W Normalized SAR_{1g}(W/Kg)	Deviation (%)	Limited (%)	Date
Body835	22	21.5	0.25	2.34	9.53	9.36	-1.78	± 10	2015-8-12
Body1800	22	21.5	0.25	10.21	39.30	40.84	3.92	± 10	2015-8-12
Body1900	22	21.5	0.25	10.59	40.50	42.36	4.59	± 10	2015-8-13

11.4 EUT TUNE-UP PROCEDURES AND TEST MODE

The following procedure had been used to prepare the EUT for the SAR test.
To setup the desire channel frequency and the maximum output power. A Radio Communication Tester "CMU200 " was used to program the EUT.

General Note:

1. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. For head SAR testing, the EUT was set in GSM Voice for GSM850 and GSM1900 due to its highest frame-average power.
3. For body worn SAR testing, the EUT was set in GPRS 4 Tx slots for GSM850 and GPRS 4 Tx GSM1900 due to its highest frame-average power.
4. For hotspot SAR testing, the EUT was set in GPRS 4 Tx slots for GSM850 and GPRS 4 Tx GSM1900 due to its highest frame-average power.

GSM Conducted output power(dBm):

Band	GSM 850			GSM 1900		
Channel	128	190	251	512	661	810
Frequency(MHz)	824.2	836.6	848.8	1850.2	1880.0	1909.8
Maximum Burst-Averaged Output Power						
GSM(GMSK,1Uplink)	32.85	**32.92**	32.89	**29.69**	29.45	29.35
GPRS 8 (GMSK,1 Uplink)	32.91	32.69	32.65	29.68	29.49	29.48
GPRS 10 (GMSK,2 Uplink)	32.12	31.91	31.84	28.95	28.82	28.75
GPRS 11 (GMSK,3 Uplink)	30.44	30.16	30.04	27.24	27.22	27.28
GPRS 12 (GMSK,4 Uplink)	29.34	29.01	28.79	26.17	26.16	26.38
EDGE 8 (GMSK,1 Uplink)	26.91	26.89	26.85	25.82	25.78	25.74
EDGE 10 (GMSK,2 Uplink)	26.56	26.61	26.58	25.45	25.51	25.47
EDGE 11 (GMSK,3 Uplink)	25.96	25.88	25.91	24.85	24.77	24.83
EDGE 12 (GMSK,4 Uplink)	25.44	25.39	25.37	24.33	24.28	24.26
Maximum Frame-Averaged Output Power						
GSM(GMSK,1Uplink)	23.83	23.90	23.87	20.67	20.43	20.33
GPRS 8 (GMSK,1 Uplink)	23.88	23.66	23.62	20.65	20.46	20.45
GPRS 10 (GMSK,2 Uplink)	26.09	25.88	25.81	22.92	22.79	22.72
GPRS 11 (GMSK,3 Uplink)	26.18	25.90	25.78	22.98	22.96	23.02
GPRS 12 (GMSK,4 Uplink)	**26.33**	26.00	25.78	23.16	23.15	**23.37**
EDGE 8 (GMSK,1 Uplink)	17.88	17.86	17.82	16.79	16.75	16.71
EDGE 10 (GMSK,2 Uplink)	20.54	20.59	20.56	19.43	19.49	19.45
EDGE 11 (GMSK,3 Uplink)	21.70	21.62	21.65	20.59	20.51	20.57
EDGE 12 (GMSK,4 Uplink)	22.43	22.38	22.36	21.32	21.27	21.25

Remark: The frame-averaged power is linearly scaled the maximum burst-averaged power based on time slots. The calculated methods are shown as below:
Frame-averaged power = Burst-averaged power (1 Uplink) – 9.03 dBm
Frame-averaged power = Burst averaged power (2 Uplink) – 6.02 dBm
Frame-averaged power = Burst-averaged power (3 Uplink) – 4.26 dBm
Frame-averaged power = Burst averaged power (4 Uplink) – 3.01 dBm

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

2. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.

3. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.
4. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.

WCDMA Conducted output power(dBm):
As the SAR body tests for WCDMA **Band II, Band IV and Band V** , we established the radio link through call processing. The Maximum Burst-Averaged Output Power were verified on high, middle and low channels for each test band according to 3GPP TS 34.121 with the following configuration: a 12.2kbps RMC, 64,144,384 kbps RMC with TPC set to all “all ‘1’s”b Test loop Mode 1
The following procedures had been used to prepare the EUT for the SAR test.

HSDPA Setup Configuration:

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1, Note 2)*	**CM** (dB) *(Note 3)*	**MPR** (dB) *(Note 3)*
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c , and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c .

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

HSUPA Setup Configuration:

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Band	WCDMA Band II			WCDMA Band IV		
Channel	9262	9400	9538	1312	1413	1513
Frequency(MHz)	1852.4	1880	1907.6	1712.4	1732.6	1752.6
Maximum Burst-Averaged Output Power						
RMC12.2K	**22.08**	22.02	22.06	22.02	22.08	**22.17**
HSDPA Subtest-1	21.99	21.89	21.62	21.26	21.30	21.35
HSDPA Subtest-2	21.89	21.70	21.70	21.53	21.57	21.61
HSDPA Subtest-3	21.56	21.67	21.59	21.32	21.35	21.39
HSDPA Subtest-4	21.61	21.68	21.89	21.22	21.25	21.28
HSUPA Subtest-1	21.65	21.68	21.97	21.76	21.81	21.83
HSUPA Subtest-2	21.50	21.86	21.58	21.62	21.66	21.69
HSUPA Subtest-3	21.87	21.77	21.67	21.42	21.46	21.52
HSUPA Subtest-4	21.56	21.86	21.58	21.34	21.35	21.39
HSUPA Subtest-5	21.46	21.58	21.79	21.13	21.16	21.18

Band	WCDMA Band V		
Channel	4132	4182	4233
Frequency(MHz)	826.4	836.4	846.6
Maximum Burst-Averaged Output Power			
RMC12.2K	**22.97**	22.74	22.95
HSDPA Subtest-1	21.79	21.81	22.11
HSDPA Subtest-2	21.81	21.97	21.86
HSDPA Subtest-3	21.93	21.99	21.75
HSDPA Subtest-4	21.80	22.03	22.09
HSUPA Subtest-1	21.93	21.91	21.49
HSUPA Subtest-2	21.84	22.06	21.81
HSUPA Subtest-3	21.73	22.11	21.94
HSUPA Subtest-4	22.05	21.81	22.17
HSUPA Subtest-5	22.13	22.25	21.94

Note:

Per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 0.25dB higher than RMC, HSDPA/HSUPA SAR evaluation can be excluded.

General Note:

1 Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.

2 Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.

1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.

2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.

3 For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

WLAN 2.4G Conducted output power(dBm):

Mode	Channel	Frequence	Average power(dBm)
802.11 b	1	2412 MHZ	8.67
	6	2437 MHZ	8.41
	11	2462 MHZ	**8.89**
802.11 g	1	2412 MHZ	7.19
	6	2437 MHZ	7.36
	11	2462 MHZ	**7.78**
802.11 n 20M	1	2412 MHZ	7.15
	6	2437 MHZ	**7.50**
	11	2462 MHZ	7.33
802.11 n 40M	3	2422 MHZ	**6.77**
	7	2442 MHZ	6.39
	11	2462 MHZ	6.44

According to KDB447498 D01:The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation[25]
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

· If the test separation distance (antenna-user) is < 5mm, 5mm is used for excluded SAR calculation

	Wireless Interface	WiFi
Tune-up Maximum power (dBm)		9
Tune-up Maximum rated power (mW)		7.943
Head	Antenna to user (mm)	5
	Frequency(GHz)	2.462
	SAR exclusion threshold	2.49
Body	Antenna to user (mm)	10
	Frequency(GHz)	2.462
	SAR exclusion threshold	1.25

Per KDB 447498 D01 exclusion thresholds is 2.49 < 3, WiFi RF exposure evaluation is not required.

Bluetooth 3.0 Conducted output power(dBm):

Channel	Frequency	Average power(dBm)		
		Date Rate		
		1Mbps	2Mbps	3Mbps
CH00	2402MHZ	**3.52**	1.98	2.76
CH39	2441MHZ	3.48	1.87	2.71
CH78	2480MHZ	3.21	2.25	2.87

According to KDB447498 D01:The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[24] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation[25]
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

· If the test separation distance (antenna-user) is < 5mm, 5mm is used for excluded SAR calculation

	Wireless Interface	Bluetooth
Tune-up Maximum power (dBm)		4
Tune-up Maximum rated power (mW)		2.512
Head	Antenna to user (mm)	5
	Frequency(GHz)	2.480
	SAR exclusion threshold	0.791
Body	Antenna to user (mm)	10
	Frequency(GHz)	2.480
	SAR exclusion threshold	0.396

Per KDB 447498 D01 exclusion thresholds is[(*max. power of channel, including tune-up tolerance:2.512mW*)/(*min. test separation distance: 5mm*)] · [√2.480] =0.791< 3, Bluetooth RF exposure evaluation is not required.

Maximum Burst-Averaged output power for Product unit

Mode	The Tune-up Maximum Power(Customer Declared)(dBm)	Tune up limit	Measured Conduct Maximum Power(dBm)
GSM 850	32+/-1	33	32.92
GPRS 850-1TS	32+/-1	33	32.91
GPRS 850-2TS	31.5+/-1	32.5	32.12
GPRS 850-3TS	30+/-1	31	30.44
GPRS 850-4TS	29+/-1	30	29.34
EDGE 850-1TS	26+/-1	27	26.91
EDGE 850-2TS	26+/-1	27	26.61
EDGE 850-3TS	25.5+/-1	26.5	25.96
EDGE 850-4TS	25+/-1	26	25.44
PCS 1900	29+/-1	30	29.69
GPRS 1900-1TS	29+/-1	30	29.68
GPRS 1900-2TS	28+/-1	29	28.95
GPRS 1900-3TS	26.5+/-1	27.5	27.28
GPRS 1900-4TS	25.5+/-1	26.5	26.38
EDGE 1900-1TS	25+/-1	26	25.82
EDGE 1900-2TS	25+/-1	26	25.51
EDGE 1900-3TS	24+/-1	25	24.85
EDGE 1900-4TS	24+/-1	25	24.33
WCDMA Band II RMC 12.2K	21.5+/-1	22.5	22.08
HSDPA Band II	21.5+/-1	22.5	21.99
HSUPA Band II	21.5+/-1	22.5	21.97
WCDMA Band IV RMC 12.2K	21.5+/-1	22.5	22.17
HSDPA Band IV	21 +/-1	22	21.61
HSUPA Band IV	21 +/-1	22	21.83
WCDMA Band V RMC 12.2K	22+/-1	23	22.97
HSDPA Band V	21.5 +/-1	22.5	22.11
HSUPA Band V	21.5 +/-1	22.5	22.25
IEEE 802.11b	8+/-1	9	8.89
IEEE 802.11g	7+/-1	8	7.78
IEEE 802.11n(20M)	7+/-1	8	7.50
IEEE 802.11n(40M)	6+/-1	7	6.77
Bluetooth 1Mbps	3+/-1	4	3.52
Bluetooth 2Mbps	1.5+/-1	2.5	2.25
Bluetooth 3Mbps	2+/-1	3	2.87

So, they are in tune-up range and complied.

11.5 SAR TEST CONFIGURATIONS

Body-Worn Accessory Exposure Conditions

(1) To position the EUT parallel to the phantom surface.
(2) To adjust the EUT parallel to the flat phantom.
(3) To adjust the distance between the EUT surface and the flat phantom to 5mm.

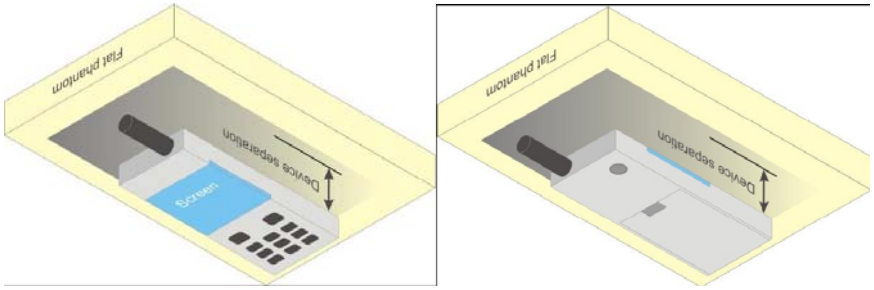
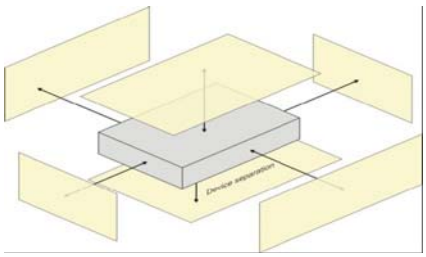


Illustration for Body Worn Position

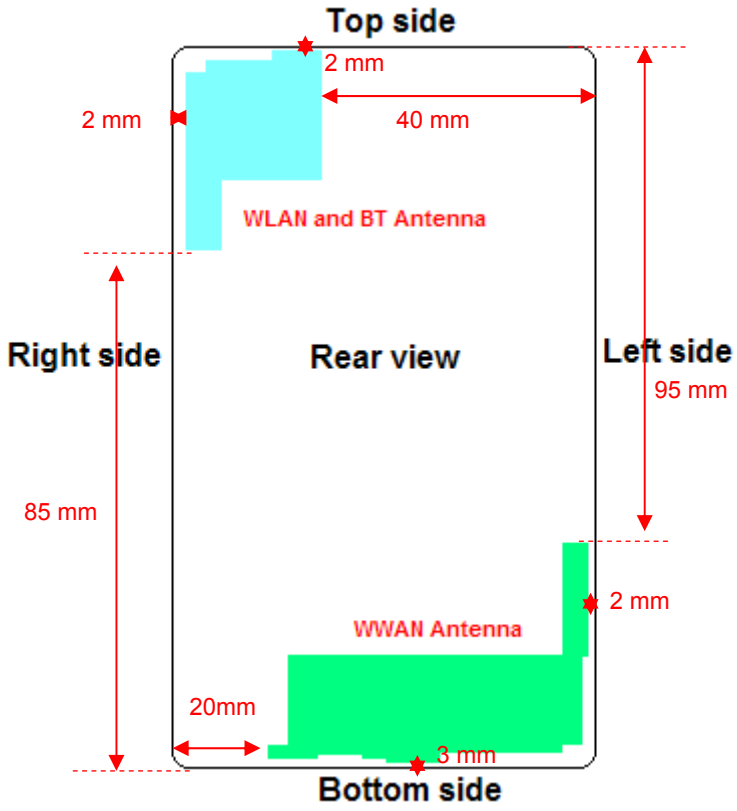
Hotspot Mode Exposure conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225 D06. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm.

(1) To position the EUT parallel to the phantom surface.
(2) To adjust the EUT parallel to the flat phantom.
(3) To adjust the distance between the EUT surface and the flat phantom to 10mm.



11.6 ANTENNA POSITION



Device dimensions (H x W): 145 x 73 mm

Antenna	Wireless Interface
WWAN Antenna	GSM850/GSM1900 WCDMA Band II WCDMA Band IV WCDMA Band V
WiFi&BT Antenna	WLAN 2.4G Bluetooth

Test Mode

GSM 850/GSM1900	Data transmission mode(GPRS)/Voice mode(GSM)
WCDMA Band II WCDMA Band IV WCDMA Band V	Data transmission mode(12.2k RMC)

Body Exposure Condition

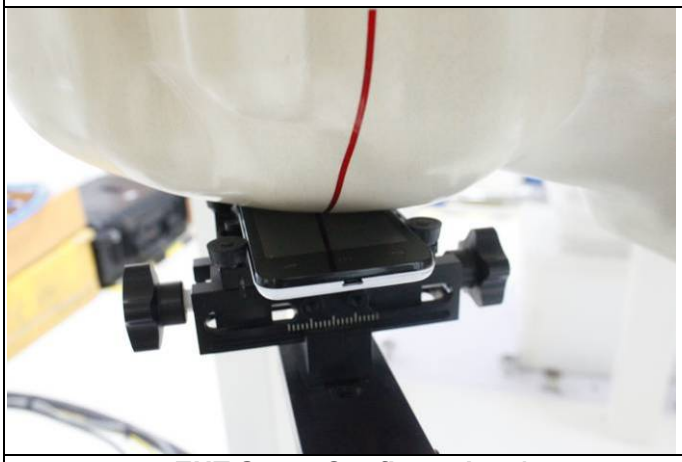
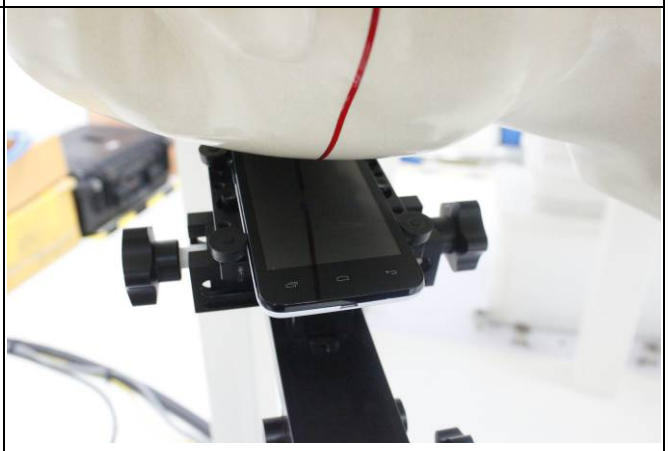
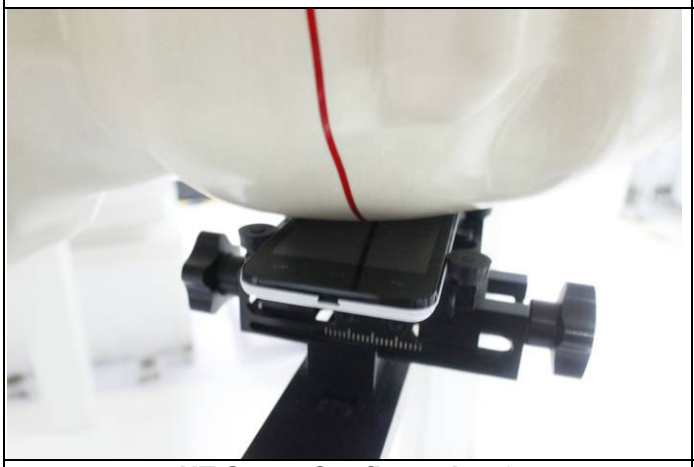
Distance of the Antenna to the EUT surface/edge Test distance: 10 mm						
Antenna	Front （mm）	Rear （mm）	Right side （mm）	Left side （mm）	Top side （mm）	Bottom side （mm）
WWAN	5<25	2<25	20<25	2<25	95>25	2<25

Body test position

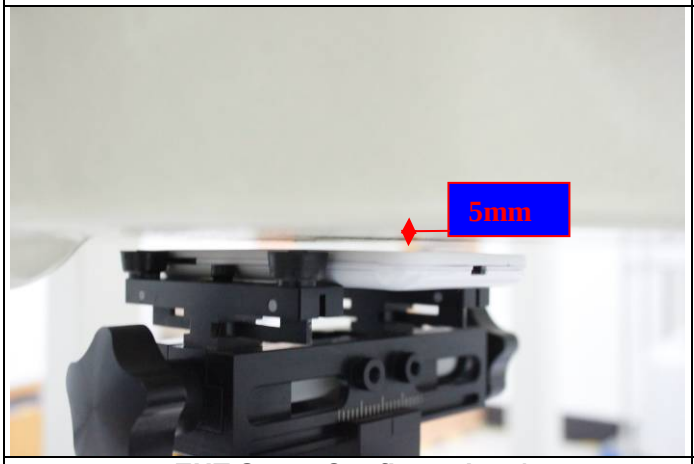
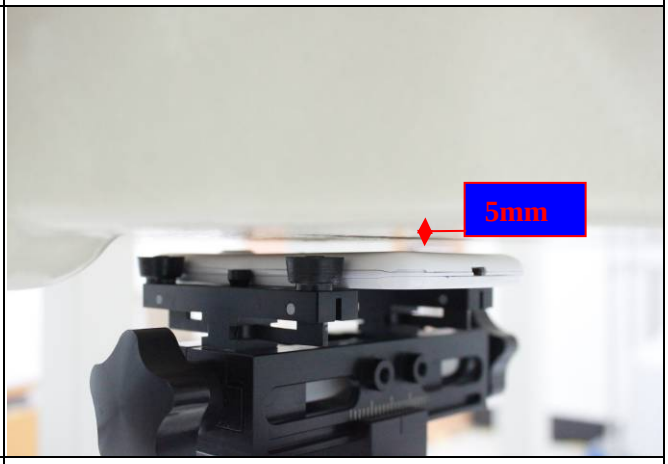
Distance of the Antenna to the EUT surface/edge Test distance: 10 mm						
Antenna	Front	Rear	Right side	Left side	Top side	Bottom side
WWAN	Yes	Yes	Yes	Yes	No	Yes

11.7 EUT SETUP PHOTOS

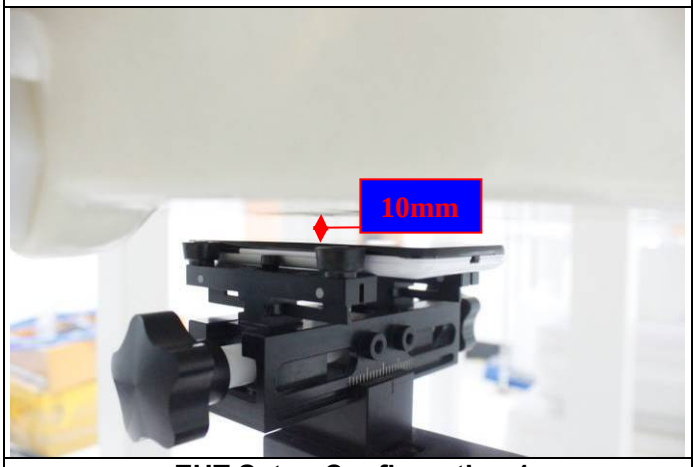
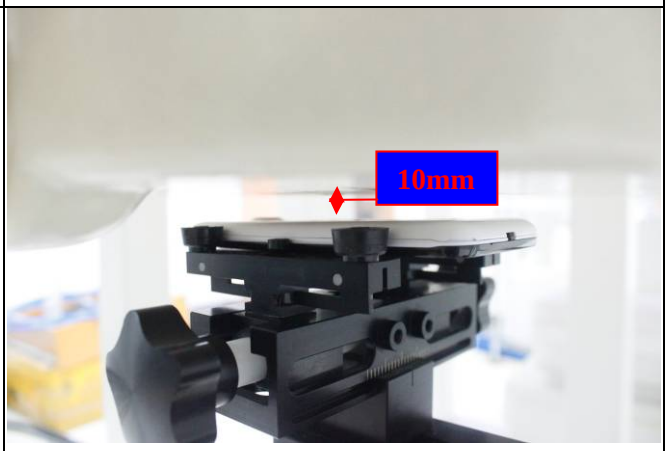
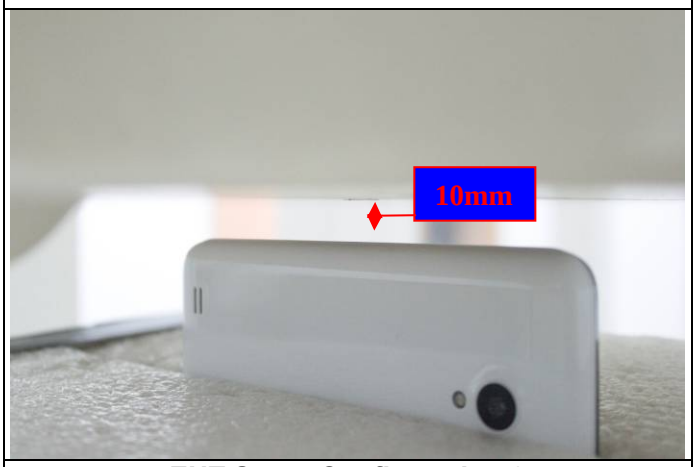
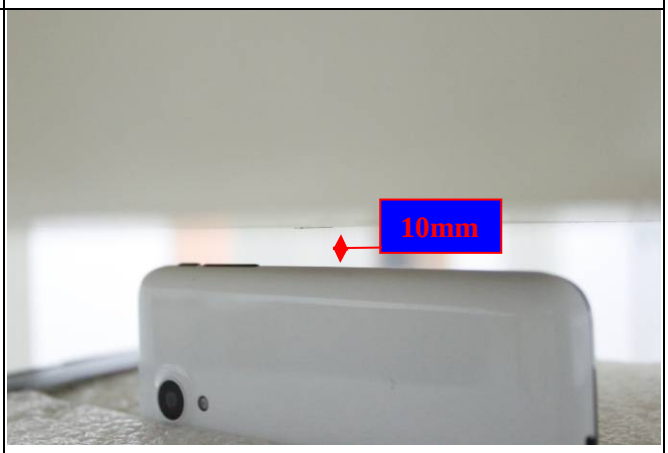
Head position

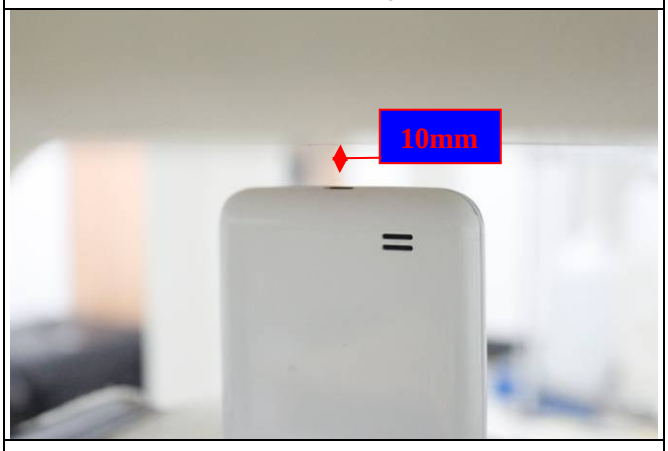
Cheek device with right head phantom.	Tilt device with right head phantom
	
EUT Setup Configuration 1	**EUT Setup Configuration 2**
Cheek device with left head phantom.	**Tilt device with left head phantom**
	
UT Setup Configuration 3	**EUT Setup Configuration 4**

Body Support test position

Front in body position	Rear in body position
	
EUT Setup Configuration 1	**EUT Setup Configuration 2**

Hotspot test position

Front in body position	Rear in body position
	
EUT Setup Configuration 1	**EUT Setup Configuration 2**
Right Side in body position	**Left Side in body position**
	
EUT Setup Configuration 3	**EUT Setup Configuration 4**

Bottom Side in body position

EUT Setup Configuration 6

11.8 SAR MEASUREMENT RESULTS

Head SAR Test Records

Band	Mode	Test Position	Ch.	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
GSM850	Voice	Right Cheek	190	836.6	32.92	33	1.019	0.02	0.042	0.043
GSM850	Voice	Right Tilted	190	836.6	32.92	33	1.019	-0.08	0.035	0.036
GSM850	Voice	Left Cheek	190	836.6	32.92	33	1.019	0.07	0.045	0.046
GSM850	Voice	Left Tilted	190	836.6	32.92	33	1.019	-0.02	0.039	0.040
GSM1900	Voice	Right Cheek	512	1850.2	29.69	30	1.074	0.16	0.167	0.179
GSM1900	Voice	Right Tilted	512	1850.2	29.69	30	1.074	-0.07	0.113	0.121
GSM1900	Voice	Left Cheek	512	1850.2	29.69	30	1.074	0.15	0.277	0.297
GSM1900	Voice	Left Tilted	512	1850.2	29.69	30	1.074	-0.06	0.131	0.141
WCDMA II	RMC 12.2k	Right Cheek	9262	1852.4	22.08	22.5	1.102	0.09	0.565	0.622
WCDMA II	RMC 12.2k	Right Tilted	9262	1852.4	22.08	22.5	1.102	0.02	0.245	0.270
WCDMA II	RMC 12.2k	Left Cheek	9262	1852.4	22.08	22.5	1.102	-0.01	0.472	0.520
WCDMA II	RMC 12.2k	Left Tilted	9262	1852.4	22.08	22.5	1.102	-0.03	0.356	0.392
WCDMA IV	RMC 12.2k	Right Cheek	1513	1752.6	22.17	22.5	1.079	0.08	0.313	0.338
WCDMA IV	RMC 12.2k	Right Tilted	1513	1752.6	22.17	22.5	1.079	-0.02	0.084	0.091
WCDMA IV	RMC 12.2k	Left Cheek	1513	1752.6	22.17	22.5	1.079	-0.08	0.335	0.361
WCDMA IV	RMC 12.2k	Left Tilted	1513	1752.6	22.17	22.5	1.079	-0.09	0.099	0.107
WCDMA V	RMC 12.2k	Right Cheek	4132	826.4	22.97	23	1.007	-0.02	0.049	0.049
WCDMA V	RMC 12.2k	Right Tilted	4132	826.4	22.97	23	1.007	0.00	0.039	0.039
WCDMA V	RMC 12.2k	Left Cheek	4132	826.4	22.97	23	1.007	-0.01	0.047	0.047
WCDMA V	RMC 12.2k	Left Tilted	4132	826.4	22.97	23	1.007	0.04	0.023	0.023

SAR for Body-Worn Test Records

Band	Mode	Test Position	Dist. (mm)	Ch.	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
GSM850	GPRS 4slots	Front	5	128	824.2	29.34	30	1.164	-0.12	0.122	0.142
GSM850	GPRS 4slots	Rear	5	128	824.2	29.34	30	1.164	-0.08	0.304	0.354
GSM1900	GPRS 4slots	Front	5	810	1909.8	26.38	26.5	1.028	0.13	0.486	0.500
GSM1900	GPRS 4slots	Rear	5	512	1850.2	26.17	26.5	1.079	0.06	0.826	0.891
GSM1900	GPRS 4slots	Rear	5	661	1880	26.16	26.5	1.081	0.11	0.944	1.021
GSM1900	GPRS 4slots	Rear	5	810	1909.8	26.38	26.5	1.028	0.05	1.02	1.049
WCDMA II	RMC 12.2k	Front	5	9262	1852.4	22.08	22.5	1.102	0.13	0.712	0.784
WCDMA II	RMC 12.2k	Rear	5	9262	1852.4	22.08	22.5	1.102	-0.18	1.10	1.212
WCDMA II	RMC 12.2k	Rear	5	9400	1880	22.02	22.5	1.117	0.15	1.12	1.251
WCDMA II	RMC 12.2k	Rear	5	9538	1907.6	22.06	22.5	1.107	0.08	1.05	1.162
WCDMA IV	RMC 12.2k	Front	5	1513	1752.6	22.02	22.5	1.117	0.00	0.692	0.773
WCDMA IV	RMC 12.2k	Rear	5	1312	1712.4	22.02	22.5	1.117	-0.04	0.987	1.102
WCDMA IV	RMC 12.2k	Rear	5	1413	1732.6	22.08	22.5	1.102	0.09	1.11	1.223
WCDMA IV	RMC 12.2k	Rear	5	1513	1752.6	22.17	22.5	1.079	0.12	1.06	1.144
WCDMA V	RMC 12.2k	Front	5	4132	826.4	22.97	23	1.007	0.05	0.095	0.096
WCDMA V	RMC 12.2k	Rear	5	4132	826.4	22.97	23	1.007	-0.06	0.197	0.198

Note:
According to October 2013TCB Workshop, For GSM / GPRS , the number of time slots to test for SAR should correspond to the highest source-based time-averaged maximum output power configuration, Considering the possibility of e.g. 3rd party VoIP operation for body-worn SAR testing, the EUT was set in GPRS (4Tx slots) for GSM850/GSM1900 band due to its highest frame-average power.

SAR for Hotspot Test Records

Band	Mode	Test Position	Dist. (mm)	Ch.	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
GSM850	GPRS 4slots	Front	10	128	824.2	29.34	30	1.164	-0.02	0.057	0.066
GSM850	GPRS 4slots	Rear	10	128	824.2	29.34	30	1.164	-0.09	0.194	0.226
GSM850	GPRS 4slots	Right	10	128	824.2	29.34	30	1.164	-0.11	0.012	0.014
GSM850	GPRS 4slots	Left	10	128	824.2	29.34	30	1.164	-0.09	0.052	0.061
GSM850	GPRS 4slots	Bottom	10	128	824.2	29.34	30	1.164	-0.07	0.030	0.035
GSM1900	GPRS 4slots	Front	10	810	1909.8	26.38	26.5	1.028	0.11	0.359	0.369
GSM1900	GPRS 4slots	Rear	10	512	1850.2	26.17	26.5	1.079	0.16	0.726	0.783
GSM1900	GPRS 4slots	Rear	10	661	1880	26.16	26.5	1.081	0.17	0.824	0.891
GSM1900	GPRS 4slots	Rear	10	810	1909.8	26.38	26.5	1.028	-0.05	0.910	0.935
GSM1900	GPRS 4slots	Right	10	810	1909.8	26.38	26.5	1.028	0.07	0.075	0.077
GSM1900	GPRS 4slots	Left	10	810	1909.8	26.38	26.5	1.028	0.04	0.414	0.426
GSM1900	GPRS 4slots	Bottom	10	810	1909.8	26.38	26.5	1.028	0.12	0.341	0.351
WCDMA II	RMC 12.2k	Front	10	9262	1852.4	22.08	22.5	1.102	0.03	0.600	0.661
WCDMA II	RMC 12.2k	Rear	10	9262	1852.4	22.08	22.5	1.102	0.14	1.02	1.124
WCDMA II	RMC 12.2k	Rear	10	9400	1880	22.02	22.5	1.117	0.15	1.07	1.195
WCDMA II	RMC 12.2k	Rear	10	9538	1907.6	22.06	22.5	1.107	0.08	0.961	1.063
WCDMA II	RMC 12.2k	Right	10	9262	1852.4	22.08	22.5	1.102	-0.03	0.132	0.145
WCDMA II	RMC 12.2k	Left	10	9262	1852.4	22.08	22.5	1.102	-0.02	0.655	0.722
WCDMA II	RMC 12.2k	Bottom	10	9262	1852.4	22.08	22.5	1.102	0.09	0.528	0.582
WCDMA IV	RMC 12.2k	Front	10	1513	1752.6	22.02	22.5	1.117	0.06	0.585	0.653
WCDMA IV	RMC 12.2k	Rear	10	1312	1712.4	22.02	22.5	1.117	0.00	0.858	0.958
WCDMA IV	RMC 12.2k	Rear	10	1413	1732.6	22.08	22.5	1.102	0.06	1.07	1.179
WCDMA IV	RMC 12.2k	Rear	10	1513	1752.6	22.17	22.5	1.079	0.10	0.998	1.077
WCDMA IV	RMC 12.2k	Right	10	1513	1752.6	22.02	22.5	1.117	0.00	0.100	0.112
WCDMA IV	RMC 12.2k	Left	10	1513	1752.6	22.02	22.5	1.117	-0.09	0.358	0.400
WCDMA IV	RMC 12.2k	Bottom	10	1513	1752.6	22.02	22.5	1.117	-0.08	0.481	0.537
WCDMA V	RMC 12.2k	Front	10	4132	826.4	22.97	23	1.007	0.14	0.050	0.050
WCDMA V	RMC 12.2k	Rear	10	4132	826.4	22.97	23	1.007	-0.03	0.137	0.138
WCDMA V	RMC 12.2k	Right	10	4132	826.4	22.97	23	1.007	0.06	0.015	0.015
WCDMA V	RMC 12.2k	Left	10	4132	826.4	22.97	23	1.007	0.03	0.062	0.062
WCDMA V	RMC 12.2k	Bottom	10	4132	826.4	22.97	23	1.007	-0.16	0.022	0.022

Repeated SAR Test Records

Band	Mode	Test Position	Dist. (mm)	Ch.	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
GSM1900	GPRS 4slots	Rear	10	810	1909.8	26.38	26.5	1.028	0.09	0.908	0.933
WCDMA II	RMC 12.2k	Rear	10	9400	1880	22.02	22.5	1.117	0.00	1.05	1.173
WCDMA IV	RMC 12.2k	Rear	10	1413	1732.6	22.08	22.5	1.102	0.05	1.07	1.179

Band	Mode	Test Position	Dist. (mm)	Ch.	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
GSM1900	GPRS 4slots	Rear	5	810	1909.8	26.38	26.5	1.028	0.13	1.02	1.049
WCDMA II	RMC 12.2k	Rear	5	9400	1880	22.02	22.5	1.117	-0.03	1.11	1.240
WCDMA IV	RMC 12.2k	Rear	5	1413	1732.6	22.08	22.5	1.102	0.05	1.10	1.212

11.9 REPEATED SAR MEASUREMENT

Band	Mode	Test Position	Dist. (mm)	Ch.	Original Measured SAR1g (mW/g)	1st Repeated SAR1g (mW/g)	Ratio	Original Measured SAR1g (mW/g)	2nd Repeated SAR1g (mW/g)	Ratio
GSM1900	GPRS 4slots	Rear	10	810	0.910	0.908	1.002	--	--	--
WCDMA II	RMC 12.2k	Rear	10	9400	1.07	1.05	1.019	--	--	--
WCDMA IV	RMC 12.2k	Rear	10	1413	1.07	1.07	1.000	--	--	--

Band	Mode	Test Position	Dist. (mm)	Ch.	Original Measured SAR1g (mW/g)	1st Repeated SAR1g (mW/g)	Ratio	Original Measured SAR1g (mW/g)	2nd Repeated SAR1g (mW/g)	Ratio
GSM1900	GPRS 4slots	Rear	5	810	1.02	1.02	1.000	--	--	--
WCDMA II	RMC 12.2k	Rear	5	9400	1.12	1.11	1.009	--	--	--
WCDMA IV	RMC 12.2k	Rear	5	1413	1.11	1.10	1.009	--	--	--

Note:

1. Per KDB 865664 D01v01,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8W/Kg
2. Per KDB 865664 D01v01,if the ratio of largest to smallest SAR for the original and first repeated measurement is ≤1.2 and the measured SAR ＜1.45W/Kg,only one repeated measurement is required.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg
4. The ratio is the difference in percentage between original and repeated measured SAR.

12. SAR HANDSETS MULTI XMITER ASSESSMENT

	Position	Applicable Combination
Simultaneous Transmission	Head	WWAN + WLAN
		WWAN + BT
	Body-worn	WWAN + WLAN
		WWAN + BT
	Hotspot	WWAN + WLAN
		WWAN + BT

Note:

1. 2.4GHz WLAN and BT share the same antenna, and cannot transmit simultaneously.
2. The reported SAR summation is calculated based on the same configuration and test position.
3. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05 based on the formula below.
   (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.
   0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Bluetooth:

	Max power	Head (5mm distance)	Body (10mm distance)
Estimated SAR (W/kg)	4 dBm	0.105 W/kg	0.053 W/kg

WIFI:

	Max power	Head (5mm distance)	Body (10mm distance)
Estimated SAR (W/kg)	9 dBm	0.332 W/kg	0.166 W/kg

4. Bluetooth& Wi-Fi estimated SAR is conservatively determined by 5mm separation, for all applicable exposure positions
5. Per KDB 447498 D01v05, simultaneous transmission SAR is compliant if,
   1) Scalar SAR summation < 1.6W/kg.
   2) 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 is compliant
   3) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg

Result of SUM ∑SAR1g of Head

SUM ∑SAR1g (GSM850+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	GSM850	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Right Cheek	0	0.043	0.332	0.105	0.375	0.148
Right Tilted	0	0.036	0.332	0.105	0.368	0.141
Left Cheek	0	0.046	0.332	0.105	0.378	0.151
Left Tilted	0	0.040	0.332	0.105	0.372	0.145

SUM ∑SAR1g (GSM1900+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	PCS 1900	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Right Cheek	0	0.179	0.332	0.105	0.511	0.284
Right Tilted	0	0.121	0.332	0.105	0.453	0.226
Left Cheek	0	0.297	0.332	0.105	0.629	0.402
Left Tilted	0	0.141	0.332	0.105	0.473	0.246

SUM ∑SAR1g (WCDMA Band II+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA II	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Right Cheek	0	0.622	0.332	0.105	0.954	0.727
Right Tilted	0	0.270	0.332	0.105	0.602	0.375
Left Cheek	0	0.520	0.332	0.105	0.852	0.625
Left Tilted	0	0.392	0.332	0.105	0.724	0.497

SUM ∑SAR1g (WCDMA Band IV+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA IV	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Right Cheek	0	0.338	0.332	0.105	0.670	0.443
Right Tilted	0	0.091	0.332	0.105	0.423	0.196
Left Cheek	0	0.361	0.332	0.105	0.693	0.466
Left Tilted	0	0.107	0.332	0.105	0.439	0.212

SUM ∑SAR1g (WCDMA Band V+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA V	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Right Cheek	0	0.049	0.332	0.105	0.381	0.154
Right Tilted	0	0.039	0.332	0.105	0.371	0.144
Left Cheek	0	0.047	0.332	0.105	0.379	0.152
Left Tilted	0	0.023	0.332	0.105	0.355	0.128

Result of SUM ∑SAR$_{1g}$ for Body worn

SUM ∑SAR1g (GSM850+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	GSM850	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	5	0.142	0.332	0.105	0.474	0.247
Rear	5	0.354	0.332	0.105	0.686	0.459

SUM ∑SAR1g (GSM1900+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	GSM1900	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	5	0.500	0.332	0.105	0.832	0.605
Rear	5	1.049	0.332	0.105	1.381	1.154

SUM ∑SAR1g (WCDMA Band II+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA II	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	5	0.784	0.332	0.105	1.116	0.889
Rear	5	1.251	0.332	0.105	1.583	1.356

SUM ∑SAR1g (WCDMA Band IV+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA IV	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	5	0.773	0.332	0.105	1.105	0.878
Rear	5	1.223	0.332	0.105	1.555	1.328

SUM ∑SAR1g (WCDMA Band V+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA V	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	5	0.096	0.332	0.105	0.428	0.201
Rear	5	0.198	0.332	0.105	0.530	0.303

Result of SUM ∑SAR1g for Hotspot

SUM ∑SAR1g (GSM850+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	GPRS850	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	10	0.066	0.166	0.053	0.232	0.119
Rear	10	0.226	0.166	0.053	0.392	0.279
Right Side	10	0.014	0.166	0.053	0.180	0.067
Left Side	10	0.061	0.166	0.053	0.227	0.114
Top side	10	--	0.166	0.053	0.166	0.053
Bottom side	10	0.035	0.166	0.053	0.201	0.088

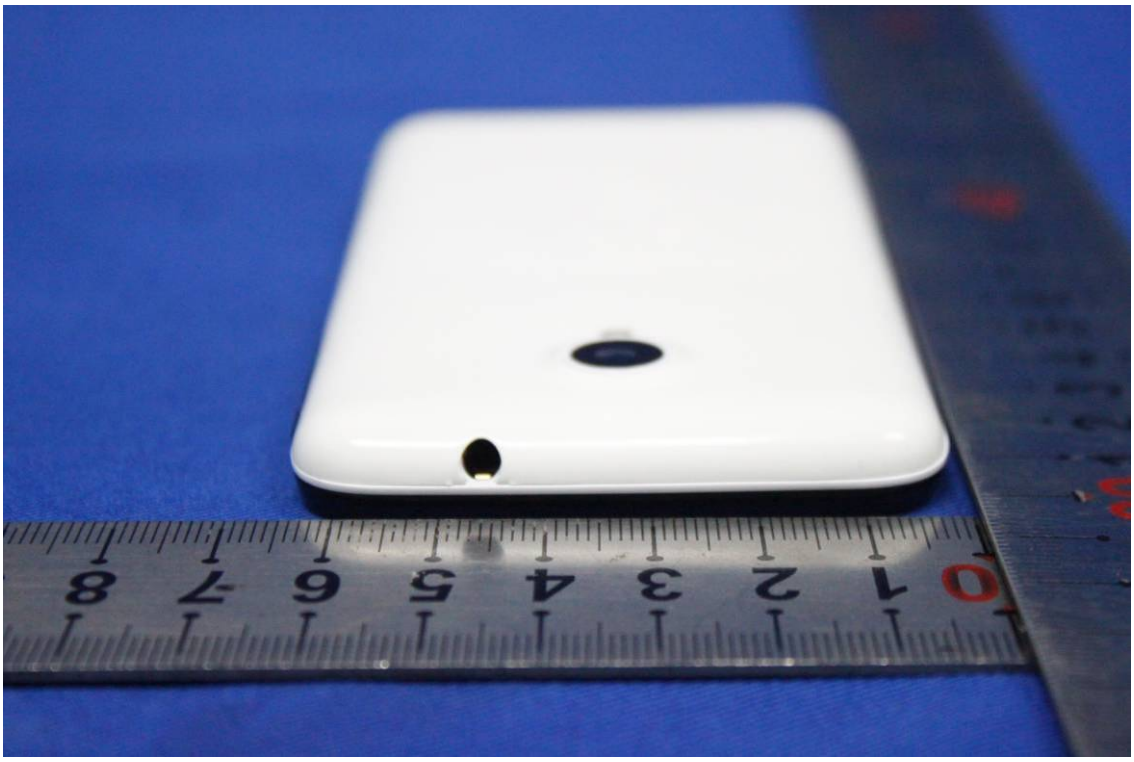
SUM ∑SAR1g (GSM1900+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	GPRS 1900	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	10	0.369	0.166	0.053	0.535	0.422
Rear	10	0.935	0.166	0.053	1.101	0.988
Right Side	10	0.077	0.166	0.053	0.243	0.130
Left Side	10	0.426	0.166	0.053	0.592	0.479
Top side	10	--	0.166	0.053	0.166	0.053
Bottom side	10	0.351	0.166	0.053	0.517	0.404

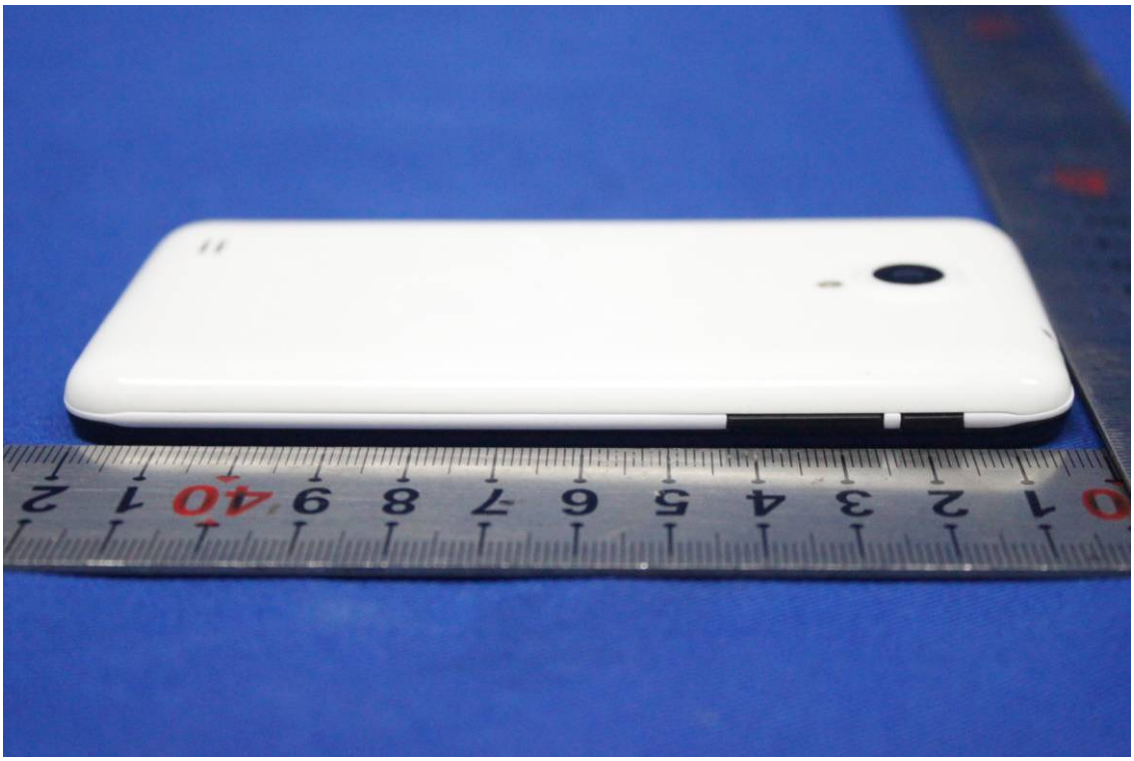
SUM ∑SAR1g (WCDMA Band II+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA II	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	10	0.661	0.166	0.053	0.827	0.714
Rear	10	1.195	0.166	1.361	1.248	1.270
Right Side	10	0.145	0.166	0.053	0.311	0.198
Left Side	10	0.722	0.166	0.053	0.888	0.775
Top side	10	--	0.166	0.053	0.166	0.053
Bottom side	10	0.582	0.166	0.053	0.748	0.635

SUM ∑SAR1g (WCDMA Band IV+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA IV	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	10	0.653	0.166	0.053	0.819	0.706
Rear	10	1.179	0.166	0.053	1.345	1.232
Right Side	10	0.112	0.166	0.053	0.278	0.165
Left Side	10	0.400	0.166	0.053	0.566	0.453
Top side	10	--	0.166	0.053	0.166	0.053
Bottom side	10	0.537	0.166	0.053	0.703	0.590

SUM ∑SAR1g (WCDMA Band V+WLAN(2.4G) or Bluetooth)						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	SUM SAR(1g)[W/kg]
	[mm]	WCDMA V	WLAN 2.4G	Bluetooth	WWAN + WLAN(2.4G)	WWAN + Bluetooth
Front	10	0.050	0.166	0.053	0.216	0.103
Rear	10	0.138	0.166	0.053	0.304	0.191
Right Side	10	0.015	0.166	0.053	0.181	0.068
Left Side	10	0.062	0.166	0.053	0.228	0.115
Top side	10	--	0.166	0.053	0.166	0.053
Bottom side	10	0.022	0.166	0.053	0.188	0.075

13. EUT PHOTO





14. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Calibration	Calibration Due
P C	HP	Core(rm)3.16G	CZCO48171H	N/A	N/A
Signal Generator	Agilent	E8257C	US37101915	11/21/2014	11/20/2015
S-Parameter Network Analyzer	Agilent	E5071B	MY42301382	03/03/2015	03/02/2016
Wireless Communication Test Set	R&S	CMU200	SN:109525	01/12/2015	01/11/2016
Power Meter	Agilent	E4416A	GB41292714	03/03/2015	03/02/2016
Peak & Average sensor	Agilent	E9327A	us40441788	03/03/2015	03/02/2016
Power meter	Anritsu	ML2495A	1445010	03/03/2015	03/02/2016
Power sensor	Anritsu	MA2411B	1339220	03/03/2015	03/02/2016
E-field PROBE	SPEAG	EX3DV4	3661	04/24/2015	04/23/2016
DAE	SPEAG	DEA4	918	12/29/2014	12/28/2015
DIPOLE 835MHZ ANTENNA	SPEAG	D835V2	4d114	07/30/2013	07/27/2016
DIPOLE 1800MHZ ANTENNA	SPEAG	D1800V2	2d170	07/31/2013	07/27/2016
DIPOLE 1900MHZ ANTENNA	SPEAG	D1900V2	5d136	07/22/2013	07/29/2016
DUMMY PROBE	SPEAG	DP_2	SPDP2001AA	N/A	N/A
SAM PHANTOM (ELI4 v4.0)	SPEAG	QDOVA001BB	1102	N/A	N/A
Twin SAM Phantom	SPEAG	QD000P40CD	1609	N/A	N/A
ROBOT	SPEAG	TX60	F10/5E6AA1/A101	N/A	N/A
ROBOT KRC	SPEAG	CS8C	F10/5E6AA1/C101	N/A	N/A
LIQUID CALIBRATION KIT	ANTENNESSA	41/05 OCP9	00425167	N/A	N/A

15. FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

16. REFERENCES

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environ-mental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commision, O_ce of Engineering & Technology, Washington, DC, 1997.

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-_eld scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.

[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz – 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[6] ANSI, ANSI/IEEE C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-_eld probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120{124.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-_eld probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172{175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions onMicrowave Theory and Techniques, vol. 44, no. 10, pp. 1865{1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992..Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10

17. ATTACHMENTS

Exhibit	Content
1	System Performance Check Plots
2	Dipole calibration report D835V2 SN:4d114
3	Dipole calibration report D1800V2 SN: 2d170
4	Dipole calibration report D1900V2-SN:5d136
5	Probe calibration report EX3DV4 SN3661
6	DAE calibration report DEA4 SD000D04BK SN:918
7	SAR Test Plots

APPENDIX A: PLOTS OF PERFORMANCE CHECK

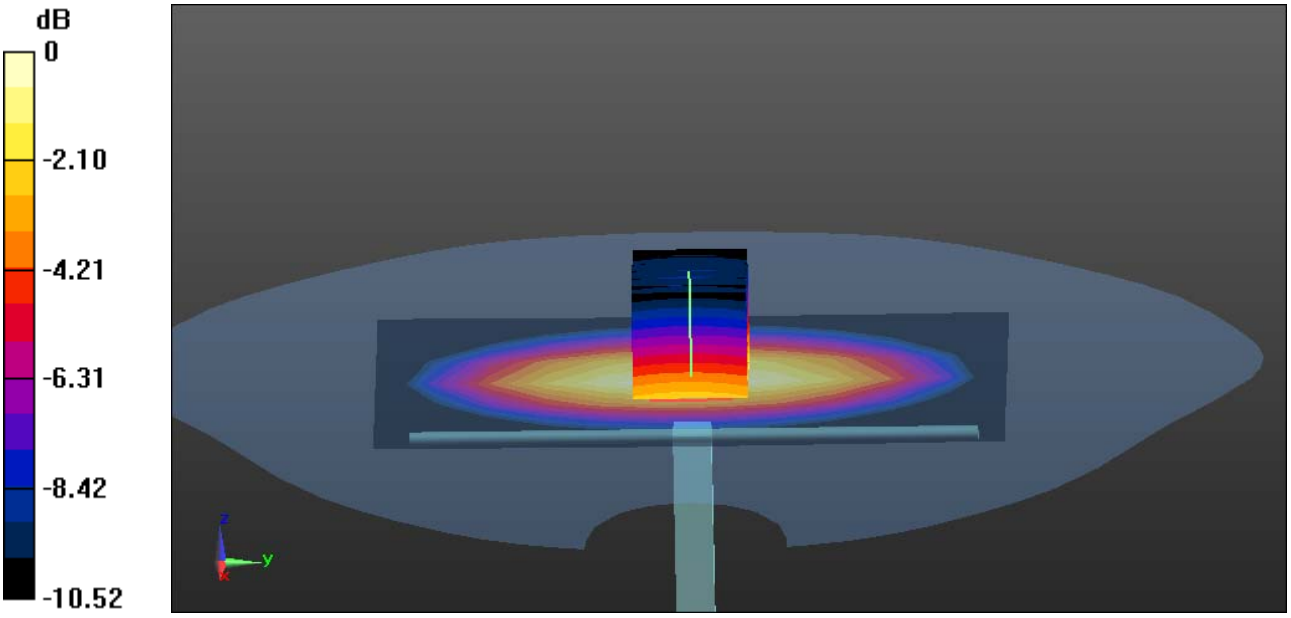
The plots are showing as followings.

Test Laboratory: Compliance Certification Services Inc. Date: 7/10/2015
System Performance Check-Head D835
DUT: Dipole 835 MHz ; Type: D835V2; Serial: 4d114
Communication System: UID 0, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.9166 S/m; ε_r = 42.88; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3661; ConvF(9.6, 9.6, 9.6); Calibrated: 4/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies Low 1 GHz/Pin=250 mW, dist=15 mm (EX-Probe)/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.78 W/kg

System Performance Check at Frequencies Low 1 GHz/Pin=250 mW, dist=15 mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.63 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.45 W/kg
SAR(1 g) = 2.27 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.90 W/kg



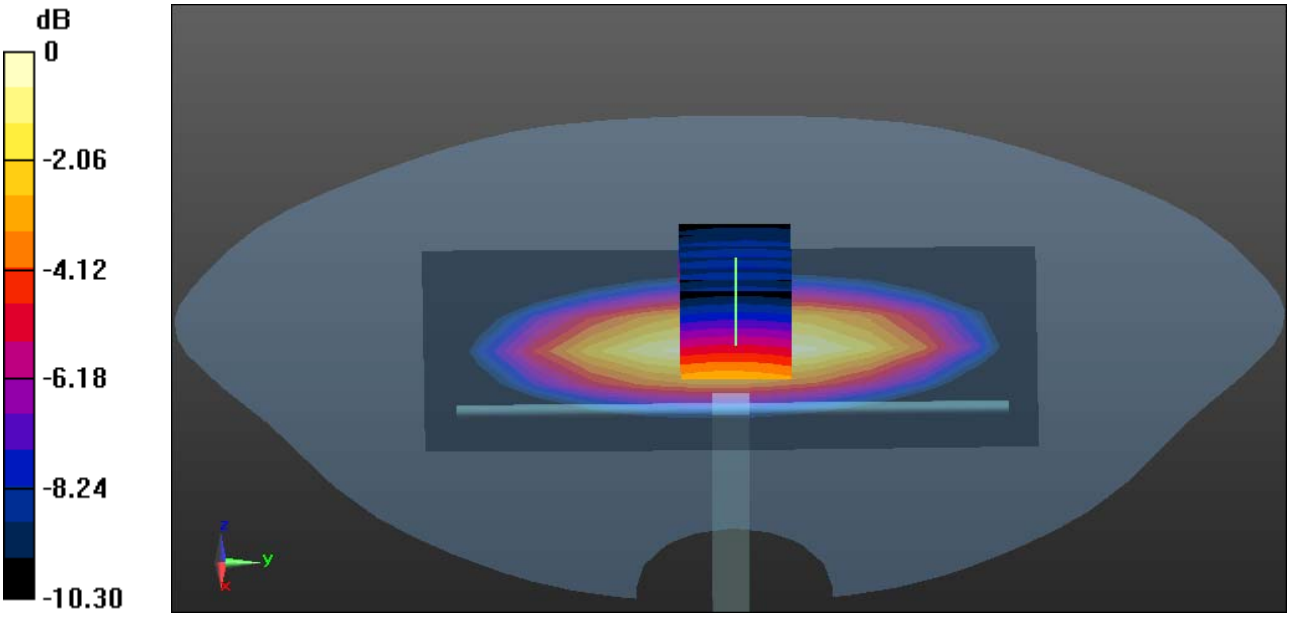
0 dB = 2.90 W/kg = 4.62 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 7/10/2015
System Performance Check-Body D835
DUT: Dipole 835 MHz ; Type: D835V2; Serial: 4d114
Communication System: UID 0, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.9915 S/m; ε_r = 55.47; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3661; ConvF(9.68, 9.68, 9.68); Calibrated: 4/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.99 W/kg

System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.33 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 2.99 W/kg



0 dB = 2.99 W/kg = 4.76 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 7/20/2015
System Performance Check-Head D1800
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: 2d170
Communication System: UID 10000, CW; Communication System Band: D1800 (1800.0 MHz);
Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used (extrapolated): f = 1800 MHz; σ = 1.428 S/m; ε_r = 38.77; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

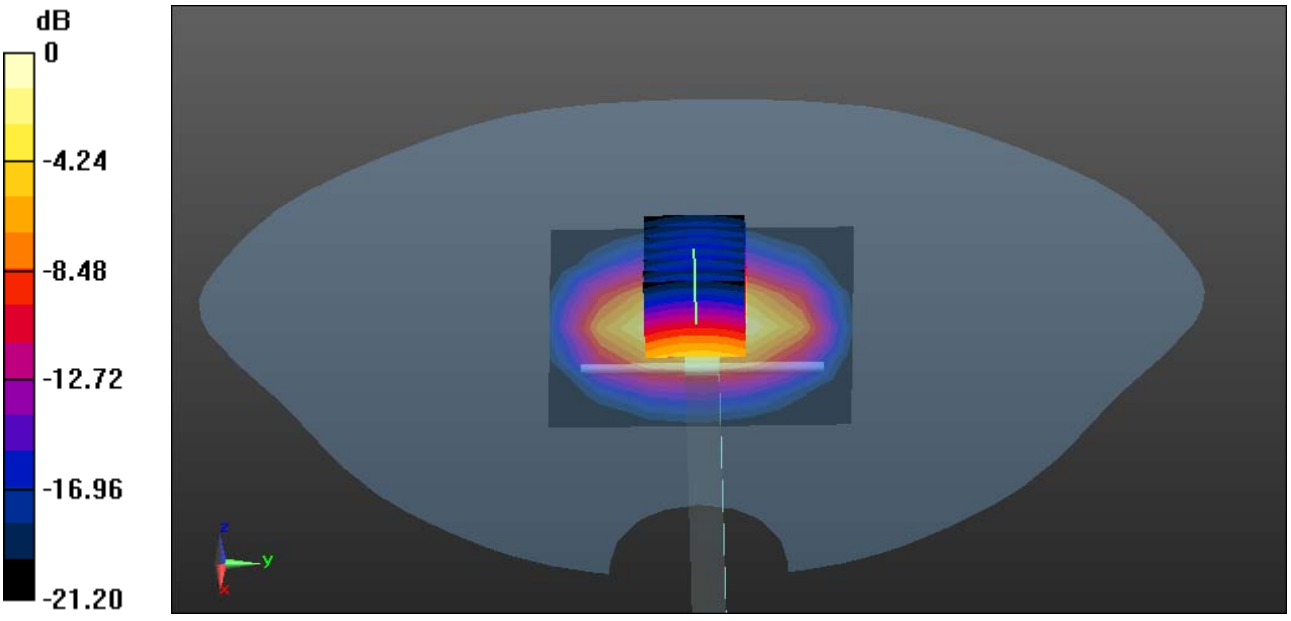
- Probe: EX3DV4 - SN3661; ConvF(8.43, 8.43, 8.43); Calibrated: 4/24/2015;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW,(EX-Probe)/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

Info: Extrapolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 12.1 W/kg

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW,(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.73 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 19.3 W/kg
SAR(1 g) = 9.29 W/kg; SAR(10 g) = 4.52 W/kg

Maximum value of SAR (measured) = 12.1 W/kg



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

Test Laboratory: Compliance Certification Services Inc. Date: 7/20/2015
System Performance Check-Body D1800
DUT: Dipole 1800 MHz ; Type: D1800V2; Serial: 2d170
Communication System: UID 10000, CW; Communication System Band: D1800 (1800.0 MHz);
Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used (extrapolated): f = 1800 MHz; σ = 1.582 S/m; ε_r = 51.08; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

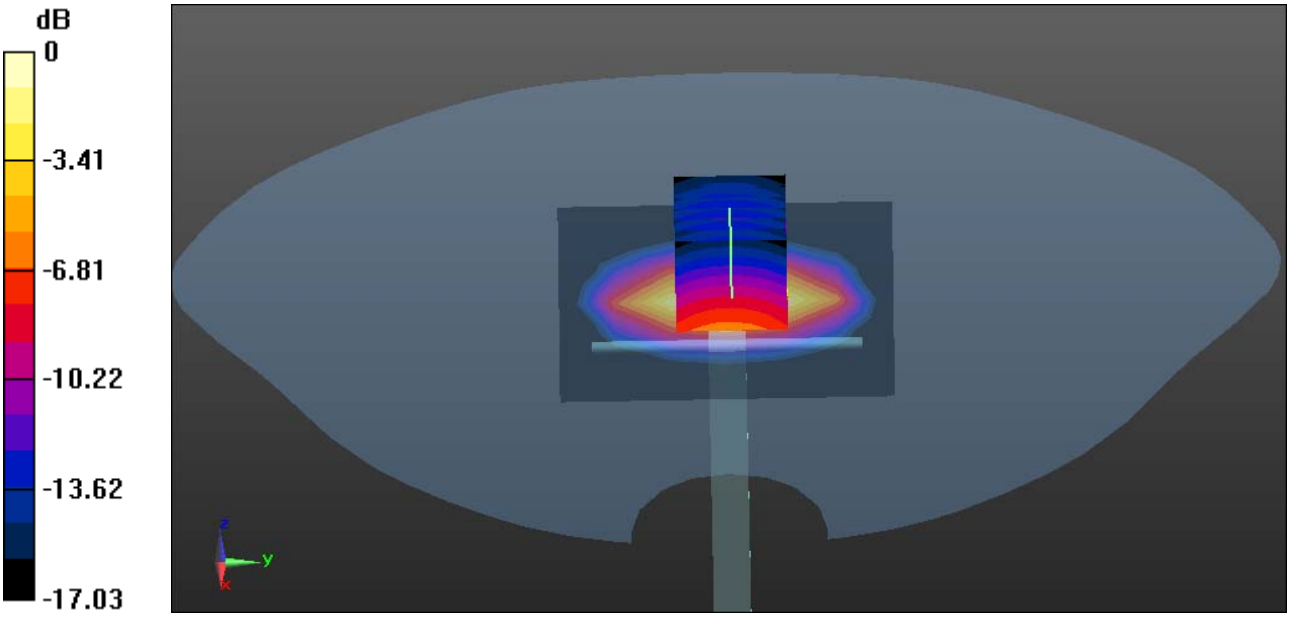
- Probe: EX3DV4 - SN3661; ConvF(7.92, 7.92, 7.92); Calibrated: 4/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) (23.6 dBm)/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

Info: Extrapolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 16.0 W/kg

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) (23.6 dBm)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.0 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 19.2 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.39 W/kg

Maximum value of SAR (measured) = 16.0 W/kg



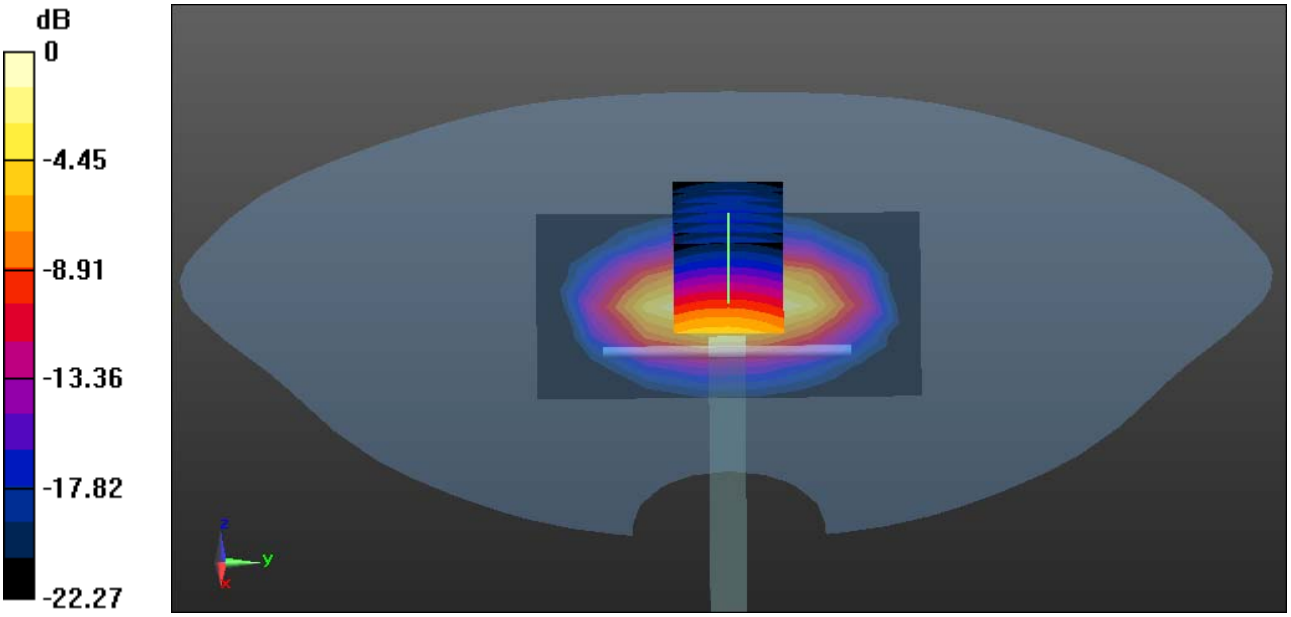
0 dB = 16.0 W/kg = 12.04 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 7/12/2015
System Performance Check-Head D1900
DUT: Dipole 1900 MHz ; Type: D1900V2; Serial: 5d136
Communication System: UID 0, CW; Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.397 S/m; ε_r = 39.5; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3661; ConvF(7.94, 7.94, 7.94); Calibrated: 4/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 14.4 W/kg

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 109.0 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 21.6 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 4.81 W/kg
Maximum value of SAR (measured) = 15.5 W/kg



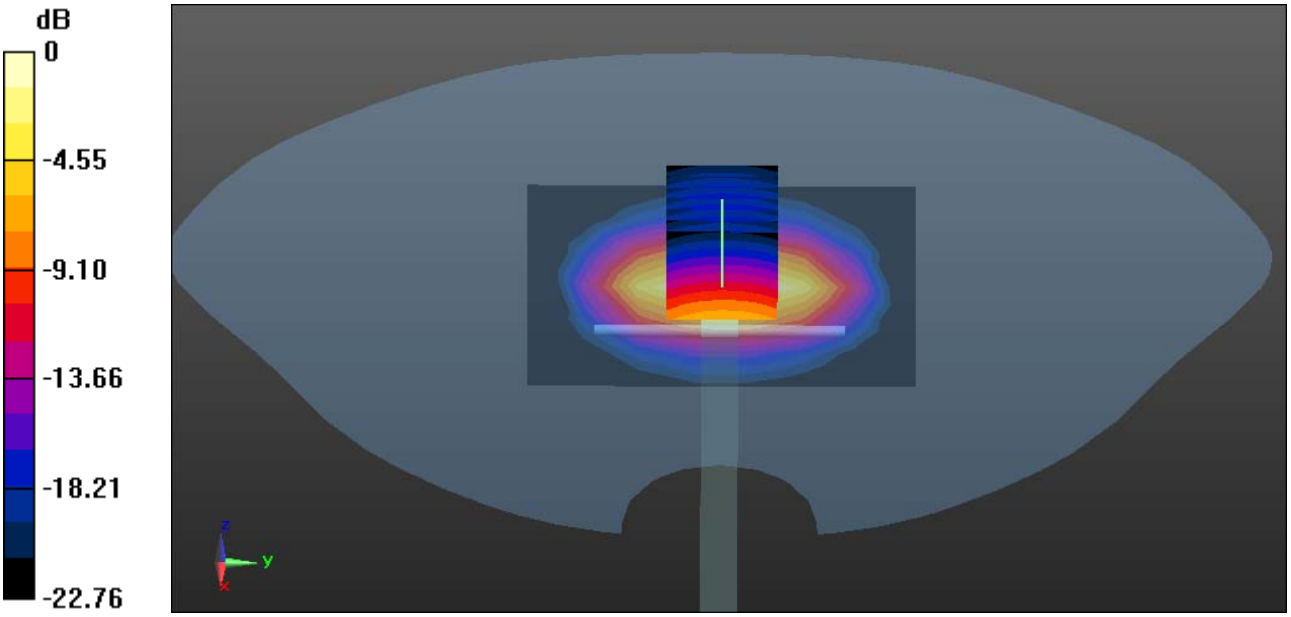
0 dB = 15.5 W/kg = 11.90 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 7/12/2015
System Performance Check-Body D1900
DUT: Dipole 1900 MHz ; Type: D1900V2; Serial: 5d136
Communication System: UID 0, CW; Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.561 S/m; ε_r = 52.32; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3661; ConvF(8.08, 8.08, 8.08); Calibrated: 4/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 15.7 W/kg

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.8 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 23.2 W/kg
SAR(1 g) = 10.9 W/kg; SAR(10 g) = 5.11 W/kg
Maximum value of SAR (measured) = 16.9 W/kg



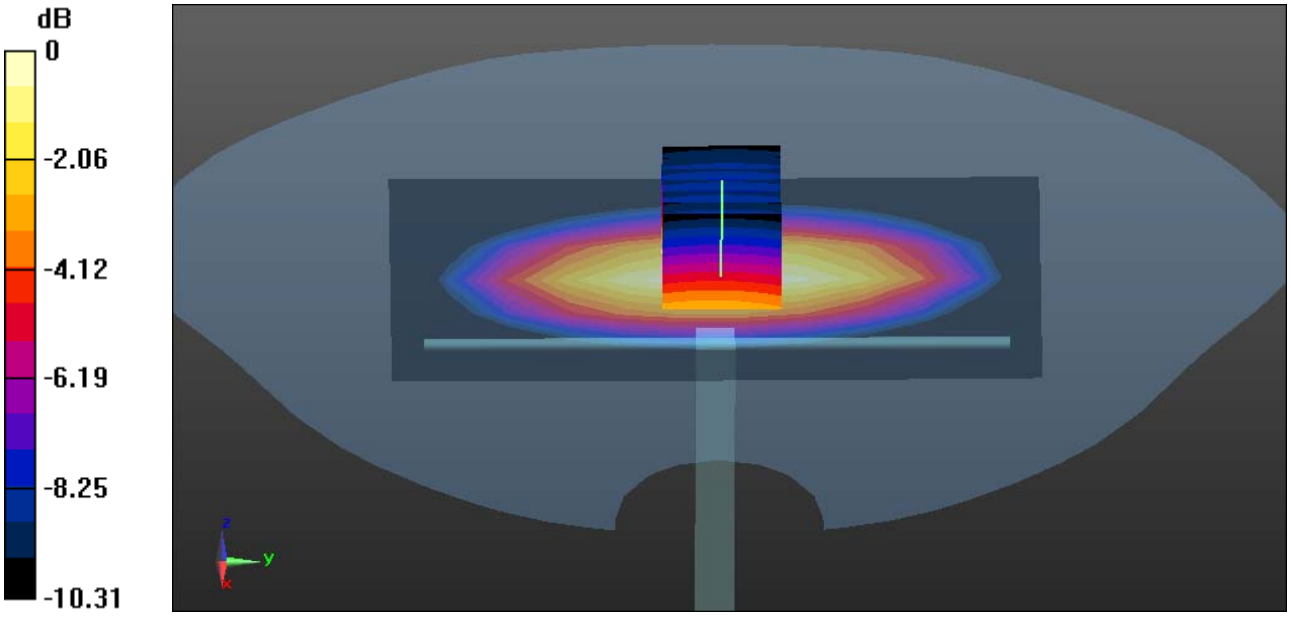
0 dB = 16.9 W/kg = 12.28 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 8/12/2015
System Performance Check-Body D835
DUT: Dipole 835 MHz ; Type: D835V2; Serial: 4d114
Communication System: UID 0, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.978 S/m; ε_r = 53.445; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3661; ConvF(9.68, 9.68, 9.68); Calibrated: 4/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.95 W/kg

System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.33 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.54 W/kg



0 dB = 2.95 W/kg = 4.70 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 8/12/2015
System Performance Check-Body D1800
DUT: Dipole 1800 MHz ; Type: D1800V2; Serial: 2d052
Communication System: UID 10000, CW; Communication System Band: D1800 (1800.0 MHz);
Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used (extrapolated): f = 1800 MHz; σ = 1.581 S/m; ε_r = 51.088; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

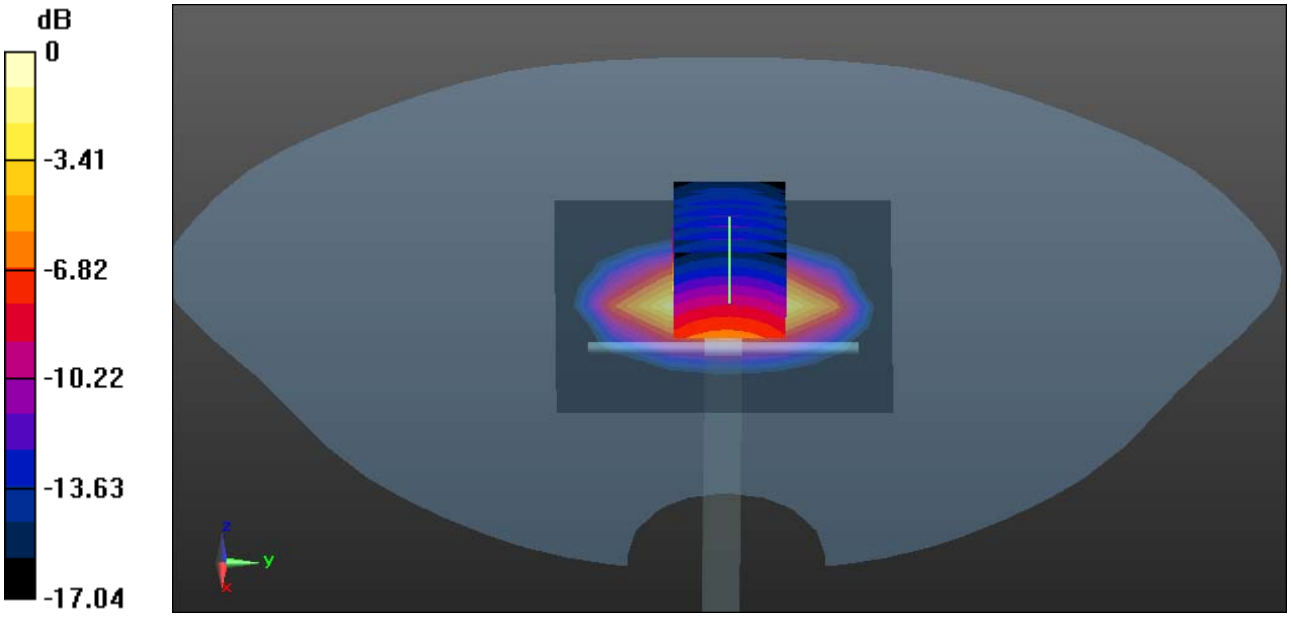
- Probe: EX3DV4 - SN3661; ConvF(7.92, 7.92, 7.92); Calibrated: 4/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) (23.6 dBm)/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

Info: Extrapolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 15.9 W/kg

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) (23.6 dBm)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.0 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 19.2 W/kg
SAR(1 g) = 10.21 W/kg; SAR(10 g) = 5.37 W/kg

Info: Extrapolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 16.0 W/kg



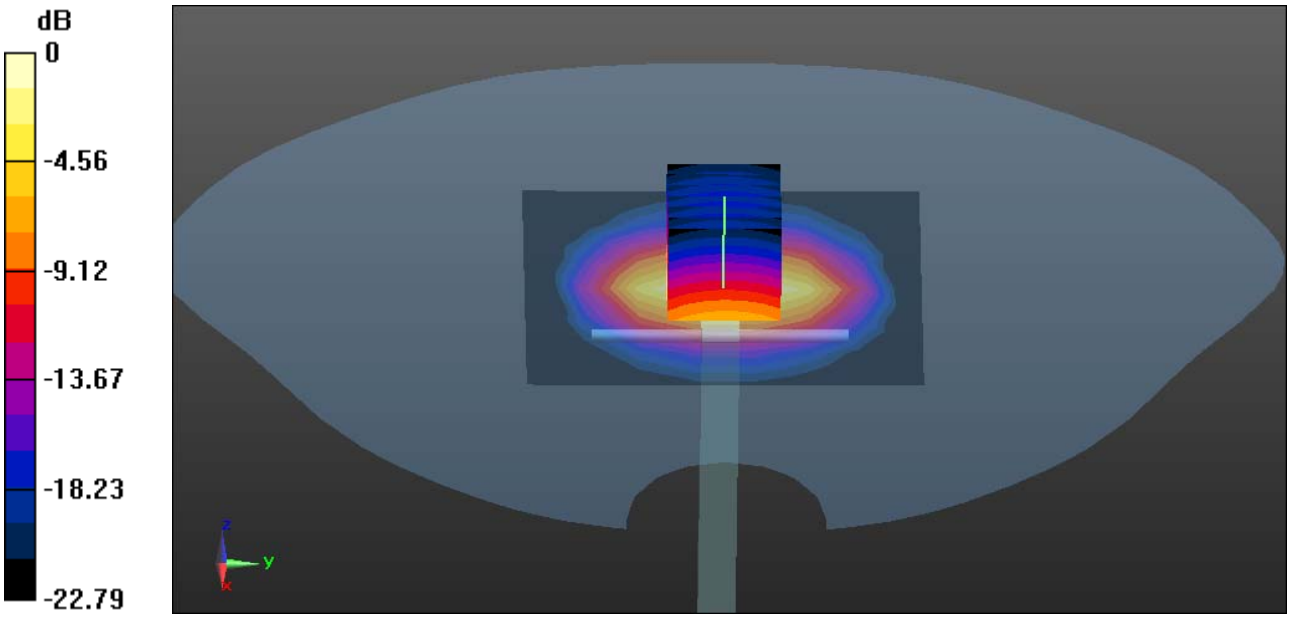
0 dB = 16.0 W/kg = 12.04 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 8/13/2015
System Performance Check-Body D1900
DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: 5d136
Communication System: UID 0, CW; Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.563 S/m; ε_r = 52.456; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3661; ConvF(8.08, 8.08, 8.08); Calibrated: 4/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn918; Calibrated: 12/29/2014
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 15.7 W/kg

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.8 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 23.2 W/kg
SAR(1 g) = 10.59 W/kg; SAR(10 g) = 5.12 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



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

APPENDIX B: DASY CALIBRATION CERTIFICATE

The DASY Calibration Certificates are showing as followings .

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

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

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

Accreditation No.: SCS 108

Client CCS-CN (Auden)

Certificate No: D835V2-4d114_Jul13

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d114
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 30, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: July 30, 2013

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

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

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S Servizio svizzero di taratura
Swiss Calibration Service

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	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	41.8 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.50 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.24 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.53 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.32 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 Ω - 1.3 jΩ
Return Loss	- 32.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.2 Ω - 3.0 jΩ
Return Loss	- 29.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.399 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 29, 2010

DASY5 Validation Report for Head TSL

Date: 30.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d114

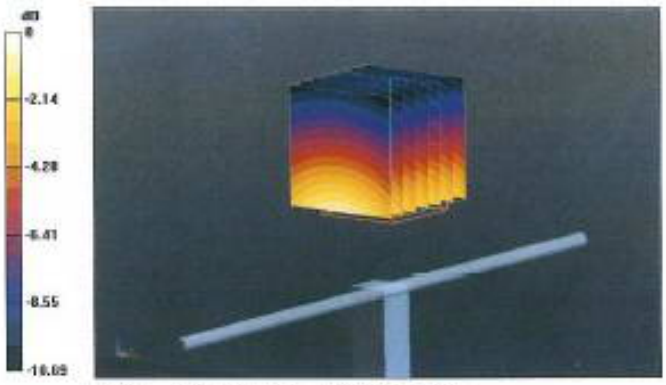
Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 41.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

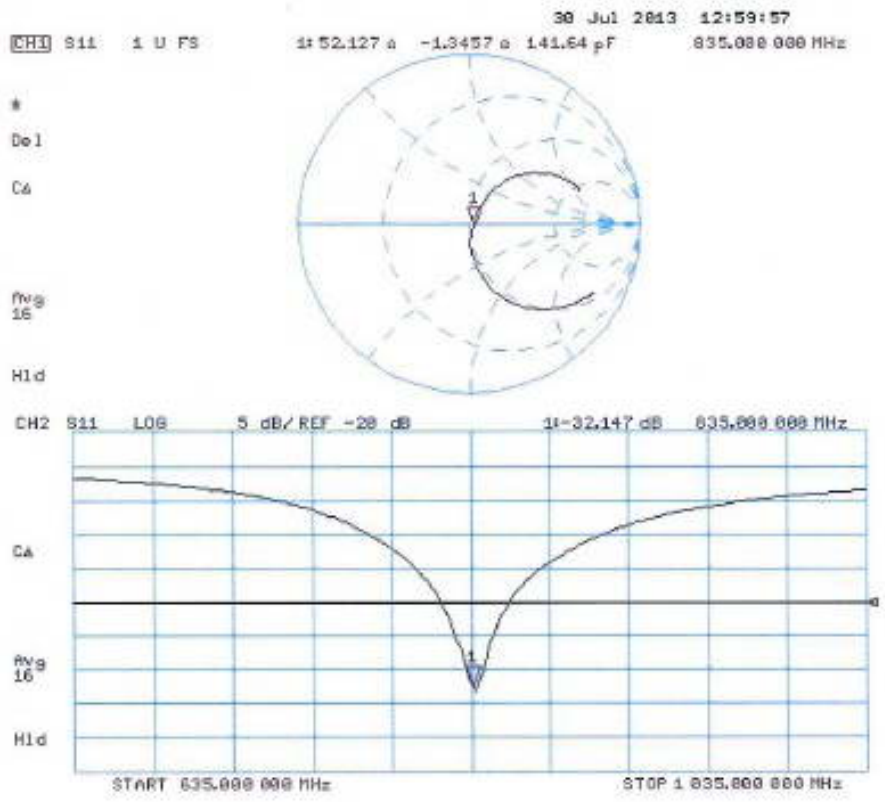
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.702 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.60 W/kg
SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (measured) = 2.81 W/kg



0 dB = 2.81 W/kg = 4.49 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

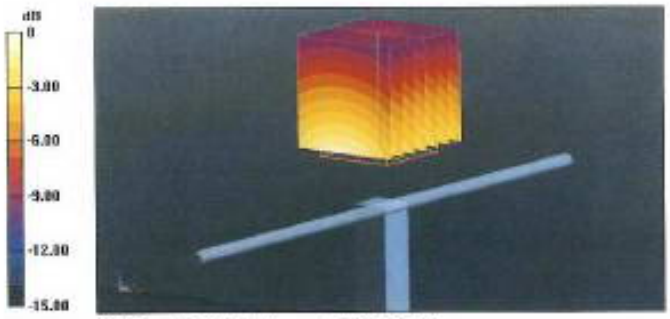
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d114

Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 S/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

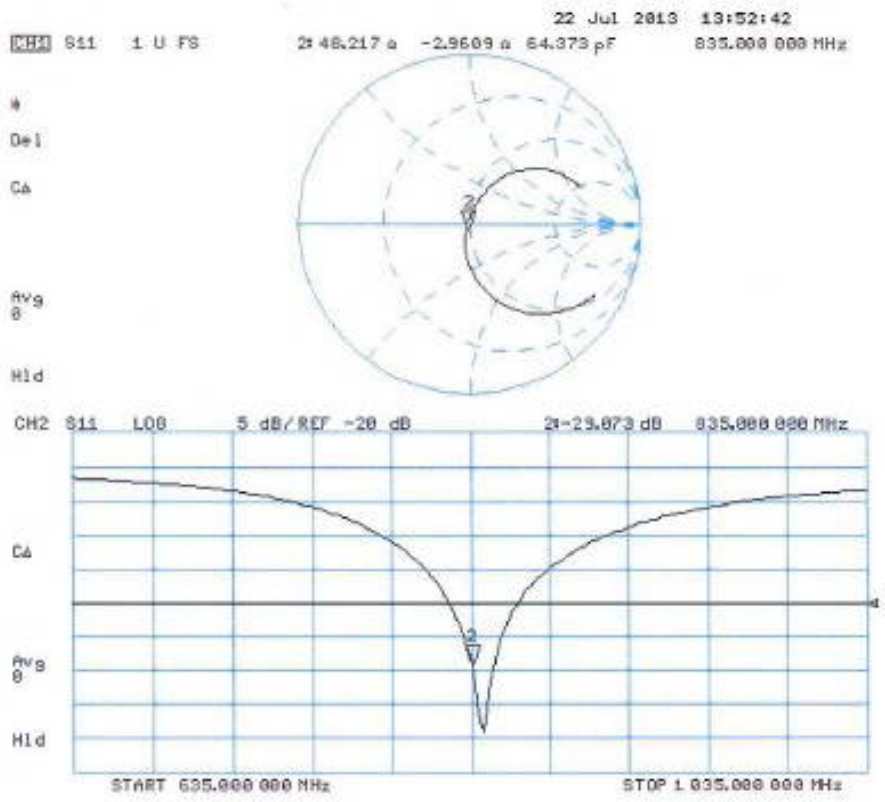
- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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 = 54.853 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.61 W/kg
Maximum value of SAR (measured) = 2.83 W/kg



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

Impedance Measurement Plot for Body TSL



D835V2,Serial No.4d114 Extended Dipole Calibrations

Per IEEE Std 1528-2003,the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.
Per KDB 865664 D01,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.

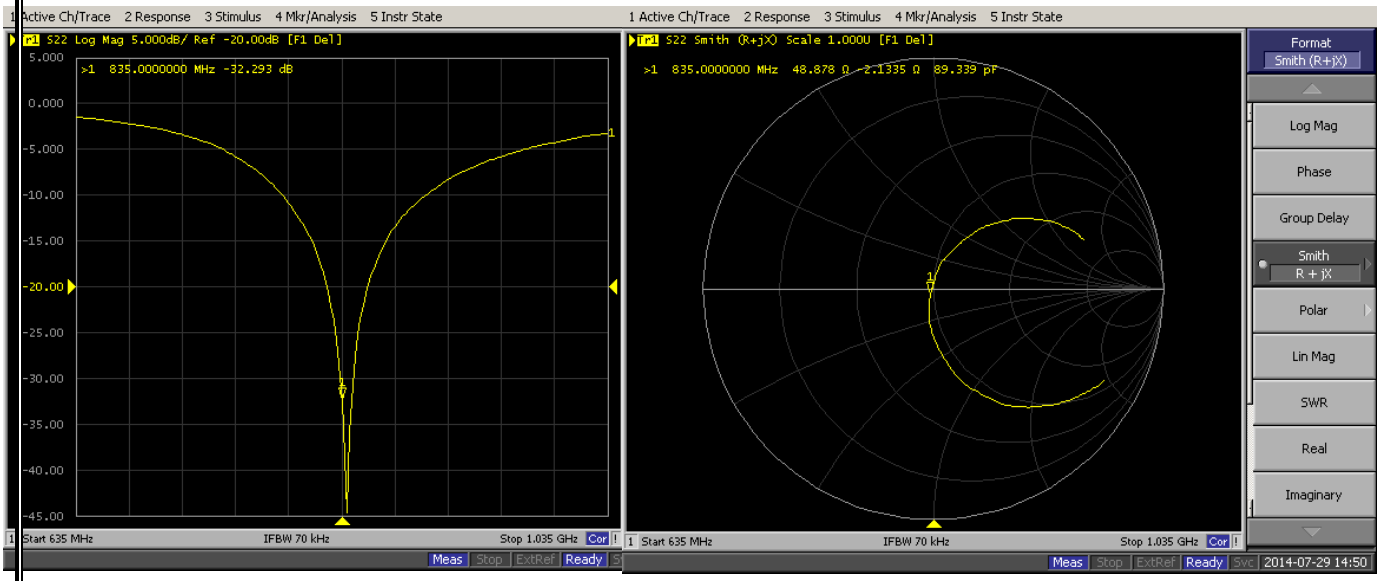
Justification of the extended calibration

D835V2 Serial No.4d114						
835 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.30.2013	-32.147	--	52.127	--	-1.346	--
7.29.2014	-32.293	0.45	48.878	3.249	-2.134	0.788

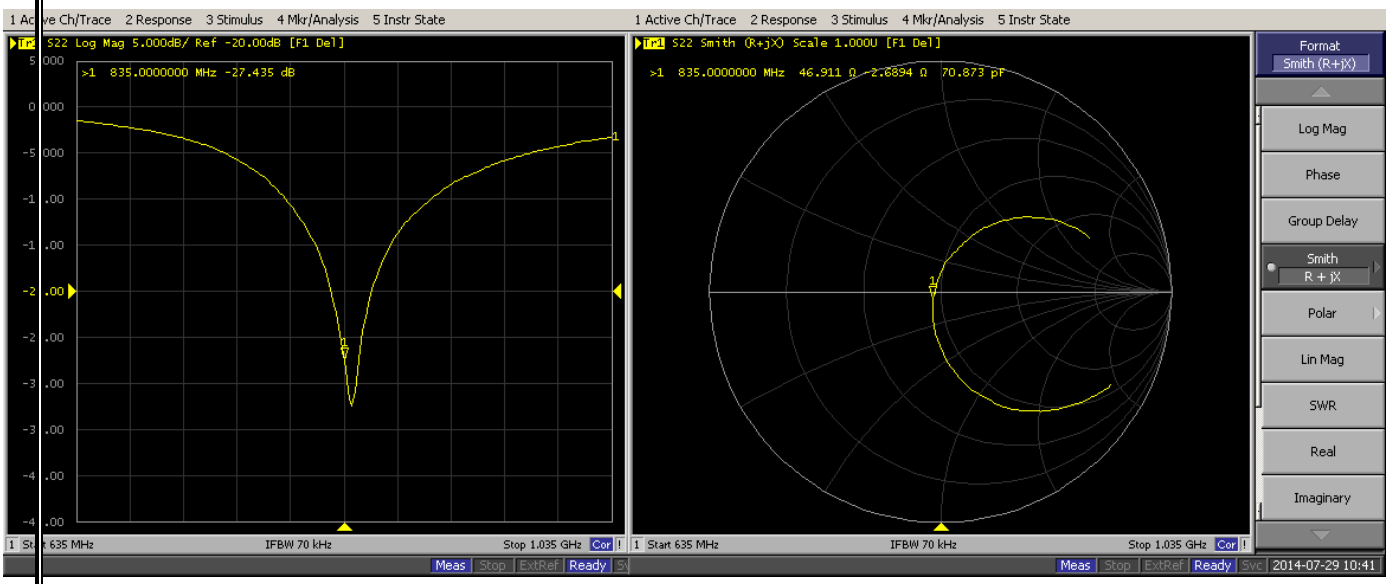
D835V2 Serial No.4d114						
835 Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.30.2013	-29.073	--	48.217	--	-2.961	--
7.29.2014	-27.435	5.63	46.911	1.306	-2.689	0.272

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data D850V2 Serial No.4d114
835MHz-Head



835MHz-Body



Per IEEE Std 1528-2003,the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.
Per KDB 865664 D01,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.

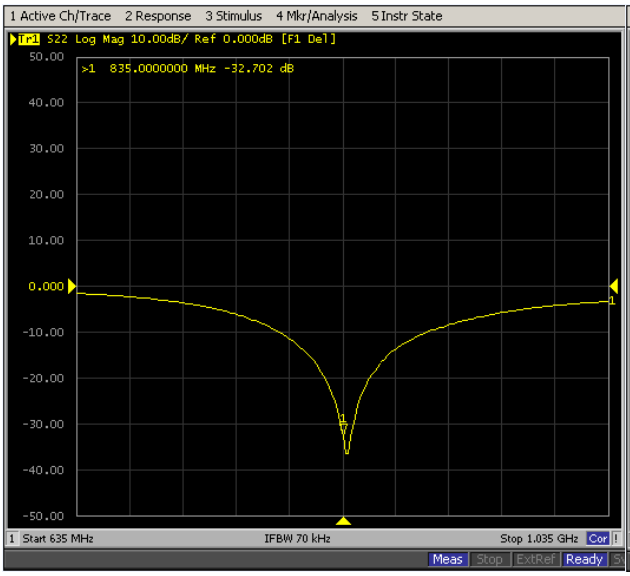
Justification of the extended calibration

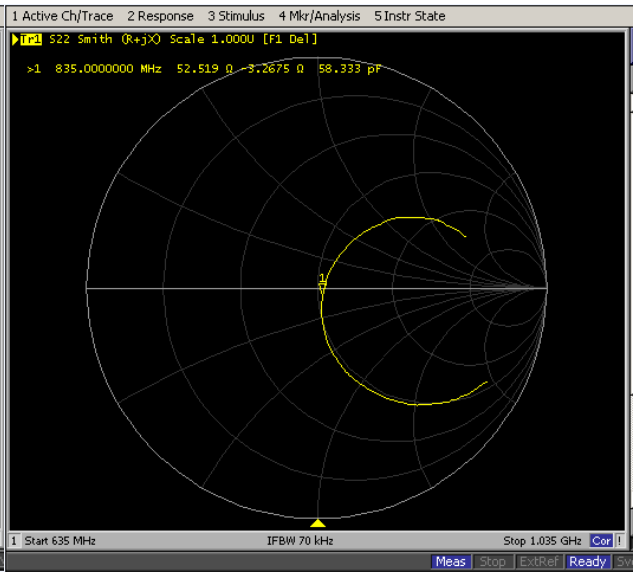
D835V2 Serial No.4d114						
835 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.30.2013	-32.147	--	52.127	--	-1.346	--
7.29.2014	-32.293	0.45	48.878	3.249	-2.134	0.788
7.28.2015	-32.702	1.27	52.519	3.641	-3.267	1.133

D835V2 Serial No.4d114						
835 Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.30.2013	-29.073	--	48.217	--	-2.961	--
7.29.2014	-27.435	5.63	46.911	1.306	-2.689	0.272
7.28.2015	-27.436	0.01	47.229	0.318	-3.066	0.377

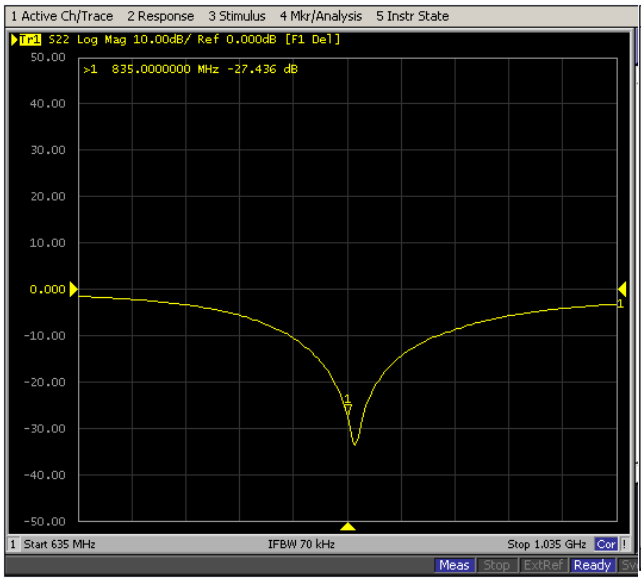
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

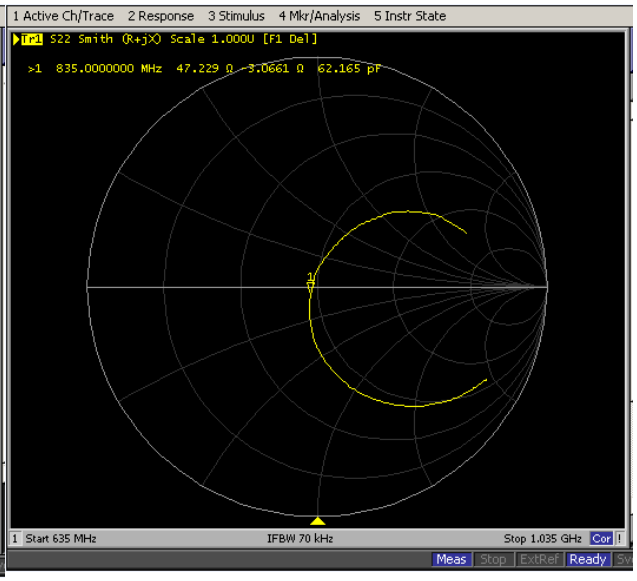
Dipole Verification Data D850V2 Serial No.4d114
835MHz-Head





835MHZ-Body





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Accreditation No.: SCS 108

Client CCS-CN (Auden)

Certificate No: D1800V2-2d170_Jul13

CALIBRATION CERTIFICATE

Object D1800V2 - SN: 2d170

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

Calibration date: July 31, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: July 31, 2013

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

Certificate No: D1800V2-2d170_Jul13 Page 1 of 8

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.4 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.4 ± 6 %	1.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.7 Ω - 3.3 jΩ
Return Loss	- 29.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.7 Ω - 3.4 jΩ
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.212 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 04, 2008

DASY5 Validation Report for Head TSL

Date: 31.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d170

Communication System: UID 0 - CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.37 S/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

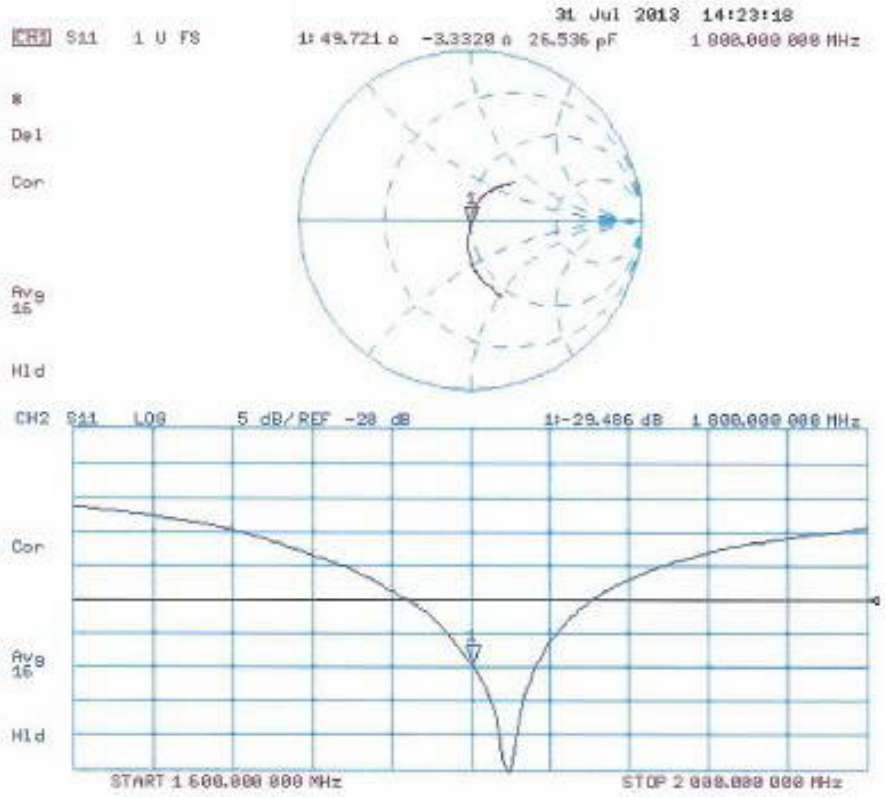
DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.04, 5.04, 5.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.137 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.59 W/kg; SAR(10 g) = 5.07 W/kg
Maximum value of SAR (measured) = 11.9 W/kg

0 dB = 11.9 W/kg = 10.76 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 31.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

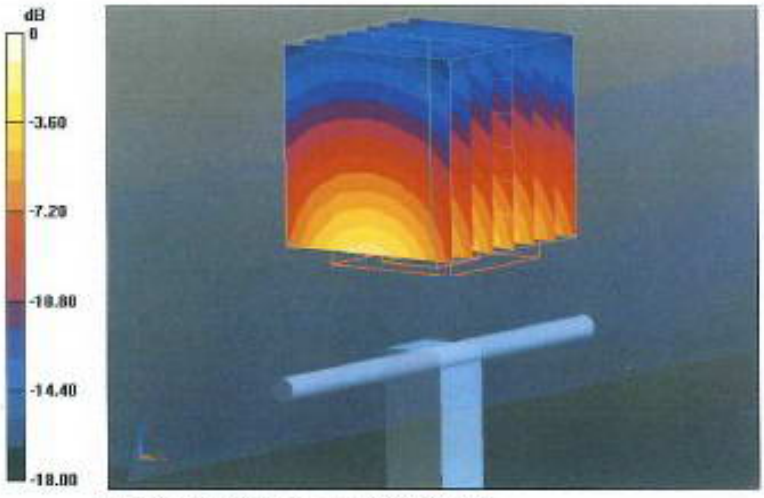
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d170

Communication System: UID 0 - CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.53 S/m; ε_r = 51.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

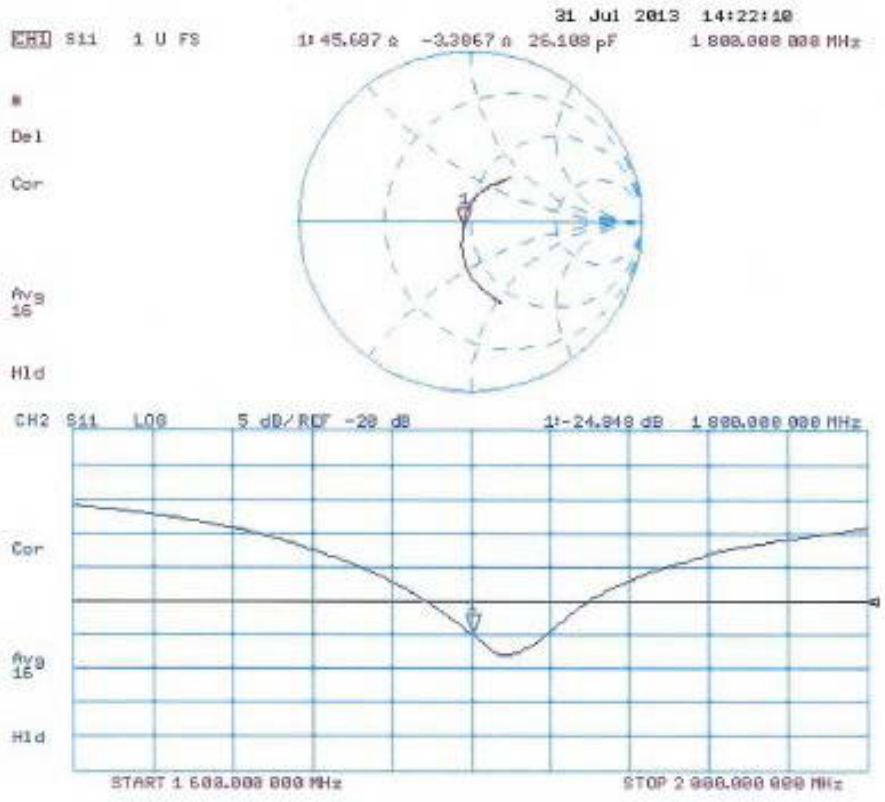
- Probe: ES3DV3 - SN3205; ConvF(4.73, 4.73, 4.73); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.137 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.94 W/kg; SAR(10 g) = 5.25 W/kg
Maximum value of SAR (measured) = 12.6 W/kg



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

Impedance Measurement Plot for Body TSL



D1800V2, Serial No.2d170 Extended Dipole Calibrations

Per IEEE Std 1528-2003,the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement

Per KDB 865664 D01,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.

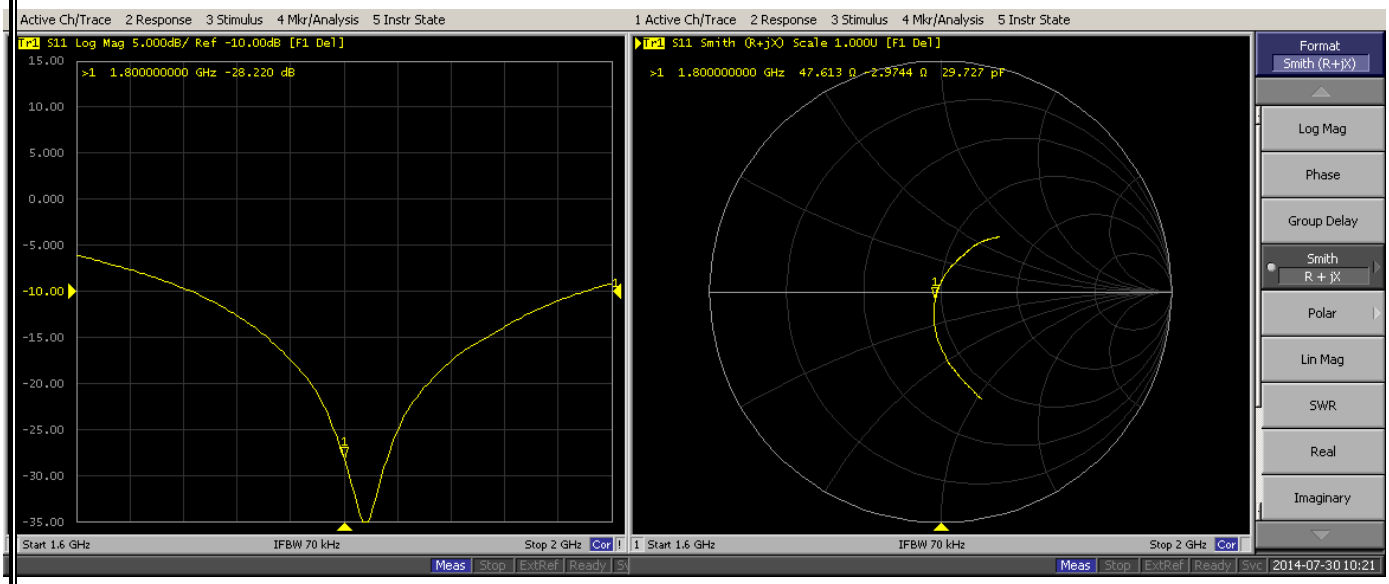
Justification of the extended calibration

D1800V2 Serial No.2d170						
1800 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.31.2013	-29.486	--	49.721	--	-3.332	--
7.30.2014	-28.220	4.29	47.613	2.108	-2.974	0.358

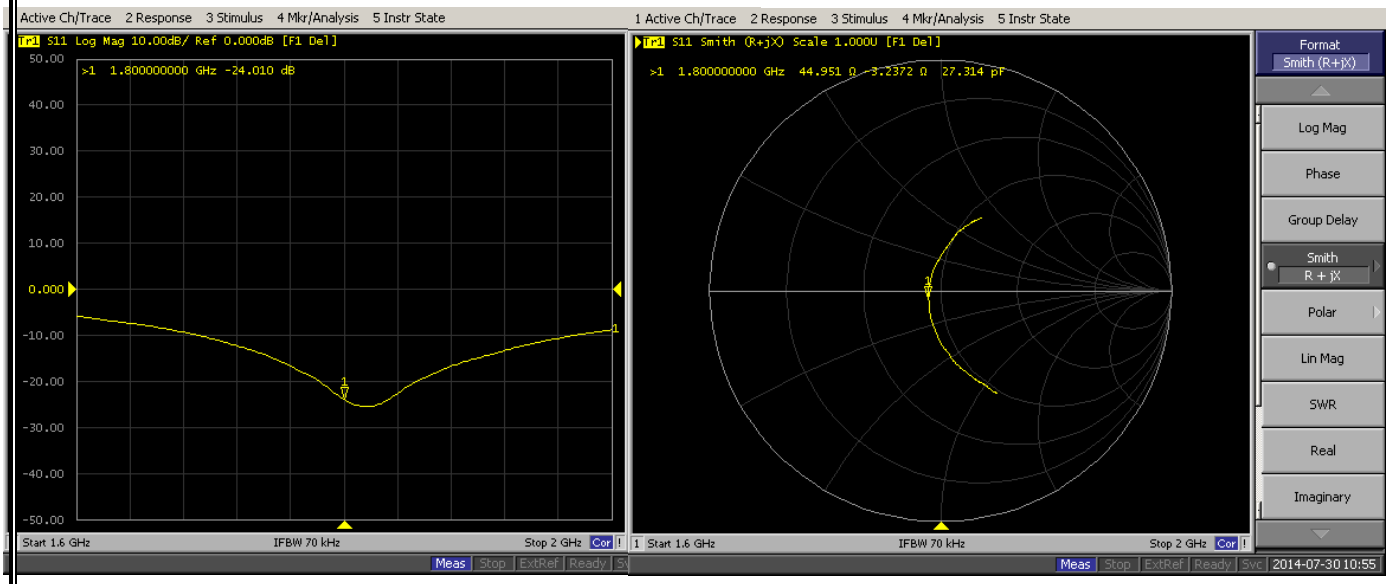
D1800V2 Serial No.2d170						
1800 Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.31.2013	-24.848	--	45.687	--	-3.387	--
7.30.2014	-24.010	3.37	44.951	0.736	-3.237	0.15

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data D1800V2 Serial No.2d170
1800MHz-Head



1800MHz-Body



Per IEEE Std 1528-2003,the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement
Per KDB 865664 D01,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.

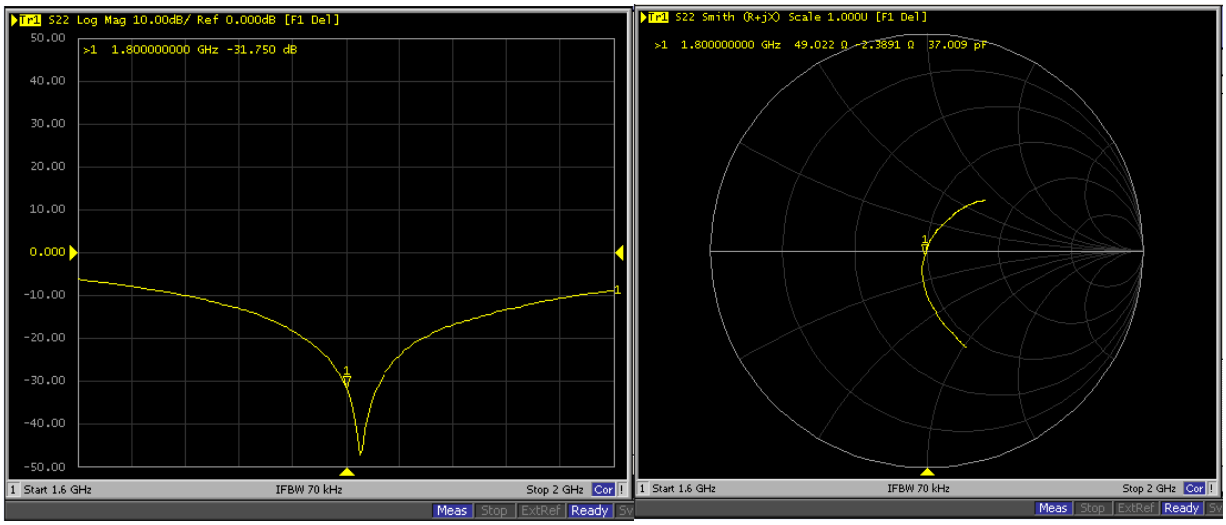
Justification of the extended calibration

D1800V2 Serial No.2d170						
1800 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.31.2013	-29.486	--	49.721	--	-3.332	--
7.30.2014	-28.220	4.29	47.613	2.108	-2.974	0.358
7.28.2015	-31.750	12.50	49.022	1.409	-2.389	0.585

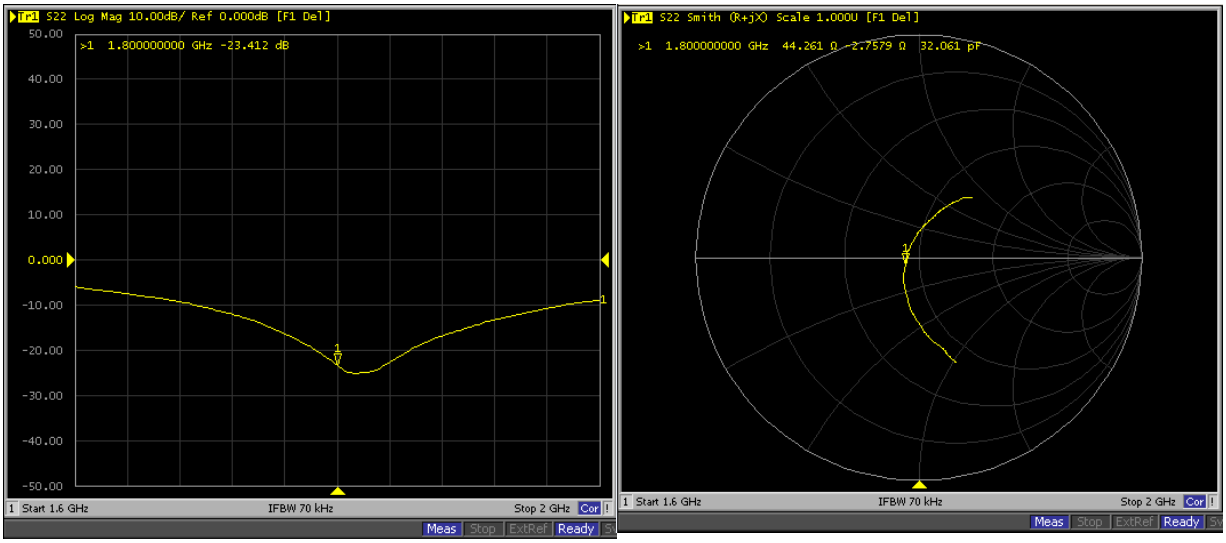
D1800V2 Serial No.2d170						
1800 Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.31.2013	-24.848	--	45.687	--	-3.387	--
7.30.2014	-24.010	3.37	44.951	0.736	-3.237	0.15
7.28.2015	-23.412	2.49	44.261	0.690	-2.758	0.479

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data D1800V2 Serial No.2d170
1800MHz-Head



1800MHz- Body



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

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

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

Accreditation No.: SCS 108

Client CCS-CN (Auden)

Certificate No: D1900V2-5d136_Jul13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d136
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 22, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: July 22, 2013

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

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.36 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 Ω + 7.2 jΩ
Return Loss	- 22.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω + 7.3 jΩ
Return Loss	- 22.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 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	April 14, 2010

DASY5 Validation Report for Head TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

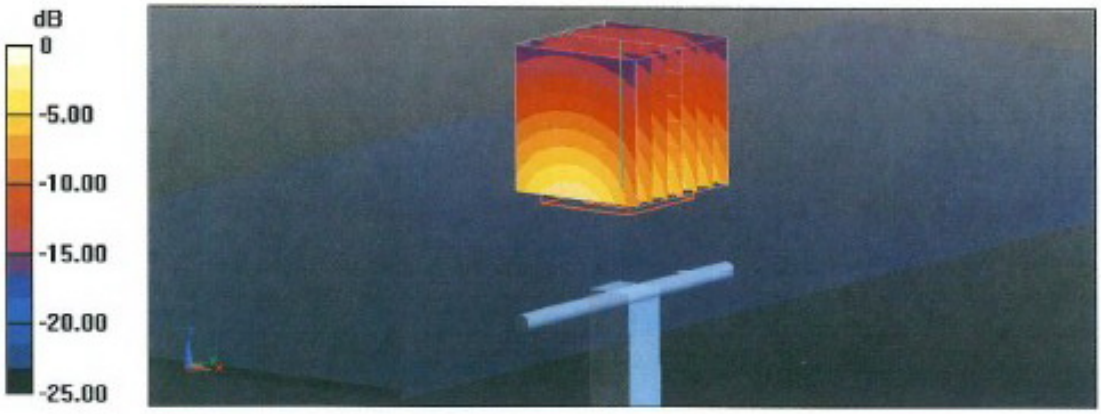
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d136

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

DASY52 Configuration:

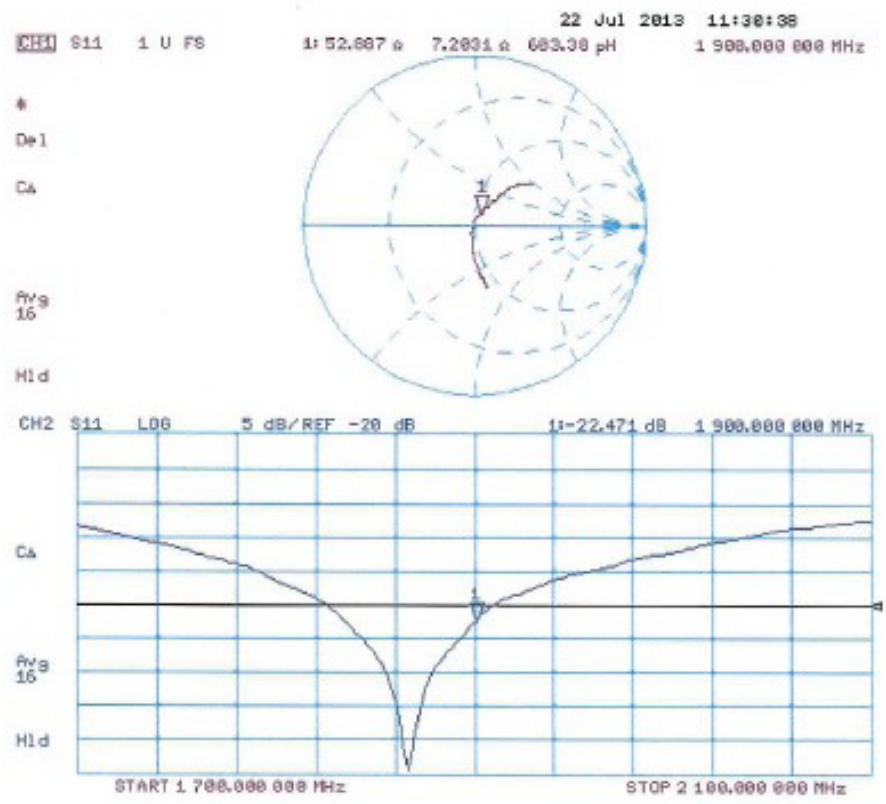
- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.803 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.29 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

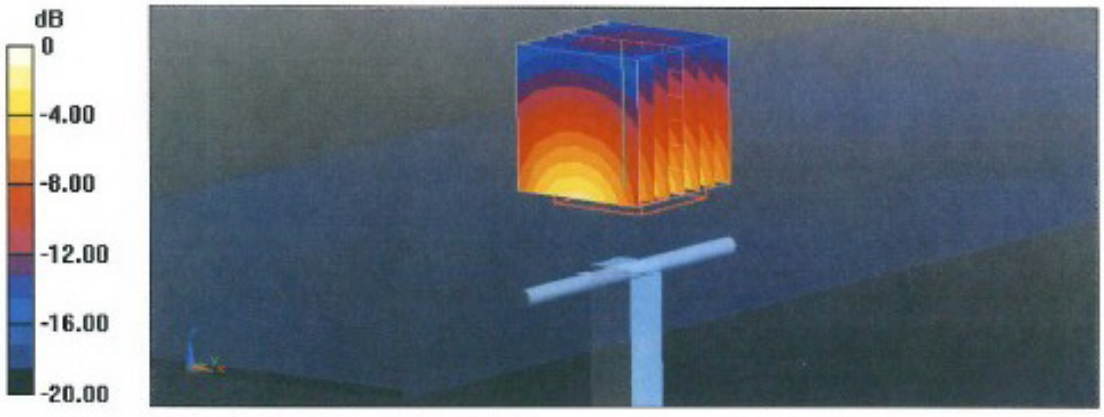
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d136

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

DASY52 Configuration:

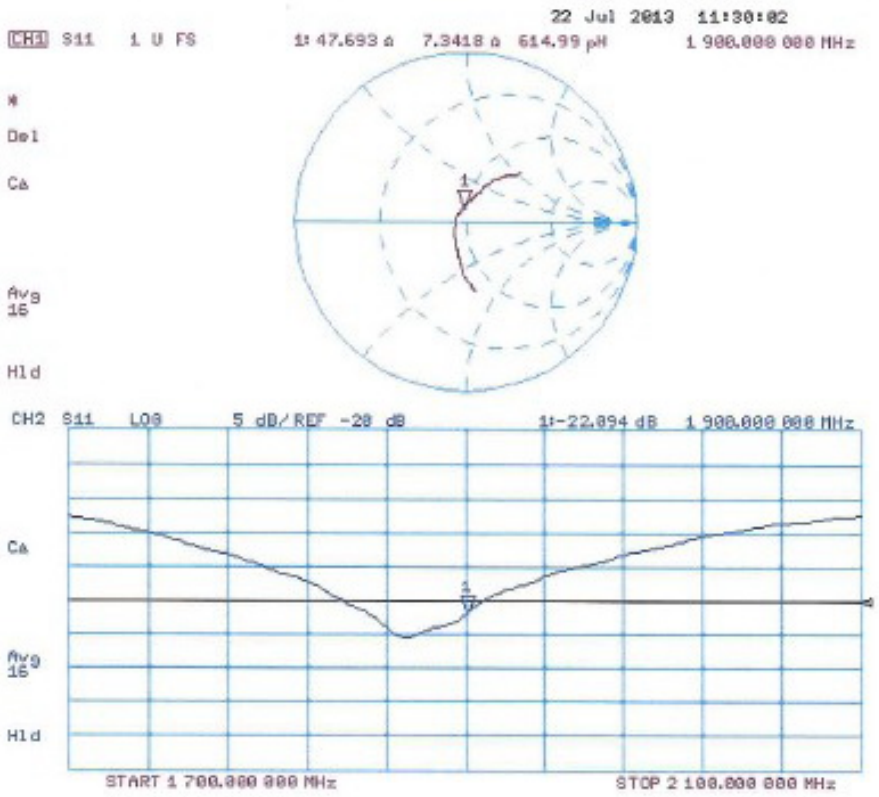
- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.803 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.37 W/kg
Maximum value of SAR (measured) = 12.5 W/kg



0 dB = 12.5 W/kg = 10.97 dBW/kg

Impedance Measurement Plot for Body TSL



D1900V2,Serial No.5d136 Extended Dipole Calibrations

Per KDB 865664 D01,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

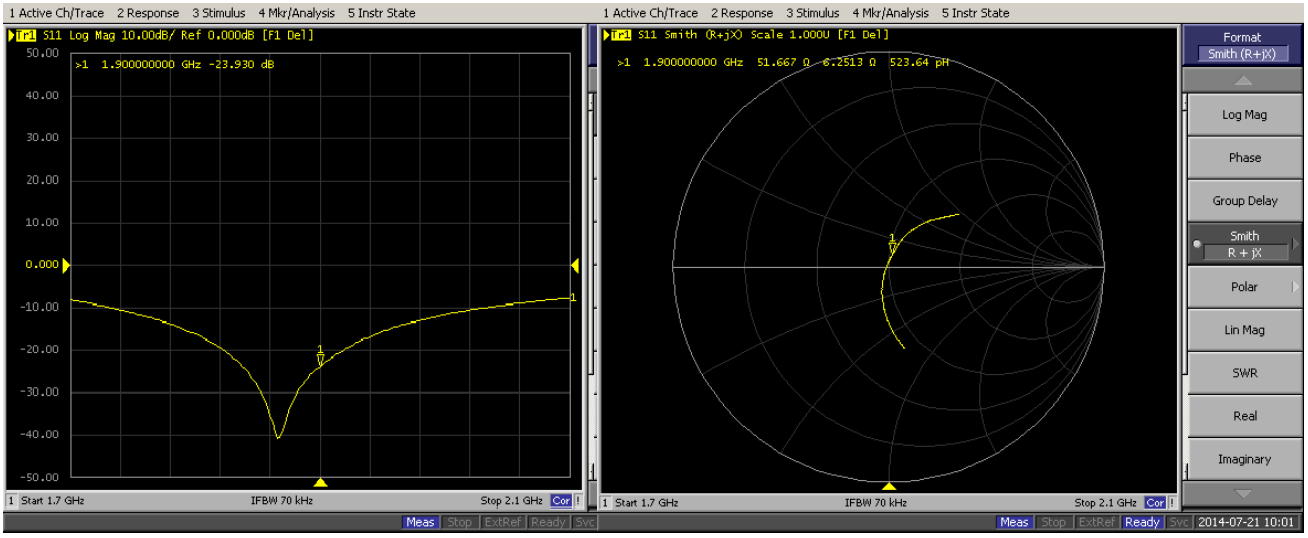
D1900V2 Serial No.5d136						
	1900 Head					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.22.2013	-22.471	--	52.887	--	7.2031	--
7.21.2014	-23.930	6.49	51.667	1.22	6.2513	0.9518

D1900V2 Serial No.5d136						
	1900 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.22.2013	-22.094	--	47.693	--	7.3418	--
7.21.2014	-22.704	2.76	47.761	0.068	6.8096	0.5322

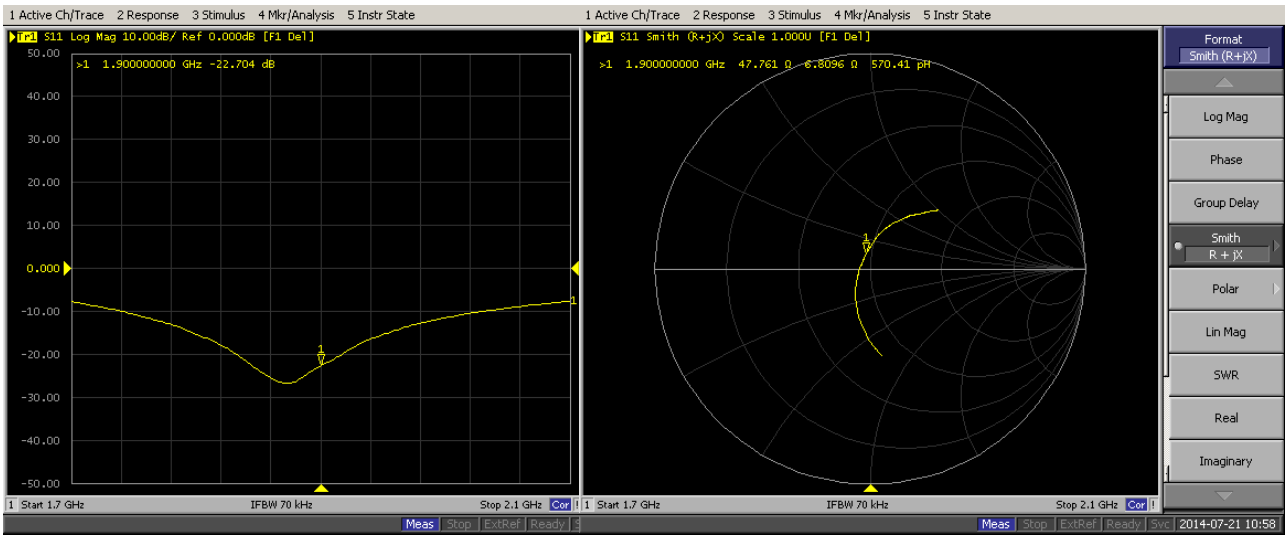
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data D1900V2 Serial No.5d136

1900MHz-Head



1900MHz-Body



Per KDB 865664 D01,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.

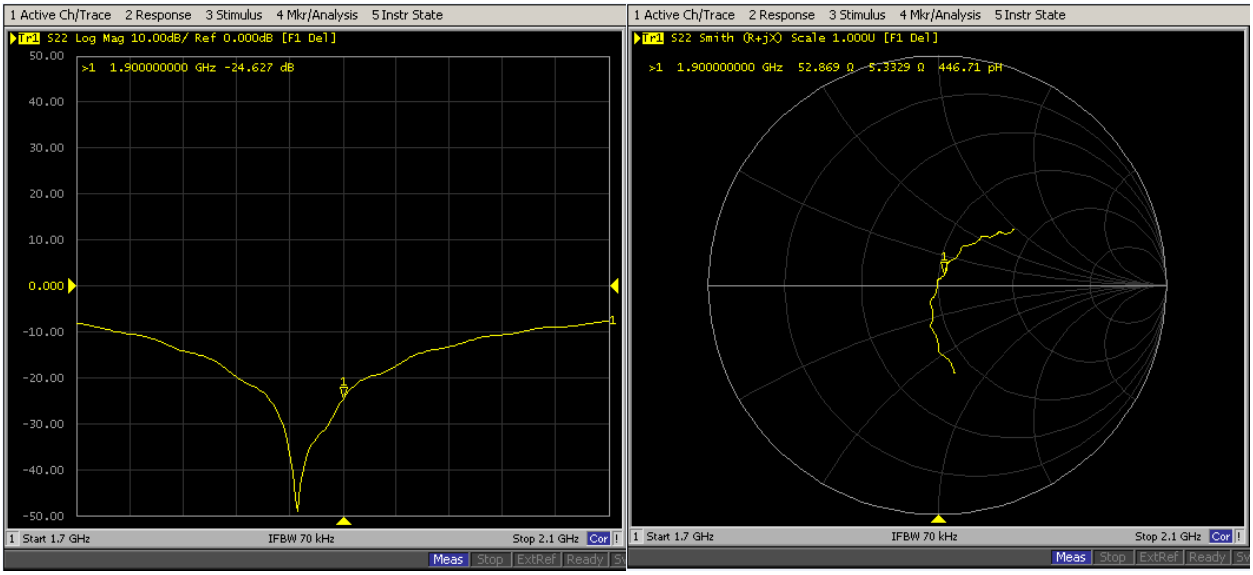
Justification of the extended calibration

D1900V2 Serial No.5d136						
1900 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.22.2013	-22.471	--	52.887	--	7.2031	--
7.21.2014	-23.930	6.49	51.667	1.22	6.2513	0.9518
7.20.2015	-24.627	2.913	52.869	1.202	5.333	0.9183

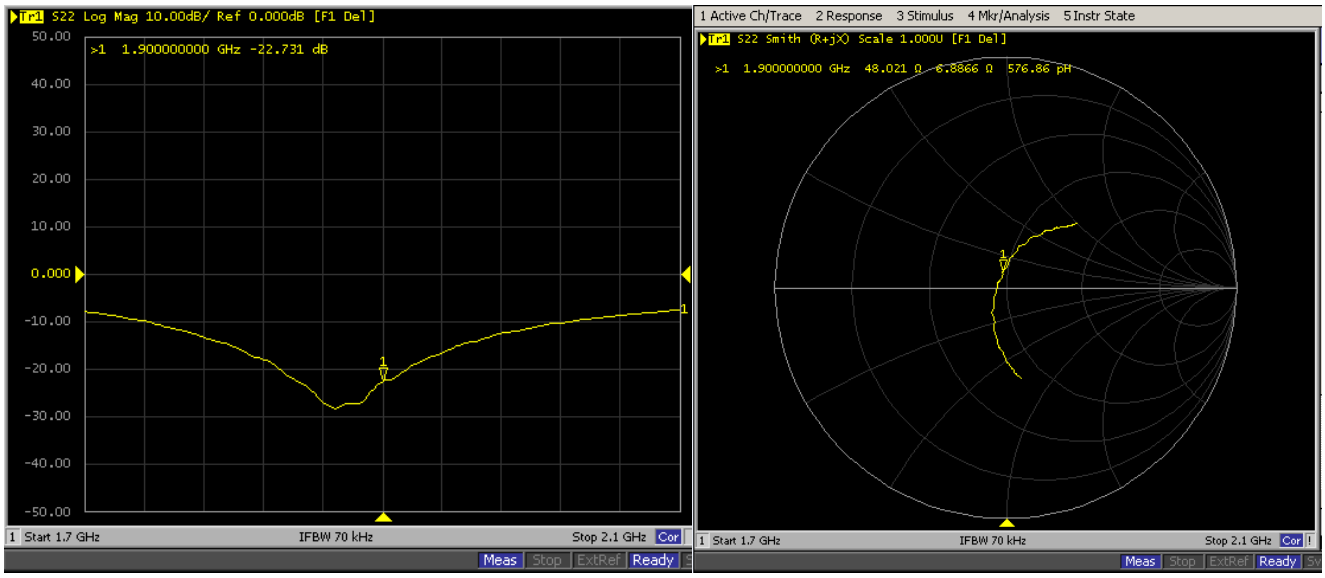
D1900V2 Serial No.5d136						
1900 Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
7.22.2013	-22.094	--	47.693	--	7.3418	--
7.21.2014	-22.704	2.76	47.761	0.068	6.8096	0.5322
7.20.2015	-22.731	0.119	48.021	0.260	6.8866	0.077

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data D1900V2 Serial No.5d136
1900MHz -Head



1900MHz-Body



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IMPORTANT NOTICE

USAGE OF THE DAE 4

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

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

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

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

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

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

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

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

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

Schmid & Partner Engineering

TN_BR040315AD DAE4.doc 11.12.2009

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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 **Auden**

Certificate No: DAE4-918_Dec14

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BK - SN: 918
Calibration procedure(s)	QA CAL-06.v28 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	December 29, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810276	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

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

Issued: December 29, 2014

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

Certificate No: DAE4-918_Dec14 Page 1 of 5

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Accreditation No.: SCS 108

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1µV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.263 ± 0.02% (k=2)	404.441 ± 0.02% (k=2)	403.975 ± 0.02% (k=2)
Low Range	3.99223 ± 1.50% (k=2)	3.98766 ± 1.50% (k=2)	3.99058 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	321.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200032.31	-4.38	-0.00
Channel X	+ Input	20003.84	-0.13	-0.00
Channel X	- Input	-20004.78	1.10	-0.01
Channel Y	+ Input	200032.27	-4.06	-0.00
Channel Y	+ Input	20002.00	-1.87	-0.01
Channel Y	- Input	-20006.00	0.05	-0.00
Channel Z	+ Input	200034.27	-2.10	-0.00
Channel Z	+ Input	20002.22	-1.48	-0.01
Channel Z	- Input	-20008.25	-2.23	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.31	0.03	0.00
Channel X	+ Input	200.99	0.68	0.34
Channel X	- Input	-198.48	1.20	-0.60
Channel Y	+ Input	2000.13	0.00	0.00
Channel Y	+ Input	199.66	-0.39	-0.20
Channel Y	- Input	-199.91	-0.16	0.08
Channel Z	+ Input	1999.95	-0.05	-0.00
Channel Z	+ Input	198.93	-1.21	-0.60
Channel Z	- Input	-201.20	-1.44	0.72

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	5.38	3.39
	- 200	-1.40	-3.69
Channel Y	200	11.47	11.14
	- 200	-12.53	-12.38
Channel Z	200	-14.52	-14.40
	- 200	11.50	11.86

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-0.57	-5.19
Channel Y	200	8.22	-	0.42
Channel Z	200	9.83	6.01	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15962	16466
Channel Y	16023	17247
Channel Z	15984	16328

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.60	-2.24	1.43	0.75
Channel Y	1.14	-0.87	2.02	0.43
Channel Z	-0.52	-1.84	0.61	0.42

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

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CALIBRATION
No. L0570

Client Auden Certificate No: Z15-97057

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3661
Calibration Procedure(s)	FD-Z11-2-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	April 24, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101547	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101548	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Reference10dBAttenuator	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 777	17-Sep-14 (SPEAG, DAE4-777_Sep14)	Sep -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	03-Feb-15 (CTTL, No.J15X00728)	Feb-16

	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: April 28, 2015

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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 (fs900MHz 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 fs800MHz) 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 EX3DV4

SN: 3661

Calibrated: April 24, 2015

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3661

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)^A	0.48	0.51	0.48	±10.8%
DCP(mV)^B	102.1	100.0	101.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	199.7	±2.0%
		Y	0.0	0.0	1.0		206.6	
		Z	0.0	0.0	1.0		200.9	

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: EX3DV4 – SN: 3661

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	9.71	9.71	9.71	0.12	1.00	±12%
835	41.5	0.90	9.60	9.60	9.60	0.10	1.57	±12%
900	41.5	0.97	9.37	9.37	9.37	0.11	1.49	±12%
1450	40.5	1.20	8.76	8.76	8.76	0.07	1.88	±12%
1750	40.1	1.37	8.43	8.43	8.43	0.13	1.73	±12%
1900	40.0	1.40	7.94	7.94	7.94	0.20	1.11	±12%
2000	40.0	1.40	7.74	7.74	7.74	0.21	1.12	±12%
2450	39.2	1.80	7.17	7.17	7.17	0.22	1.85	±12%
2600	39.0	1.96	7.10	7.10	7.10	0.26	1.38	±12%
5200	36.0	4.66	5.47	5.47	5.47	0.47	1.22	±13%
5300	35.9	4.76	5.17	5.17	5.17	0.49	1.14	±13%
5500	35.6	4.96	5.02	5.02	5.02	0.50	1.16	±13%
5600	35.5	5.07	4.96	4.96	4.96	0.50	1.15	±13%
5800	35.3	5.27	4.78	4.78	4.78	0.49	1.20	±13%

[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: EX3DV4 – SN: 3661

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	55.5	0.96	9.72	9.72	9.72	0.15	1.25	±12%
835	55.2	0.97	9.68	9.68	9.68	0.13	1.59	±12%
900	55.0	1.05	9.37	9.37	9.37	0.21	1.18	±12%
1450	54.0	1.30	8.23	8.23	8.23	0.14	1.34	±12%
1750	53.4	1.49	7.92	7.92	7.92	0.15	1.56	±12%
1900	53.3	1.52	8.08	8.08	8.08	0.14	1.93	±12%
2000	53.3	1.52	7.68	7.68	7.68	0.15	2.17	±12%
2450	52.7	1.95	7.31	7.31	7.31	0.27	1.42	±12%
2600	52.5	2.16	7.24	7.24	7.24	0.29	1.20	±12%
5200	49.0	5.30	4.92	4.92	4.92	0.54	0.99	±13%
5300	48.9	5.42	4.64	4.64	4.64	0.55	0.90	±13%
5500	48.6	5.65	4.33	4.33	4.33	0.50	1.30	±13%
5600	48.5	5.77	4.26	4.26	4.26	0.49	1.43	±13%
5800	48.2	6.00	4.35	4.35	4.35	0.50	1.67	±13%

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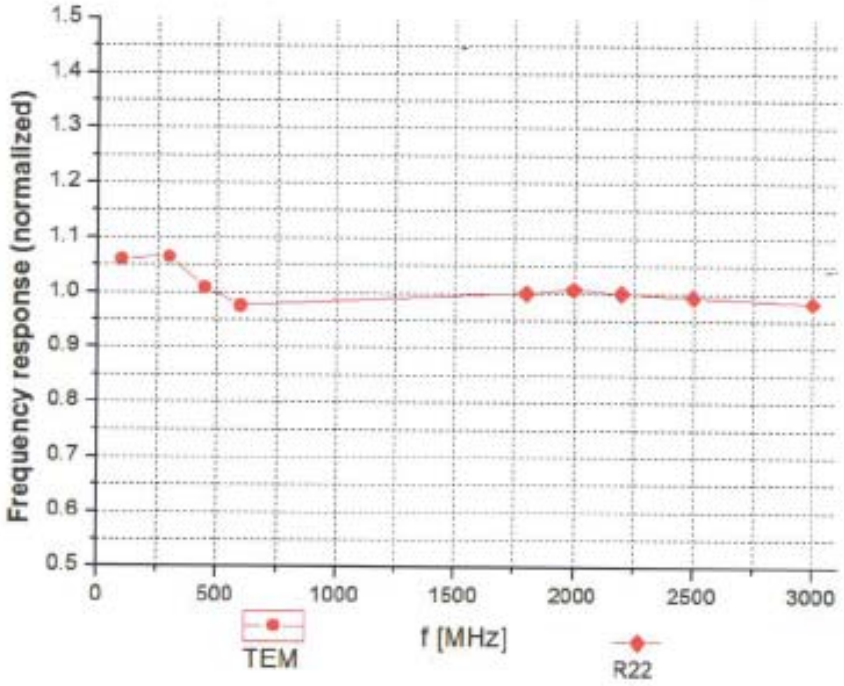
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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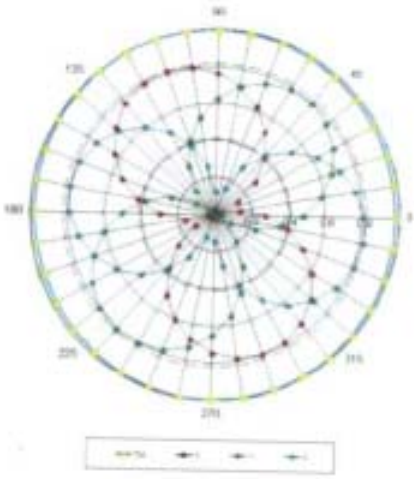
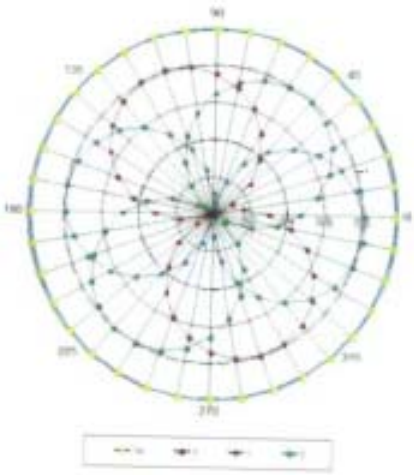
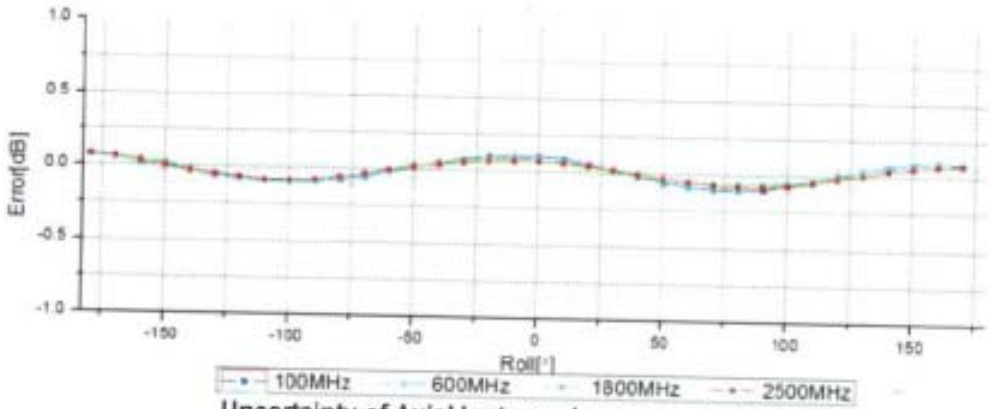
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM **f=1800 MHz, R22**







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

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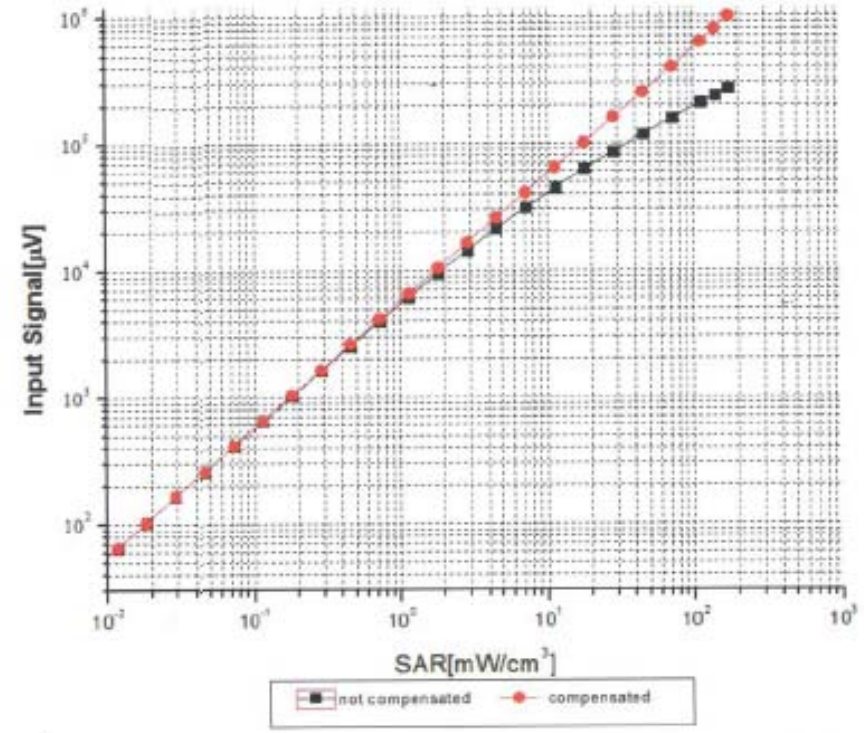
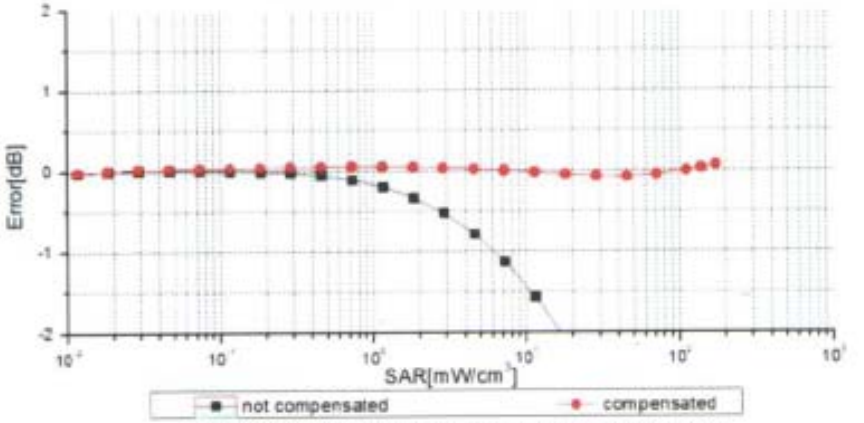
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





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

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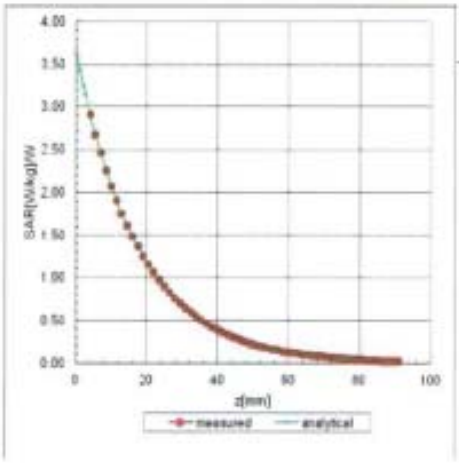
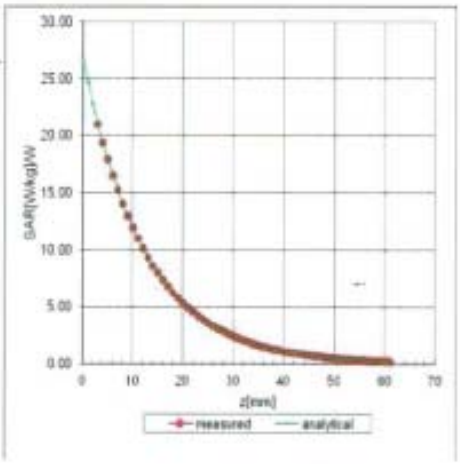
Conversion Factor Assessment

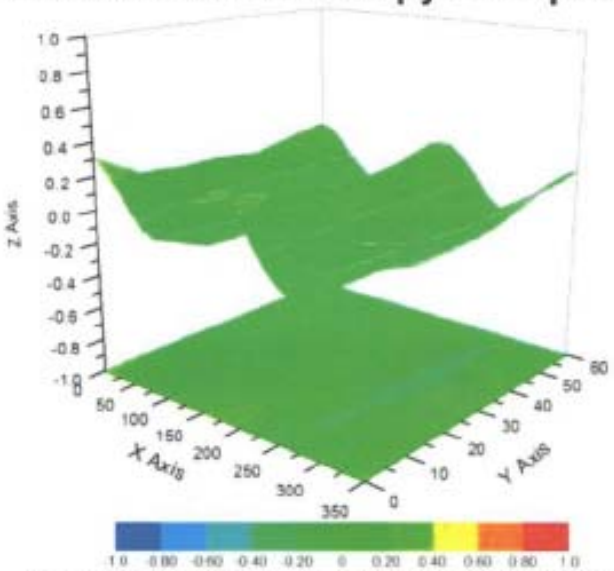
f=900 MHz, WGLS R9(H_convF)



f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



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

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3661

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	131.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

APPENDIX C: PLOTS OF SAR TEST RESULT

The plots are showing in the file named Appendix C Plots of SAR Test Result

END REPORT