TESTING
No. L2264

OET 65

TEST REPORT

Product Name	Digital Portable Repeater
Model	RD962 VHF/RD965 VHF/RD966 VHF/RD968 VHF
FCC ID	YAMRD96XVHF
Client	Hytera Communications Co.,Ltd.

TA Technology (Shanghai) Co., Ltd.

GENERAL SUMMARY

Product Name	Digital Portable Repeater	**Model**	RD962 VHF/RD965 VHF/RD966 VHF/RD968 VHF
FCC ID	YAMRD96XVHF	**Report No.**	RXA1209-0859SAR01R3
Client	Hytera Communications Co.,Ltd.		
Manufacturer	Hytera Communications Co.,Ltd.		
Reference Standard(s)	**FCC 47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices **IEEE Std C95.1, 1999:** IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz. **SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438 June 19, 2002:** Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions. **KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01** SAR Measurement Requirements for 100 MHz to 6 GHz **KDB 447498 D01 Mobile Portable RF Exposure v05:** Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies **KDB 643646 D01 SAR Test for PTT Radios v01r01:** SAR Test Reduction Considerations for Occupational PTT Radios **Tracking Number 593788** **Tracking Number 868998**		
Conclusion	This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 7 of this test report are below limits specified in the relevant standards for the tested bands only. General Judgment: **Pass** (Stamp) **Date of issue: March 15th, 2013**		
Comment	The test result only responds to the measured sample.		

Approved by____________ **Revised by**____________ **Performed by**____________

Director SAR Manager SAR Engineer

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1. General Information

1.1. Notes of the Test Report

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L2264.

TA Technology (Shanghai) Co., Ltd. guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

TA Technology (Shanghai) Co., Ltd. is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. This report only refers to the item that has undergone the test.

This report standalone dose not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities. This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of **TA Technology (Shanghai) Co., Ltd.** and the Accreditation Bodies, if it applies.

If the electrical report is inconsistent with the printed one, it should be subject to the latter.

1.2. Testing Laboratory

Company:	TA Technology (Shanghai) Co., Ltd.
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1.3. Applicant Information

Company: Hytera Communications Co.,Ltd.

Address: Hytera Tower,Hi-Tech Industrial Park North, Nanshan District,Shenzhen China

City: Shenzhen

Postal Code: 518057

Country: P. R. China

1.4. Manufacturer Information

Company: Hytera Communications Co.,Ltd.

Address: Hytera Tower,Hi-Tech Industrial Park North, Nanshan District,Shenzhen China

City: Shenzhen

Postal Code: 518057

Country: P. R. China

1.5. Information of EUT

General Information

Device Type:	Portable Device
Exposure Category:	Controlled Environment /Occupational
State of Sample:	Prototype Unit
Product Name:	Digital Portable Repeater
S/N:	/
Hardware Version:	B
Software Version:	5.00.09.00
Antenna Type:	Unfixed Antenna
Device Operating Configurations:	
Test Modulation:	FM (Analog), 4FSK(Digital)
Operating Frequency Range(s):	150MHz –174MHz (VHF)

Auxiliary Equipment Details

Name	Model	Manufacturer	S/N	Note
Battery	PV3001	Hytera Communications Co.,Ltd.	PV300100RAA0003	/
Palm Microphone	SM18A1	Hytera Communications Co.,Ltd.	/	/
Backpack	NCN010	Hytera Communications Co.,Ltd.	/	/
AC/DC Adapter	NU90-9120700-I2	DONNGGUAN LEADER ELECTRONICS INC.	/	/
Antenna 1	TQC-150FCS	/	/	150MHz –156MHz
Antenna 2	TQC-150FCS	/	/	156MHz –162MHz
Antenna 3	TQC-150FCS	/	/	162MHz –168MHz
Antenna 4	TQC-150FCS	/	/	168MHz –174MHz

Equipment under Test (EUT) is a Digital Portable Repeater. SAR is tested for 150MHz –156MHz, 156MHz –162MHz, 162MHz –168MHz and 168MHz –174MHz. The EUT has four external antennas that is used for Tx/Rx.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

1.6. The Maximum Reported SAR_{1g}

Mode	Test Position	Frequency (MHz)	Limit SAR_{1g} 8.0 W/kg	
			Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Repeat mode	Towards Ground (antenna position)	150.8125	3.950	3.990
PTT mode	Towards Ground (antenna position)	150.8125	1.975	1.995

1.7. Test Date

The test performed from February 21, 2013 to February 22, 2013.

2. SAR Measurements System Configuration

2.1. SAR Measurement Set-up

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

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003
- DASY5 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.

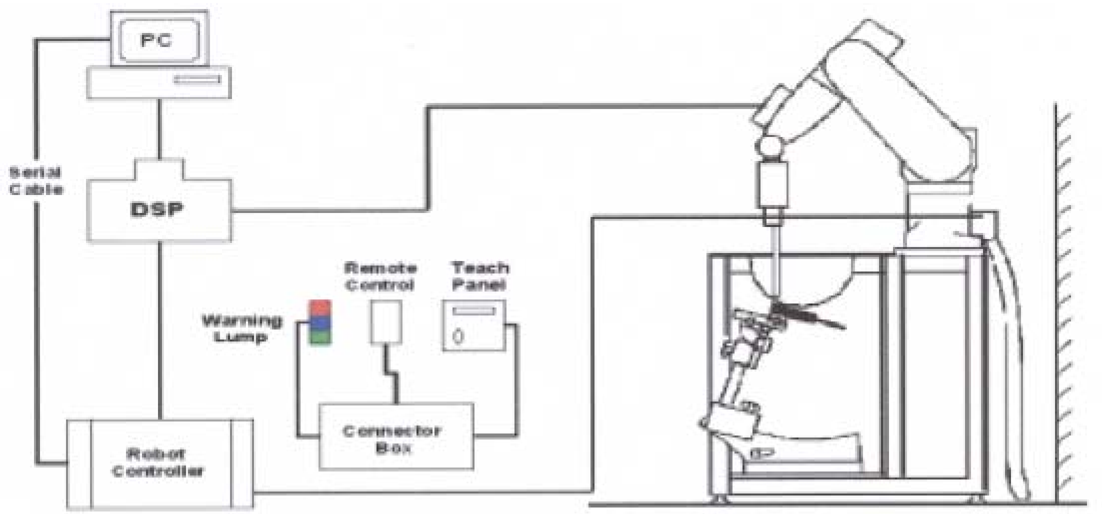


Figure 1. SAR Lab Test Measurement Set-up

2.2. DASY5 E-field Probe System

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

2.2.1. ES3DV3 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100 mW/g Linearity: ± 0.2dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

Figure 2. ES3DV3 E-field Probe

Figure 3. ES3DV3 E-field probe

2.2.2. E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.
E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where: Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
ΔT = Temperature increase due to RF exposure.
Or

$$SAR = \frac{|E|^2 \sigma}{\rho}$$

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

2.3. Other Test Equipment

2.3.1. Device Holder for Transmitters

Figure 4.Device Holder

The DASY device holder is designed to cope with the die rent positions given in the standard.
It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
The DASY device holder is constructed of low-loss POM material.The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the inference of the clamp on the test results could thus be lowered.

2.3.2. Phantom

Phantom for compliance testing of handheld andbody-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI isfully compatible with the IEC 62209-2 standard and all known tissuesimulating liquids. ELI has been optimized regarding its performance and can beintegrated into our standard phantom tables. A cover prevents evaporation ofthe liquid. Reference markings on the phantom allow installation of thecomplete setup, including all predefined phantom positions and measurementgrids, by teaching three points. The phantom is compatible with all SPEAGdosimetric probes and dipoles.

Shell Thickness	2±0.2 mm
Filling Volume	Approx. 30 liters
Dimensions	190×600×0 mm (H x L x W)

Figure 5.ELI4 Phantom

2.4. Scanning Procedure

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

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

- The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

- Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing is set according to FCC KDB Publication 865664. During scan the distance of the probe to the phantom remains unchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- Zoom Scan

  After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

- Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY5 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 maxima 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 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 Zoom 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.

- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm) $\Delta z_{zoom}(n)$	Minimum Zoom Scan Volume (mm) (x,y,z)
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≥ 25

2.5. Data Storage and Evaluation

2.5.1. Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DAE4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

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

2.5.2. Data Evaluation by SEMCAD

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

Probe parameters:	- Sensitivity	Normi, 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 they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter 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:

$$V_i = U_i + U_i^2 \cdot c\,f / d\,c\,p_i$$

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 parameter)

dcp_i = diode compression point (DASY parameter)

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

E-field probes: $$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$

H-field probes: $$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$$

With V_i = compensated signal of channel i (i = x, y, z)

$Norm_i$ = sensor sensitivity of channel i (i = x, y, z) [mV/(V/m)^2] for E-field Probes

$ConvF$ = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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

$$SAR = (E_{tot})^2 \cdot \sigma / (\rho \cdot 1000)$$

with $\boldsymbol{SAR}$ = local specific absorption rate in mW/g

$\boldsymbol{E_{tot}}$ = 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 to be a free space field.

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

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

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

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

3. Laboratory Environment

Table 2: The Requirements of the Ambient Conditions

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

4. Tissue-equivalent Liquid

4.1. Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, sugar, salt, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The table 3 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the OET 65.

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in table 3 below for 300 MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at 300, 150.8125, 158.8125, 166.8125, 173.3875 MHz frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Table 3: Composition of the Body Tissue Equivalent Matter

MIXTURE%	FREQUENCY(Body) 300/150MHz
Water	49.48
Sugar	47.4
Salt	2.32
Preventol	0.1
Cellulose	1.0
Dielectric Parameters Target Value	f=300MHz ε=58.2 σ=0.92 f=150MHz ε=61.9 σ=0.8

4.2. Tissue-equivalent Liquid Properties

Table 4: Dielectric Performance of Body Tissue Simulating Liquid

Frequency	Test Date	Temp ℃	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)	
			ε_r	σ(s/m)	ε_r	σ(s/m)	Dev ε_r(%)	Dev σ(%)
300MHz	2013-02-21	21.5	57.34	0.912	58.20	0.92	-1.48	-0.87
150MHz	2013-02-21	21.5	61.9	0.83	61.9	0.80	0.00	3.75

5. System Check

5.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyser. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 398 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 5.

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

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

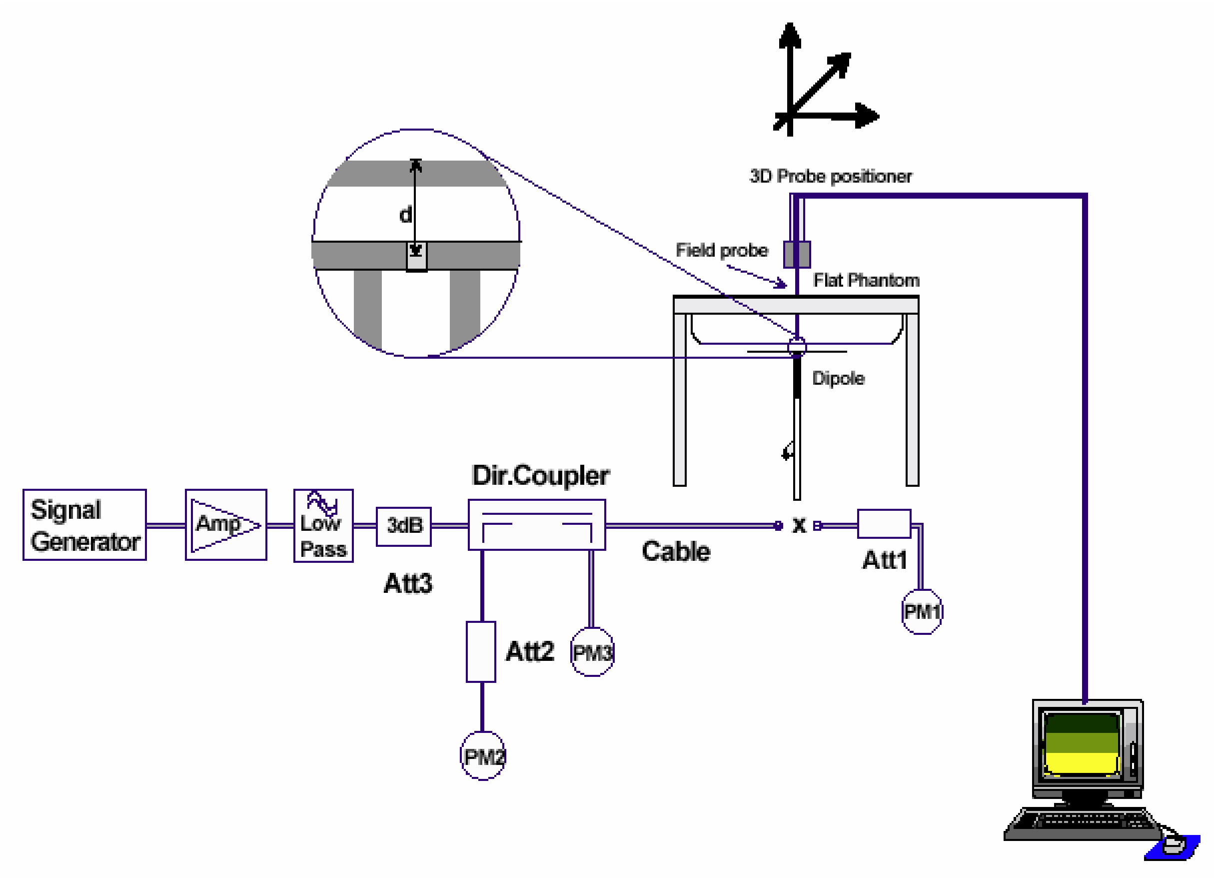


Figure 6. System Check Set-up

5.2. System Check Results

Table 5: System Check for Body Tissue Simulating Liquid

Frequency	Test Date	Dielectric Parameters		Temp	398mW Measured SAR_{1g}	1W Normalized SAR_{1g}	1W Target SAR_{1g}	Limit (±10% Deviation)
		ε_r	σ(s/m)	(℃)	(W/kg)			
300MHz	2013-02-21	57.34	0.912	21.5	1.16	2.914	2.84	2.61

Note：1. The graph results see ANNEX B.
2. Target Values used derive from the calibration certificate

6. Operational Conditions during Test

6.1. General Description of Test Procedures

The spatial peak SAR values were assessed for VHF systems. Batterys and accessories shall be specified by the manufacturer. The EUT batterys must be fully charged and checked periodically during the test to ascertain uniform power output.

6.2. Test Configuration

6.2.1. Body-Worn Configuration

The EUT is tested with the battery, the antenna and the microphone.
The back side of the EUT is towards the phantom with a separation distance 10 mm. The surface of the EUT antenna is positioned at 35mm to the flat phantom.
The front side of the EUT is towards the phantom with a separation distance 10 mm. The surface of the EUT antenna is positioned at 78mm to the flat phantom.

6.3. Positioning for devices that are large relative to phantom surface area

We have inquiry FCC, if the DUT is larger than the minimum elliptical phantom, the DUT shall be shifted such that multiple area scans can be made of the whole DUT, the SAR report should include data to justify the particular positioning of the assembly relative to the phantom, i.e., explain why it is the worst position. The highest SAR spot was found at near antenna connecter. Please refer to figure 13 and figure 14.

6.4. System verification

When products are introduced in new frequency bands, reference dipoles may not be available within the probe calibration or test device frequency range. Sometimes the reference dipole, test device and probe calibration frequencies could be substantially misaligned, hence, SAR measurement accuracy may not be easily confirmed.

These two system verification alternatives are described in the following and should only be used when a required reference dipole is unavailable. All results and analyses must be included in the SAR report to justify the use of these system verification alternatives, including dipole return loss plots, probe conversion factors, tissue dielectric parameter measurements, coefficient of variation calculations etc. The same SAR probe and tissue dielectric media used with the dipole for system verification must also be used for device testing. These interim procedures may be performed by the test laboratory. When both alternatives are not applicable, a KDB inquiry is required to resolve the system validation and verification issues, before any device testing, to ensure the measurement results are acceptable.

1) Establishing a new SAR target for the dipole at an offset frequency

a) The SAR probe must be calibrated at the offset frequency.
b) The procedures must be repeated when a dipole is recalibrated to re-establish the SAR target at the offset frequency.

c) The dipole must have a return loss of 15 dB or more at the offset frequency.

d) The differences in target tissue dielectric parameters between the offset and tuned dipole frequencies must be ≤ 10%.

e) The measured SAR at the offset frequency must be within 15% of the manufacturer calibrated SAR at the dipole's tuned frequency.

f) The SAR, on a long term basis including all previous measurements after applying these procedures, should have a coefficient of variation < 3%; that is, the standard deviation divided by the mean is < 0.03.

2) Establishing a new SAR target at the tuned dipole frequency according to the probe calibration and tissue dielectric parameters requied at an offset frequency required for device testing

a) When the conditions required in step 1) to establish a new SAR target for the dipole at an offset frequency can be satisfied, this alternative does not apply.

b) The tissue dielectric parameters measured at the tuned dipole frequency must be within 10% of those required for device testing at the offset frequencies. This tissue parameter tolerance is expected to support an operating range of 120 MHz to 250 MHz or more above 300 MHz and 100 MHz or more below 300 MHz for the typical tissue-equivalent recipes.

c) The SAR probe must be calibrated at the offset (device testing) frequency and the probe conversion factors at the tuned dipole frequency and device testing frequencies must be within 5% of each other.

d) The dipole must have a return loss of 15 dB or more at the offset frequency.

e) The new SAR target determined using the probe calibration and tissue-equivalent medium at the offset frequency must be within 15% of the calibrated SAR target at the tuned dipole frequency.

f) The new SAR target must be established using 5 or more measurements, each reconfigured separately, with a coefficient of variation < 2%; that is, standard deviation divided by mean < 0.02. The coefficient of variation for all subsequent system verifications must be less than 3% and the mean must be within 15% of the original tuned dipole SAR target. All previous system verification data must be applied to compute the coefficient of variation; until the probe or dipole is recalibrated or a different tissue recipe is used, which requires the SAR target for the dipole to be reassessed.

g) Continued use of this new SAR target and dipole combination for system verification to support SAR measurements required by similar test devices must use the same SAR probe, same probe calibration point and the same tissue-equivalent medium recipe used to establish the SAR target.

6.5. SAR system validation and verification requirements below 300 MHz

For SAR measurements in the 100 MHz to 300 MHz range, when dipoles or equivalent RF sources corresponding to the device frequency range are available from SAR system manufacturers for system validation and verification, the applicable sources must be used.16 When the required dipole sources are unavailable, the 300 MHz dipole defined in IEEE Std 1528-2003 are used in conjunction with these procedures to perform SAR system validation and verification. The test frequency range must be supported by the SAR measurement system. The SAR probe must be calibrated at 300 MHz and 150 MHz, or at 300 MHz and the applicable device measurement frequency, typically near 150 MHz. The tissue dielectric parameters in Supplement C 01-01 are interpolated and/or extrapolated to prepare tissue-equivalent media for the SAR measurements. The test laboratory must establish a new SAR target value for the 300 MHz dipole, using the 150 MHz SAR probe calibration point and 150 MHz tissue-equivalent dielectric parameters, and with the dipole transmitting at 300 MHz, according to the procedures required for establishing a new SAR target at the tuned dipole frequency according to the probe calibration and tissue dielectric parameters at an offset frequency. SAR system verification at 300 MHz is also required to support the test results. If any of the required conditions are not satisfied, a KDB inquiry must be submitted before device testing to determine the acceptable test requirements.

Table 6: New SAR target value for Tissue Simulating Liquid

Offset Frequency	Test Date	Dielectric Parameters		Temp	New target SAR_{1g}	Target SAR_{1g}	Deviation (Within 15%)
		ε_r	σ(s/m)	(℃)	(W/kg)		
150MHz (Body)	2013-02-21	61.9	0.83	21.5	1.06	1.14	-7.01%

Note：1. The graph results see ANNEX B.
2. Target Value used derives from the calibration certificate.
3. New SAR target value for the 300 MHz dipole, using the 150 MHz SAR probe calibration point and 150 MHz tissue-equivalent dielectric parameters, and with the dipole transmitting at 300 MHz.

Table 7: The differences in tissue dielectric parameters between the offset and tuned dipole frequencies

Tissue type	Dielectric Parameters				Deviation (Within 10%)	
	300 MHz		150MHz			
	ε_r	σ(s/m)	ε_r	σ(s/m)	ε_r	σ(s/m)
Body tissue	57.34	0.912	61.9	0.83	8.47%	-8.99%

7. Test Results

7.1. Conducted Power Results

Table 8: Conducted Power Measurement Results

Frequency (MHz)	Analog VHF (12.5KHz)	Digital VHF (12.5KHz)
	Conducted Power (dBm)	
150.8125	40.62	40.61
158.8125	40.59	40.58
166.8125	40.65	40.64
173.3875	40.63	40.64
Note: 1. The test channels were selected in accordance with the procedures specified in FCC KDB 447498 D01 Mobile Portable RF Exposure v05.		

7.2. SAR Test Results

7.2.1. Repeat mode (VHF)

Table 9: SAR Values (VHF)

Test Position	Frequency (MHz)	Channel Spacing	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 8.0 W/kg			
					Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Towards Ground (antenna position) (Analog)									
Towards Ground	150.8125	12.5kHz	40.68	40.62	-0.057	3.950	1.01	3.990	Figure9
	158.8125	12.5kHz	40.68	40.59	-0.020	2.570	1.02	2.621	Figure10
	166.8125	12.5kHz	40.68	40.65	0.017	3.100	1.01	3.131	Figure11
	173.3875	12.5kHz	40.68	40.63	0.029	2.870	1.01	2.899	Figure12
Shift the device scan area to identify the highest SAR location (Analog)									
Towards Ground	150.8125	12.5kHz	40.68	40.62	-0.072	3.040	1.01	3.070	Figure13
Worst Case Position of Towards Ground with Towards Phantom (Analog)									
Towards Phantom	150.8125	12.5kHz	40.68	40.62	-0.070	1.460	1.01	1.475	Figure14
Worst Case Position of Analog with Digital									
Towards Ground	150.8125	12.5kHz	40.68	40.61	-0.004	3.870	1.02	3.947	Figure15

Note: 1.The value with blue color is the maximum SAR Value of each test band.
2. The EUT Radios with duty factors of 100% apply the maximum duty factor supported by the device to determine compliance.

7.2.2. PTT mode (VHF)

Table 10: SAR Values (VHF)

Test Position	Frequency (MHz)	Channel Spacing	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 8.0 W/kg				
					Drift (dB)	Measured SAR_{1g} (W/kg) 100%	Measured SAR_{1g} (W/kg) 50%	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test Position of Towards Ground (antenna position) (Analog)										
Towards Ground	150.8125	12.5kHz	40.68	40.62	-0.057	3.950	1.975	1.01	1.995	Figure9
	158.8125	12.5kHz	40.68	40.59	-0.020	2.570	1.285	1.02	1.311	Figure10
	166.8125	12.5kHz	40.68	40.65	0.017	3.100	1.55	1.01	1.566	Figure11
	173.3875	12.5kHz	40.68	40.63	0.029	2.870	1.435	1.01	1.449	Figure12
Worst Case Position of Towards Ground (antenna position) with Towards Ground (body position) (Analog)										
Towards Ground	150.8125	12.5kHz	40.68	40.62	-0.072	3.040	1.52	1.01	1.535	Figure13
Worst Case Position of Towards Ground with Towards Phantom (Analog)										
Towards Phantom	150.8125	12.5kHz	40.68	40.62	-0.070	1.460	0.73	1.01	0.737	Figure14
Worst Case Position of Analog with Digital										
Towards Ground	150.8125	12.5kHz	40.68	40.61	-0.004	3.870	1.935	1.02	1.974	Figure15

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

2. The EUT Radios with duty factors of 50% apply the maximum duty factor supported by the device to determine compliance.

Table 11: SAR Values are scaled for the power drift

Limits	Reported SAR_{1g} Average (W/kg)		Power Drift (dB)	+ Power Drift 10^(dB/10)	Reported SAR_{1g} (W/kg) (include + power drift)	
	8.0		± 0.21			
Frequency (MHz)	Duty Cycle		Power Drift(dB)		Duty Cycle	
	100%	50%			100%	50%
Test Position of Towards Ground (antenna position) (Analog)						
150.8125	3.990	1.995	0.057	1.013	4.042	2.021
158.8125	2.621	1.311	0.020	1.005	2.634	1.318
166.8125	3.131	1.566	0.017	1.004	3.144	1.572
173.3875	2.899	1.449	0.029	1.007	2.919	1.459
Worst Case Position of Towards Ground (antenna position) with Towards Ground (body position) (Analog)						
150.8125	3.070	1.535	0.072	1.017	3.122	1.561
Worst Case Position of Towards Ground with Towards Phantom (Analog)						
150.8125	1.475	0.737	0.070	1.016	1.499	0.749
Worst Case Position of Analog with Digital						
150.8125	3.947	1.974	0.004	1.001	3.951	1.976

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

2. The Exposure category about EUT: controlled environment / Occupational, so the SAR limit is 8.0 W/kg averaged over any 1 gram of tissue.

8. 100MHz to 700MHz Measurement Uncertainty

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	c_i	Standard ncertainty $u_i^{'}$ (%)	Degree of freedom V_{eff} or v_i
1	System repetivity	A	0.5	N	1	1	0.5	9
				Measurement system				
2	-probe calibration	B	6.7	N	1	1	6.7	∞
3	-axial isotropy of the probe	B	4.7	R	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
4	- Hemispherical isotropy of the probe	B	9.4	R	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
6	-boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	∞
7	-probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	∞
8	- System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	∞
9	-readout Electronics	B	1.0	N	1	1	1.0	∞
10	-response time	B	0	R	$\sqrt{3}$	1	0	∞
11	-integration time	B	4.32	R	$\sqrt{3}$	1	2.5	∞
12	-noise	B	0	R	$\sqrt{3}$	1	0	∞
13	-RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	∞
14	-Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	∞
15	-Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
16	-Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
				Test sample Related				
17	-Test Sample Positioning	A	2.9	N	1	1	2.9	71
18	-Device Holder Uncertainty	A	4.1	N	1	1	4.1	5
19	-Output Power Variation - SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.9	∞
				Physical parameter				
20	-phantom	B	4.0	R	$\sqrt{3}$	1	2.3	∞

21	-liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	∞
22	-liquid conductivity (measurement uncertainty)	B	2.5	N	1	0.64	1.6	9
23	-liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	∞
24	-liquid permittivity (measurement uncertainty)	B	2.5	N	1	0.6	1.5	9
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$					11.88	
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		N	k=2		23.76	

9. Main Test Instruments

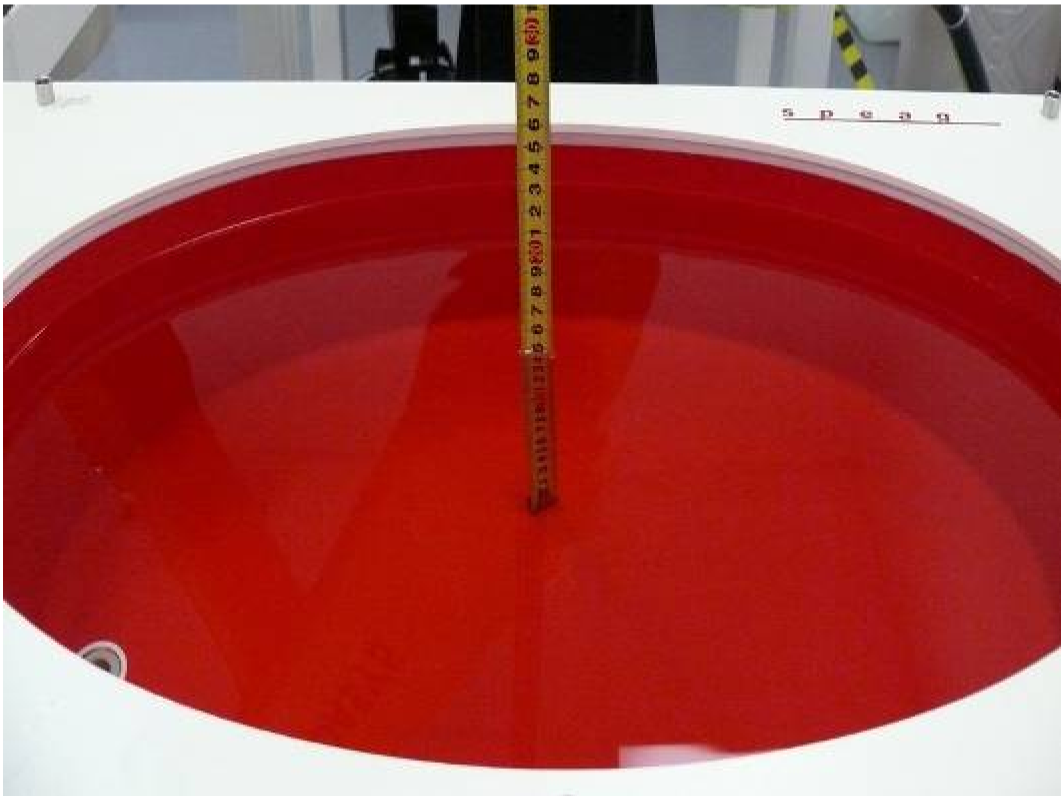
Table 12: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent 8753E	US37390326	September 11, 2012	One year
02	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
03	Power meter	Agilent E4417A	GB41291714	March 11, 2012	One year
04	Power sensor	Agilent N8481H	MY50350004	September 24, 2012	One year
05	Power sensor	E9327A	US40441622	January 2, 2013	One year
06	Signal Generator	HP 8341B	2730A00804	September 11, 2012	One year
07	Amplifier	IXA-020	0401	No Calibration Requested	
08	E-field Probe	ES3DV3	3189	June 22, 2012	One year
09	DAE	DAE4	905	June 21, 2012	One year
10	Validation Kit 300MHz	D300V3	1017	July 24, 2012	One year
11	Dual directional coupler	778D-012	50519	March 26, 2012	One year
12	Temperature Probe	JM222	AA1009129	March 15, 2012	One year
13	Hygrothermograph	WS-1	64591	September 27, 2012	One year

*****END OF REPORT *****

ANNEX A: Test Layout

Picture 1: Specific Absorption Rate Test Layout



Picture 2: Liquid depth in the Flat Phantom (150/300MHz, 15.4cm depth)

ANNEX B: System Check Results

System Performance Check at 300 MHz Body TSL

DUT: Dipole300 MHz; Type: D300V3; Serial: 1017

Date/Time: 02/21/2013 2:05:18 PM

Communication System: CW; Frequency: 300 MHz;Duty Cycle: 1:1

Medium parameters used: f = 300 MHz; σ = 0.912 mho/m; ε_r = 57.34; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(6.53, 6.53, 6.53); Calibrated: 6/22/2012

Electronics: DAE4 Sn 905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

d=15mm, Pin=398mW/Area Scan (61x301x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.23 mW/g

d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 37.2 V/m; Power Drift = -0.015 dB

Peak SAR (extrapolated) = 1.65 W/kg

SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.809 mW/g

Maximum value of SAR (measured) = 1.24 mW/g

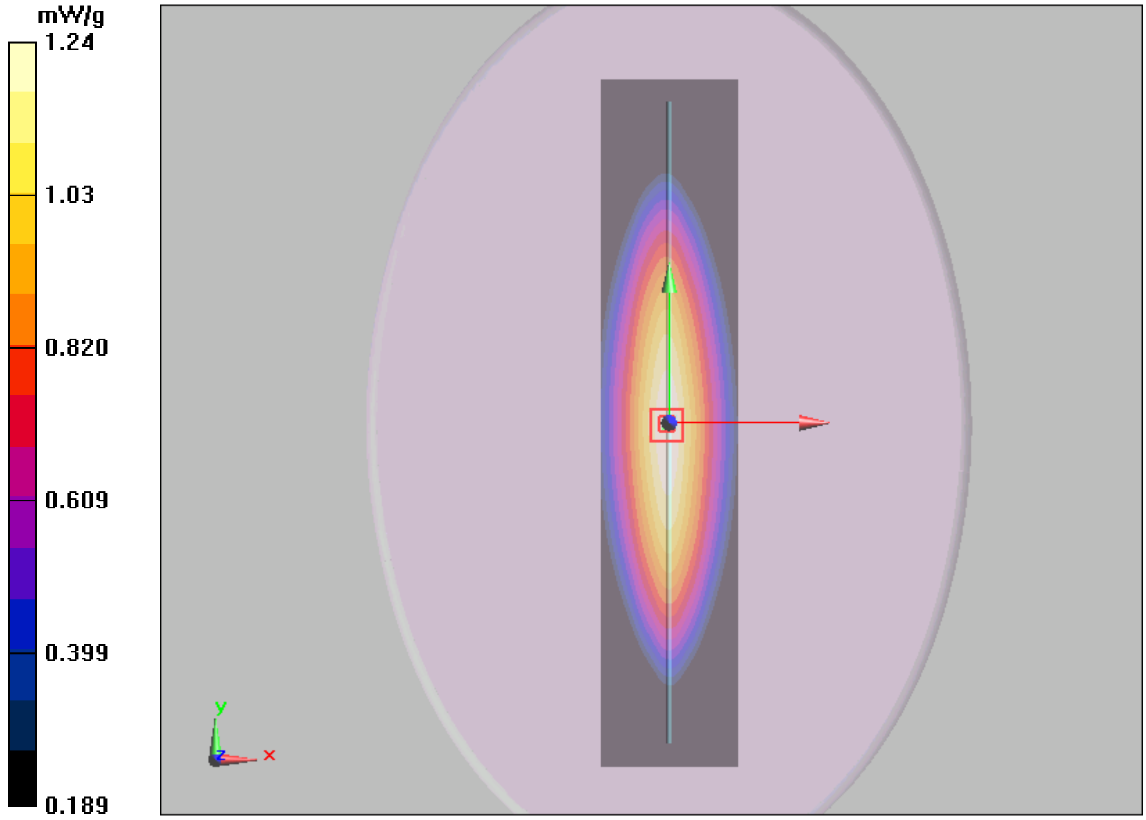


Figure 7 System Performance Check 300MHz 398mW

System Verification at 150 MHz Body TSL

DUT: Dipole300 MHz; Type: D300V3; Serial: 1017

Date/Time: 02/21/2013 11:22:41 AM

Communication System: CW; Frequency: 150 MHz;Duty Cycle: 1:1

Medium parameters used: f = 150 MHz; σ = 0.83 mho/m; ε_r = 61.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

d=15mm, Pin=398mW/Area Scan (61x301x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.12 mW/g

d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 36.6 V/m; Power Drift = 0.043 dB

Peak SAR (extrapolated) = 1.6 W/kg

SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.733 mW/g

Maximum value of SAR (measured) = 1.13 mW/g

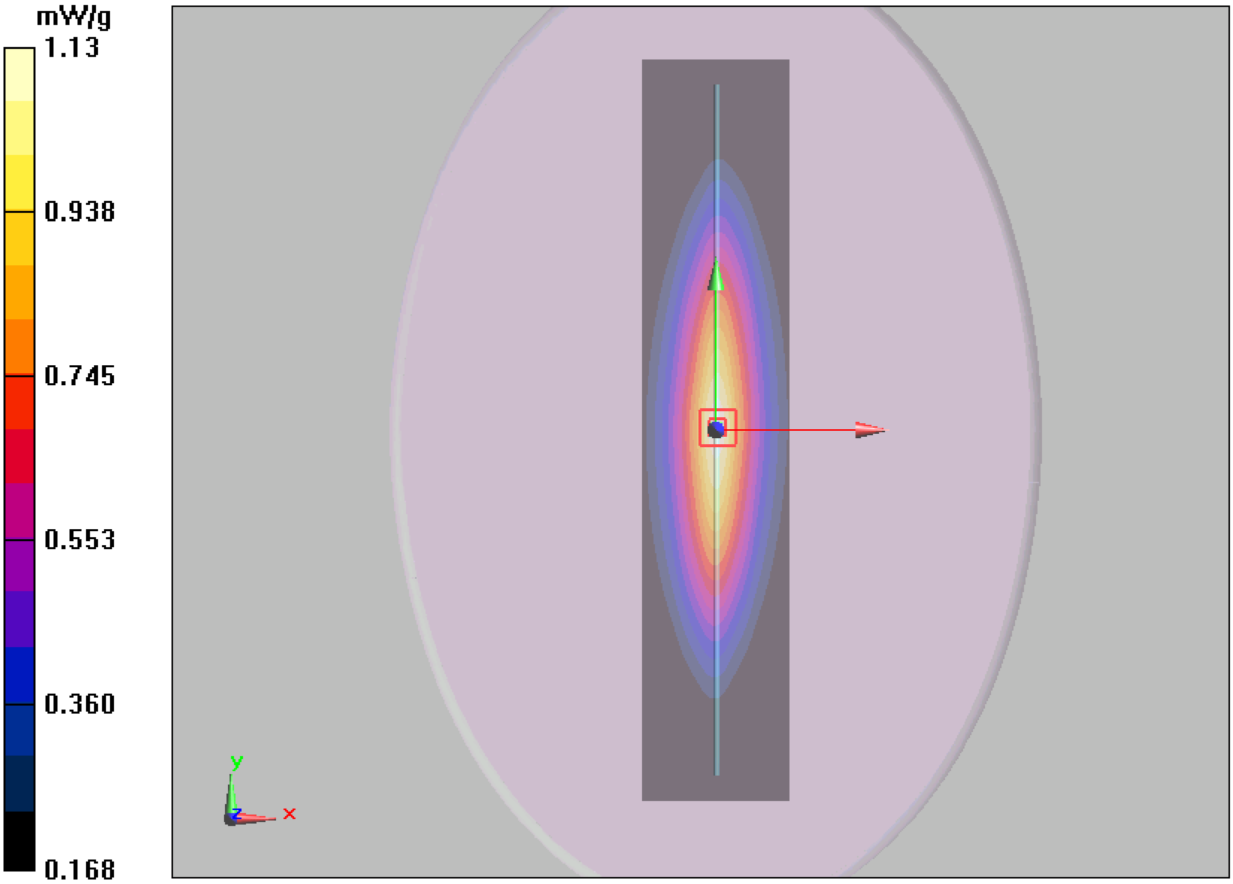


Figure 8 System Verification at 150 MHz 398mW

ANNEX C: Graph Results

Body-Worn for Analog, Front towards Ground 150.8125MHz (12.5KHz Channel Spacing, Antenna position)

Date/Time: 2/21/2013 11:05:54 PM

Communication System: PTT 150; Frequency: 150.813 MHz;Duty Cycle: 1:1

Medium parameters used: f = 151 MHz; σ = 0.833 mho/m; ε_r = 61.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Ground 150.8125MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 4.19 mW/g

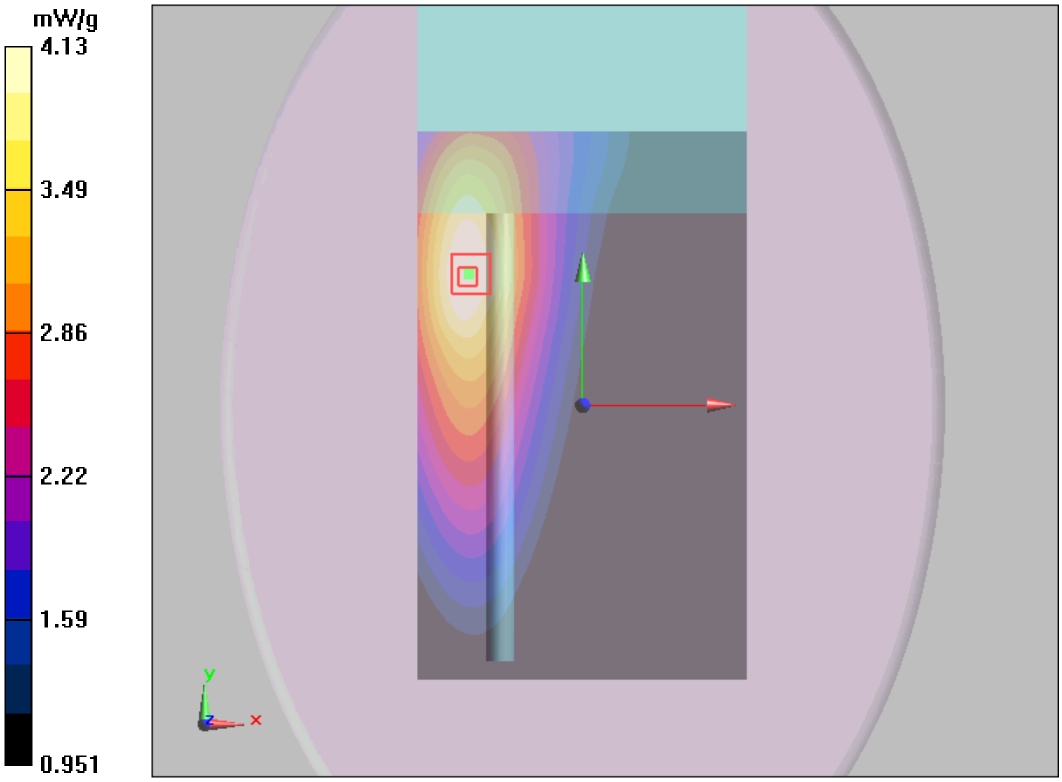
Front towards Ground 150.8125MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 35.3 V/m; Power Drift = -0.057 dB

Peak SAR (extrapolated) = 5.42 W/kg

SAR(1 g) = 3.95 mW/g; SAR(10 g) = 3.01 mW/g

Maximum value of SAR (measured) = 4.13 mW/g



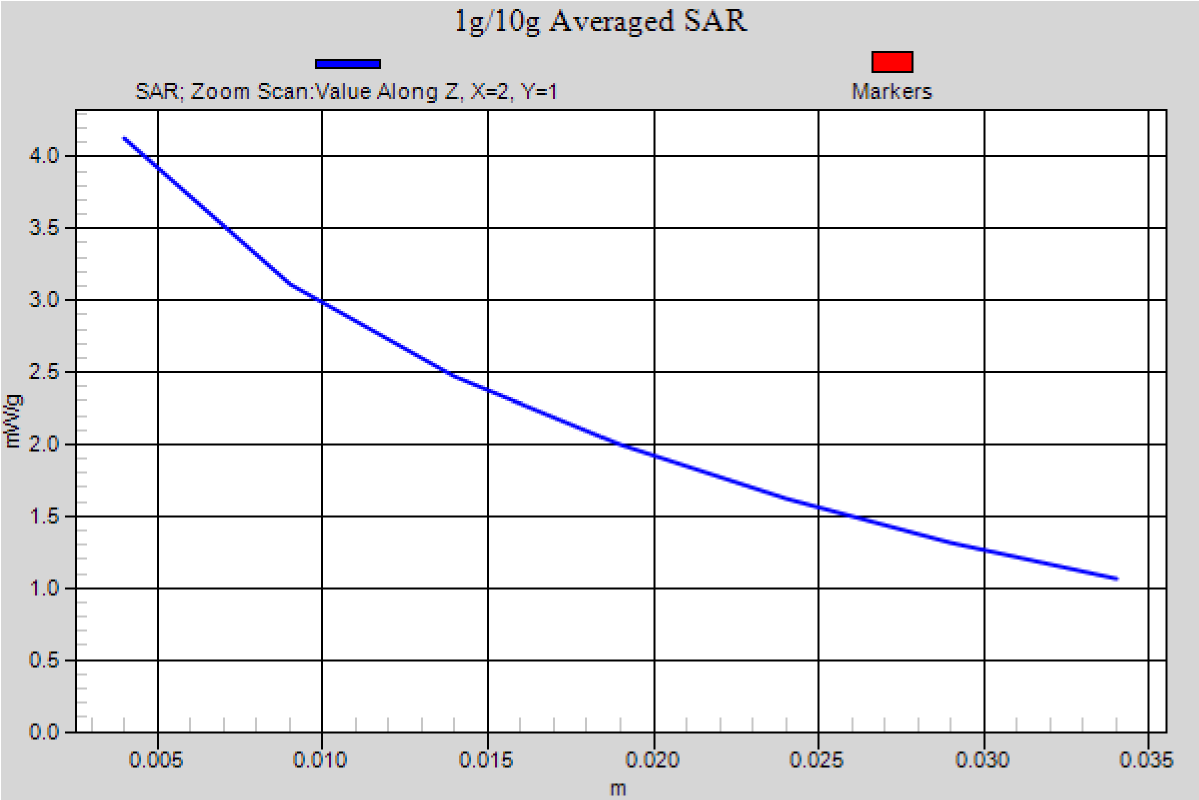


Figure 9 Body-Worn for Analog, Front towards Ground 150.8125MHz

Body-Worn for Analog, Front towards Ground 158.8125MHz (12.5KHz Channel Spacing, Antenna position)

Date/Time: 2/21/2013 11:36:05 PM

Communication System: PTT 150; Frequency: 158.813 MHz;Duty Cycle: 1:1

Medium parameters used: f = 159 MHz; 0.838 mho/m; ε_r = 61.6; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Ground 158.8125MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.16 mW/g

Front towards Ground 158.8125MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 38.7 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.2 W/kg

SAR(1 g) = 2.57 mW/g; SAR(10 g) = 2 mW/g

Maximum value of SAR (measured) = 2.69 mW/g

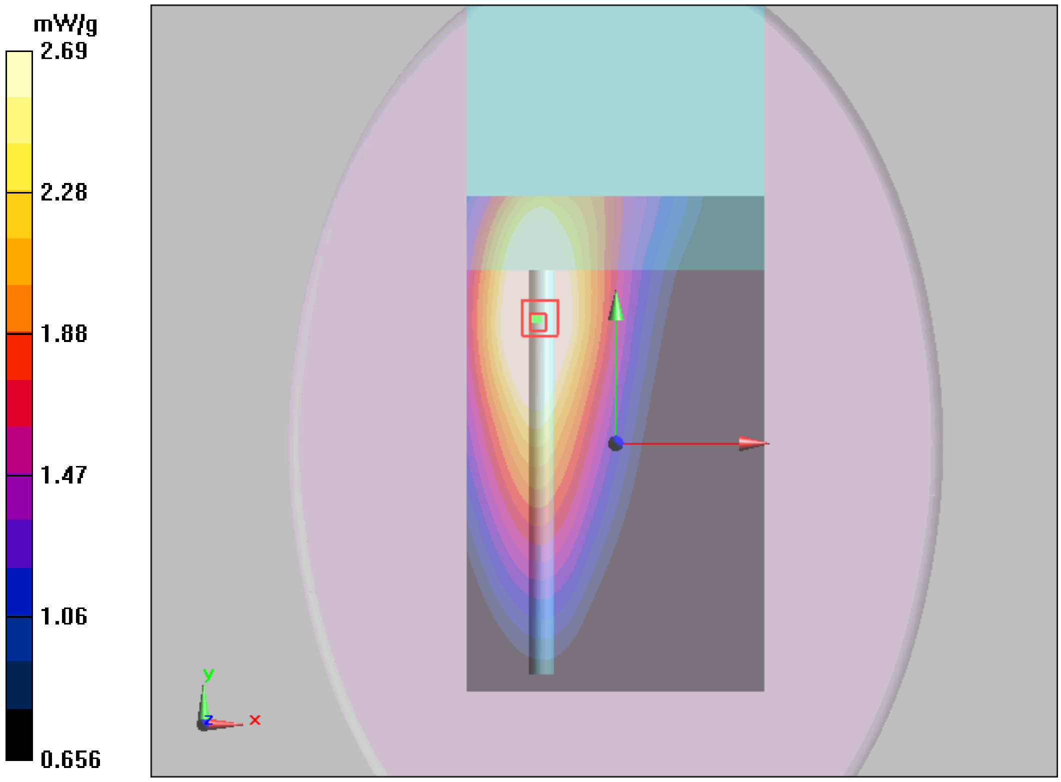


Figure 10 Body-Worn for Analog, Front towards Ground 158.8125MHz

Body-Worn for Analog, Front towards Ground 166.8125MHz (12.5KHz Channel Spacing, Antenna position)

Date/Time: 2/22/2013 12:14:11 AM

Communication System: PTT 150; Frequency: 166.813 MHz;Duty Cycle: 1:1

Medium parameters used: f = 167 MHz; σ = 0.839 mho/m; ε_r = 61.3; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Ground 166.8125MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.27 mW/g

Front towards Ground 166.8125MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 35.5 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 3.1 mW/g; SAR(10 g) = 2.43 mW/g

Maximum value of SAR (measured) = 3.24 mW/g

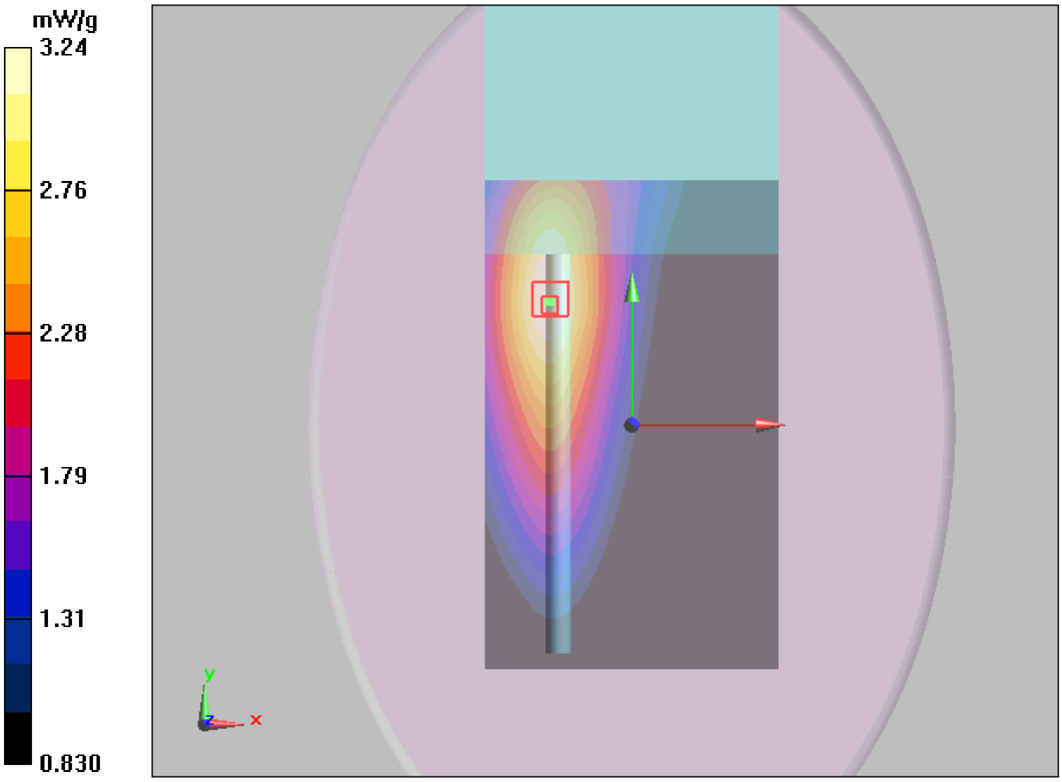


Figure 11 Body-Worn for Analog, Front towards Ground 166.8125MHz

Body-Worn for Analog, Front towards Ground 173.3875MHz (12.5KHz Channel Spacing, Antenna position)

Date/Time: 2/22/2013 12:42:33 AM

Communication System: PTT 150; Frequency: 173.387 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 173.387 MHz; σ = 0.84 mho/m; ε_r = 61.1; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Ground 173.3875MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.01 mW/g

Front towards Ground 173.3875MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 34.2 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 3.52 W/kg

SAR(1 g) = 2.87 mW/g; SAR(10 g) = 2.26 mW/g

Maximum value of SAR (measured) = 3.01 mW/g

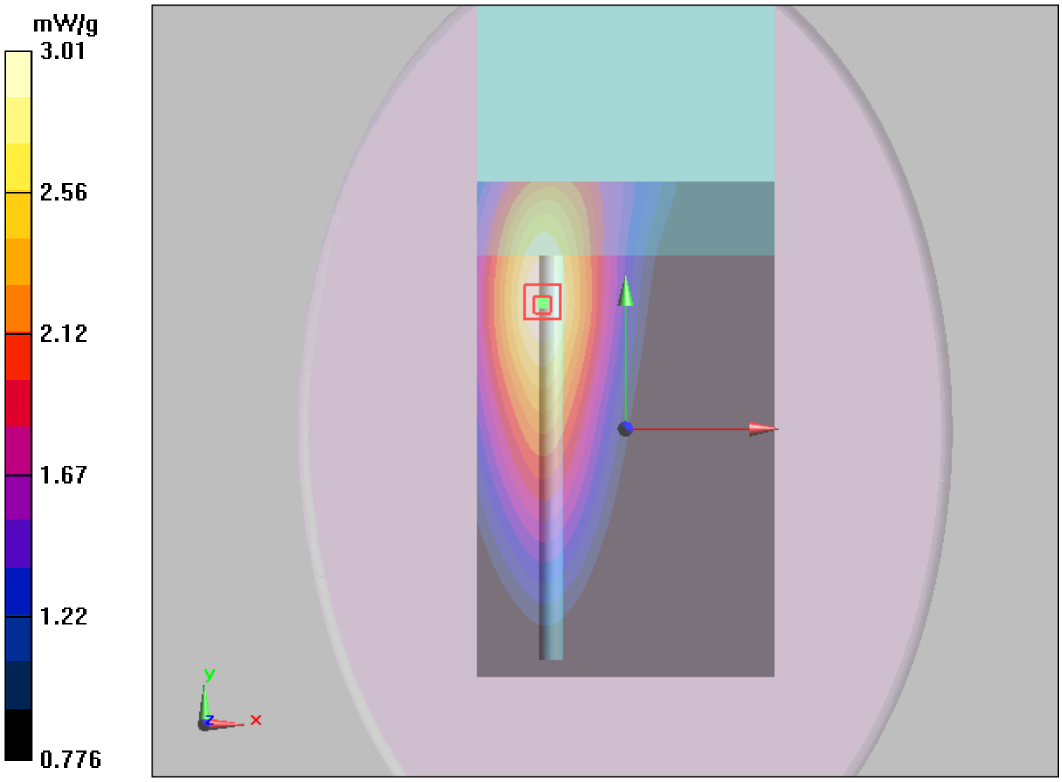


Figure 12 Body-Worn for Analog, Front towards Ground 173.3875MHz

Body-Worn for Analog, Front towards Ground 150.8125MHz (12.5KHz Channel Spacing, Body position)

Date/Time: 2/22/2013 1:12:16 AM

Communication System: PTT 150; Frequency: 150.813 MHz;Duty Cycle: 1:1

Medium parameters used: f = 151 MHz; σ = 0.833 mho/m; ε_r = 61.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Ground 150.8125MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.06 mW/g

Front towards Ground 150.8125MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 31.7 V/m; Power Drift = -0.072 dB

Peak SAR (extrapolated) = 3.81 W/kg

SAR(1 g) = 3.04 mW/g; SAR(10 g) = 2.36 mW/g

Maximum value of SAR (measured) = 3.22 mW/g

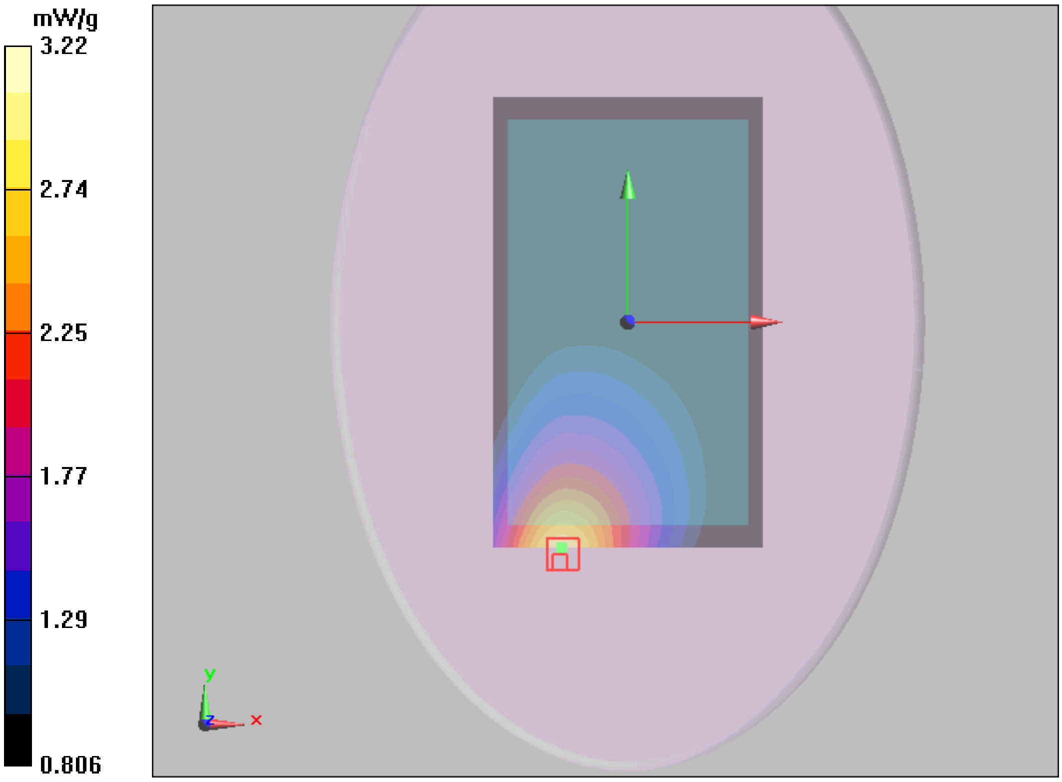


Figure 13 Body-Worn for Analog, Front towards Ground 150.8125MHz

Body-Worn for Analog, Front towards Phantom 150.8125MHz (12.5KHz Channel Spacing, Antenna position)

Date/Time: 2/22/2013 2:16:18 AM

Communication System: PTT 150; Frequency: 150.813 MHz;Duty Cycle: 1:1

Medium parameters used: f = 151 MHz; σ = 0.833 mho/m; ε_r = 61.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Phantom 150.8125MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.47 mW/g

Front towards Phantom 150.8125MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 42.5 V/m; Power Drift = -0.070 dB

Peak SAR (extrapolated) = 1.54 W/kg

SAR(1 g) = 1.46 mW/g; SAR(10 g) = 1.22 mW/g

Maximum value of SAR (measured) = 1.51 mW/g

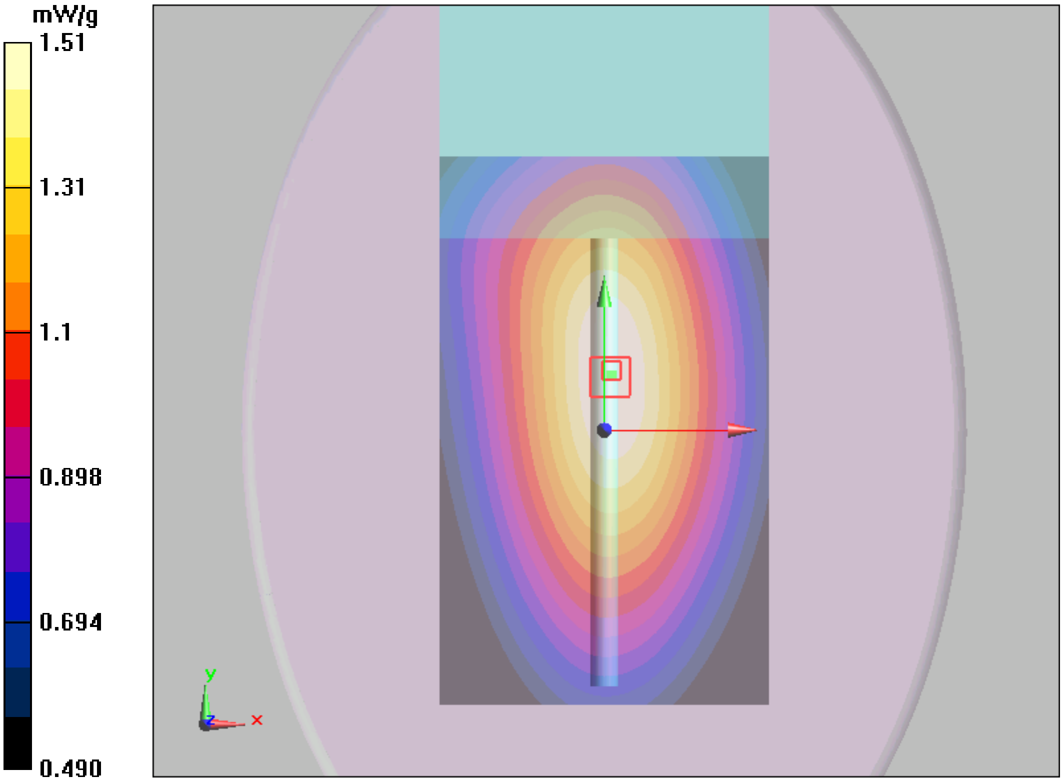


Figure 14 Body-Worn for Analog, Front towards Phantom 150.8125MHz

Body-Worn for Digital, Front towards Ground 150.8125MHz (12.5KHz Channel Spacing, Antenna position)

Date/Time: 2/22/2013 1:45:42 AM

Communication System: PTT 150; Frequency: 150.813 MHz;Duty Cycle: 1:1

Medium parameters used: f = 151 MHz; σ = 0.833 mho/m; ε_r = 61.9; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(7.3, 7.3, 7.3); Calibrated: 6/22/2012

Electronics: DAE4 Sn905; Calibrated: 6/21/2012

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Front towards Ground 150.8125MHz/Area Scan (91x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 4.07 mW/g

Front towards Ground 150.8125MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 39.6 V/m; Power Drift = -0.004 dB

Peak SAR (extrapolated) = 4.66 W/kg

SAR(1 g) = 3.87 mW/g; SAR(10 g) = 3.04 mW/g

Maximum value of SAR (measured) = 4.06 mW/g

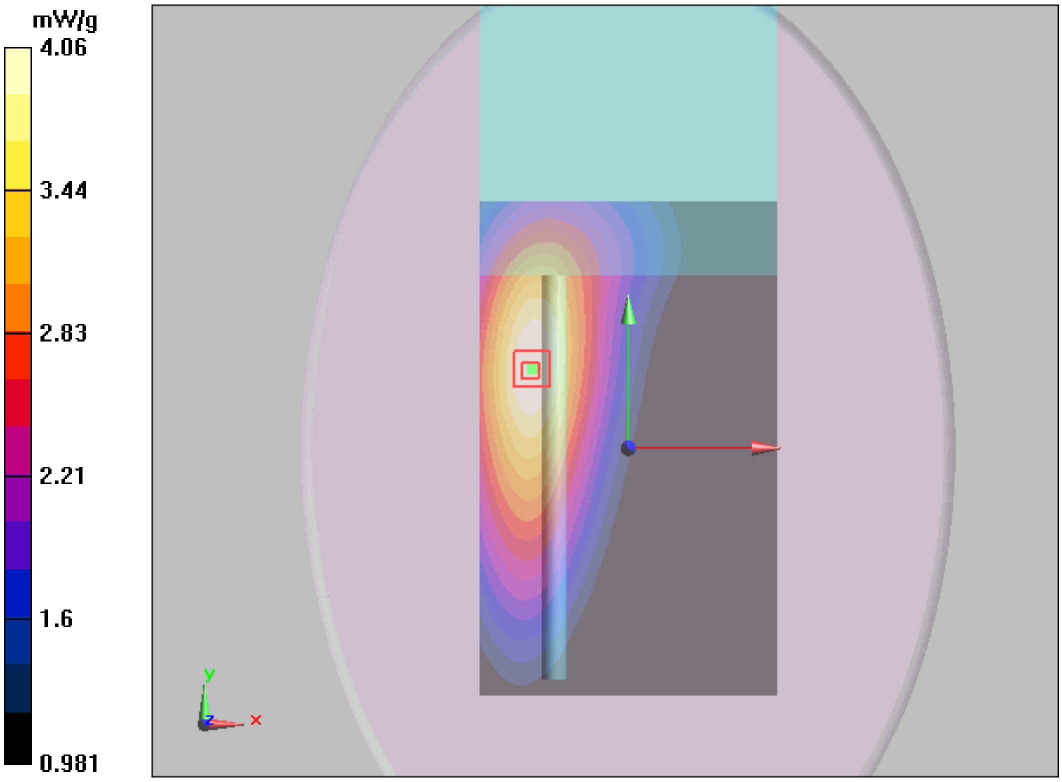


Figure 15 Body-Worn for Digital, Front towards Ground 150.8125MHz

ANNEX D: Probe Calibration Certificate

Schmid & Partner Engineering AG
s p e a g
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3189**
Place of Assessment:	**Zurich**
Date of Assessment:	**June 22, 2012**
Probe Calibration Date:	**June 22, 2012**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 300, 450 and 835 MHz.

Assessed by:

Schmid & Partner Engineering AG
s p e a g
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ES3DV3 SN:3189

Conversion factor (± standard deviation)

150 ± 50 MHz	ConvF	**7.7 ± 10%**	**ε_r = 52.3 ± 5%** **σ = 0.76 ± 5% mho/m** (head tissue)
150 ± 50 MHz	ConvF	**7.3 ± 10%**	**ε_r = 61.9 ± 5%** **σ = 0.80 ± 5% mho/m** (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also DASY Manual.

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**

Client **TA-Shanghai (Auden)**

Certificate No: **ES3-3189_Jun12**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3189

Calibration procedure(s): QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: June 22, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	10-Jan-12 (No. DAE4-660_Jan12)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: June 22, 2012

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

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: **SCS 108**

Glossary:

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

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3189

Manufactured: March 25, 2008
Calibrated: June 22, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.32	1.35	1.05	± 10.1 %
DCP (mV)[B]	99.5	100.6	100.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	160.3	±3.8 %
			Y	0.00	0.00	1.00	164.9	
			Z	0.00	0.00	1.00	182.0	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189

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	Depth (mm)	Unct. (k=2)
300	45.3	0.87	6.83	6.83	6.83	0.25	1.06	± 13.4 %
450	43.5	0.87	6.37	6.37	6.37	0.14	1.67	± 13.4 %
835	41.5	0.90	5.81	5.81	5.81	0.63	1.24	± 12.0 %
1750	40.1	1.37	4.90	4.90	4.90	0.80	1.14	± 12.0 %
1900	40.0	1.40	4.69	4.69	4.69	0.62	1.31	± 12.0 %
2450	39.2	1.80	4.14	4.14	4.14	0.65	1.36	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189

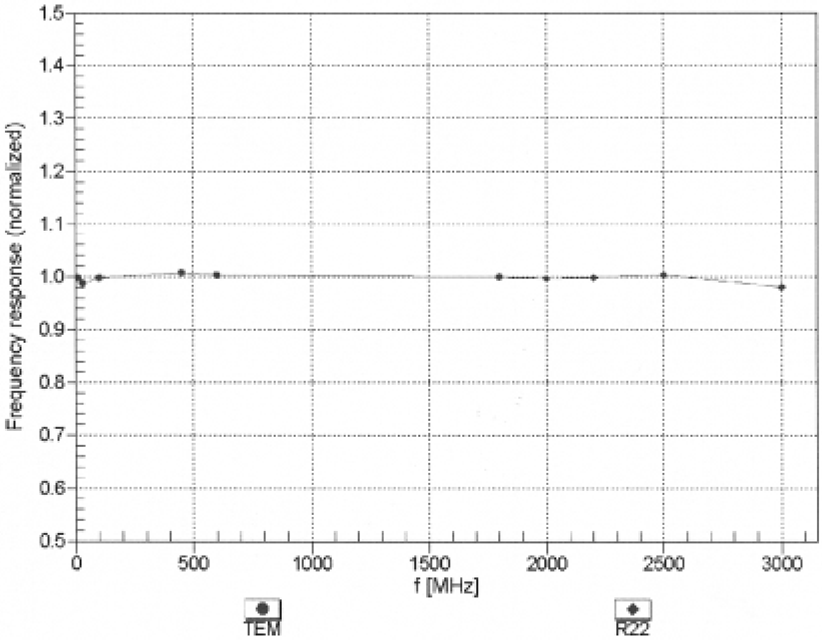
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.53	6.53	6.53	0.23	1.90	± 13.4 %
450	56.7	0.94	6.73	6.73	6.73	0.10	1.00	± 13.4 %
835	55.2	0.97	5.81	5.81	5.81	0.54	1.33	± 12.0 %
1750	53.4	1.49	4.65	4.65	4.65	0.67	1.38	± 12.0 %
1900	53.3	1.52	4.36	4.36	4.36	0.62	1.40	± 12.0 %
2450	52.7	1.95	3.96	3.96	3.96	0.64	0.99	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

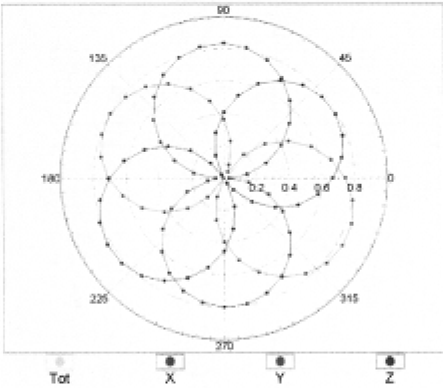
(TEM-Cell:ifi110 EXX, Waveguide: R22)



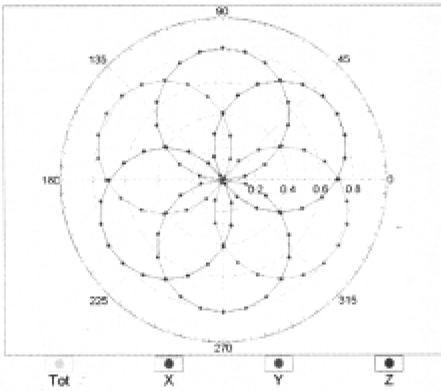
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

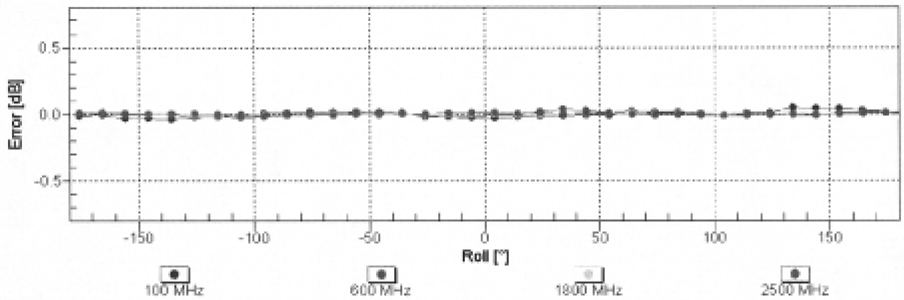
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22



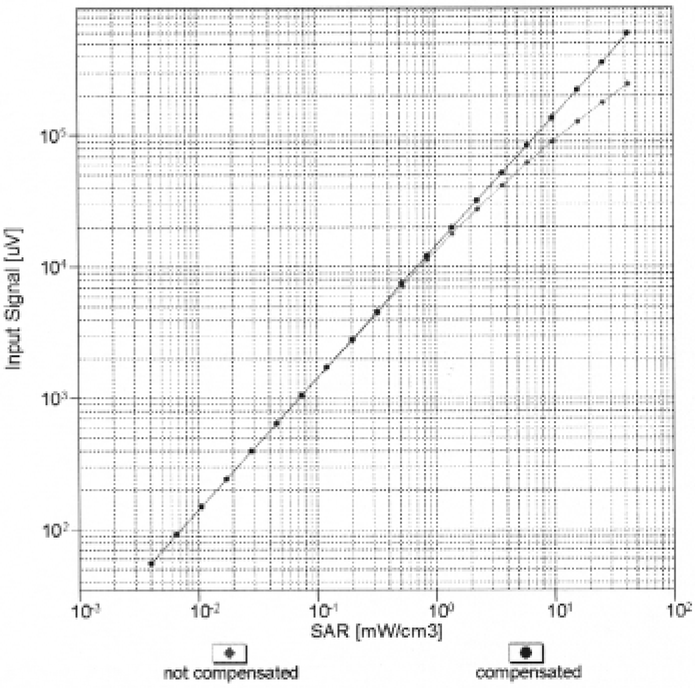


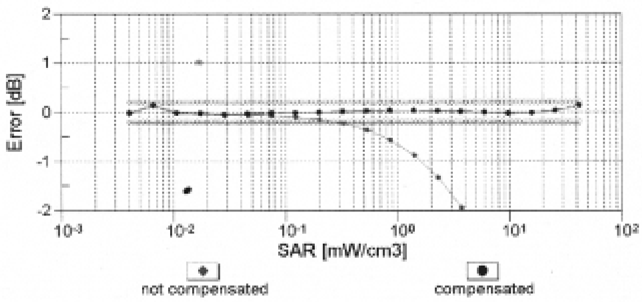
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ES3DV3– SN:3189 June 22, 2012

Dynamic Range f(SAR_{head})

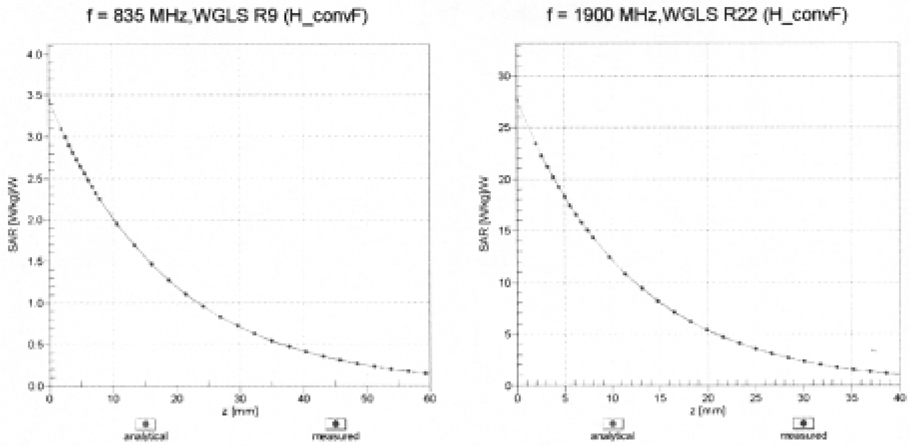
(TEM cell , f = 900 MHz)





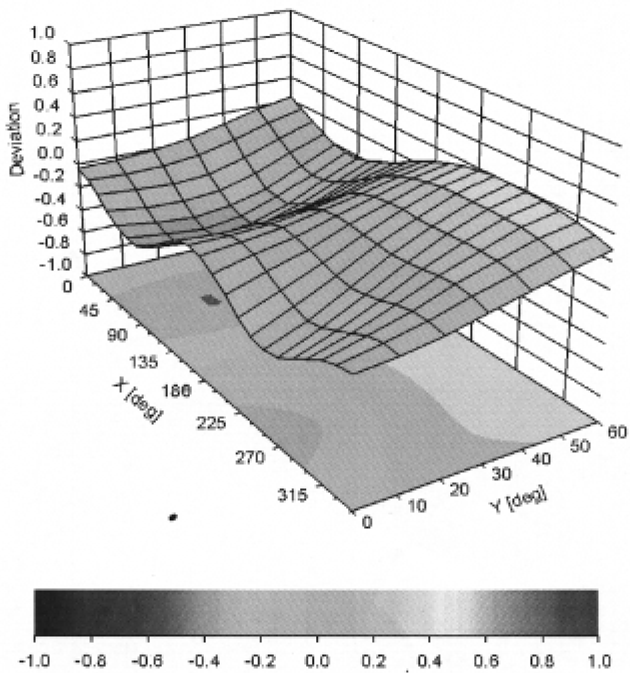
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	54.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

ANNEX E: D300V3 Dipole Calibration Certificate

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

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Accreditation No.: **SCS 108**

Client **TMC (Auden)**

Certificate No: **D300V3-1017_Jul12**

CALIBRATION CERTIFICATE

Object	D300V3 - SN: 1017
Calibration procedure(s)	QA CAL-15.v6 Calibration procedure for dipole validation kits below 700 MHz
Calibration date:	July 24, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ET3DV6	SN: 1507	30-Dec-11 (No. ET3-1507_Dec11)	Dec-12
DAE4	SN: 654	18-Apr-12 (No. DAE4-654_Apr12)	Apr-13

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

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

Issued: July 25, 2012

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	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	45.3	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	44.2 ± 6 %	0.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	398 mW input power	1.13 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**2.88 mW /g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	0.742 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**1.89 mW /g ± 17.6 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	58.2	0.92 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	58.3 ± 6 %	0.93 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	398 mW input power	1.14 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**2.84 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	398 mW input power	0.765 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**1.91 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	58.9 Ω - 1.1 jΩ
Return Loss	- 21.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.8 Ω - 5.5 jΩ
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.746 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	November 30, 2010

DASY5 Validation Report for Head TSL

Date: 24.07.2012

Test Laboratory: SPEAG

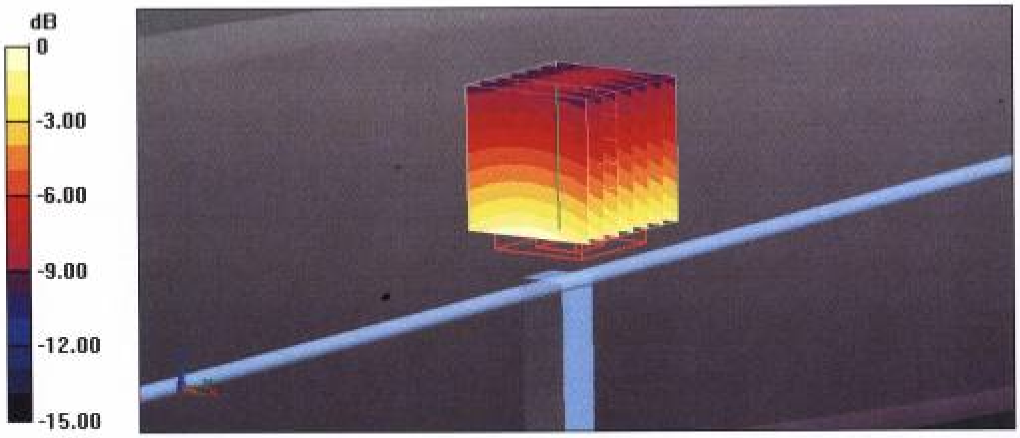
DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN: 1017

Communication System: CW; Frequency: 300 MHz
Medium parameters used: f = 300 MHz; $\sigma = 0.85$ mho/m; $\varepsilon_r = 44.2$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

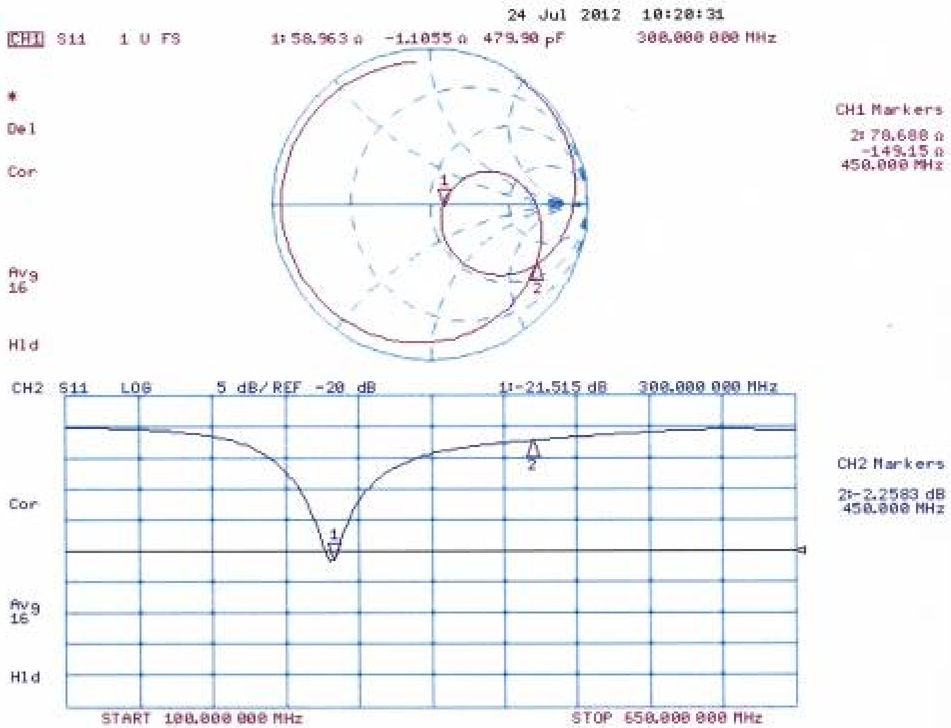
- Probe: ET3DV6 - SN1507; ConvF(7.3, 7.3, 7.3); Calibrated: 30.12.2011;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.04.2012
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

Dipole Calibration for Head Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.841 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.881 mW/g
SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.742 mW/g
Maximum value of SAR (measured) = 1.19 mW/g



0 dB = 1.19 mW/g = 1.51 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.07.2012

Test Laboratory: SPEAG

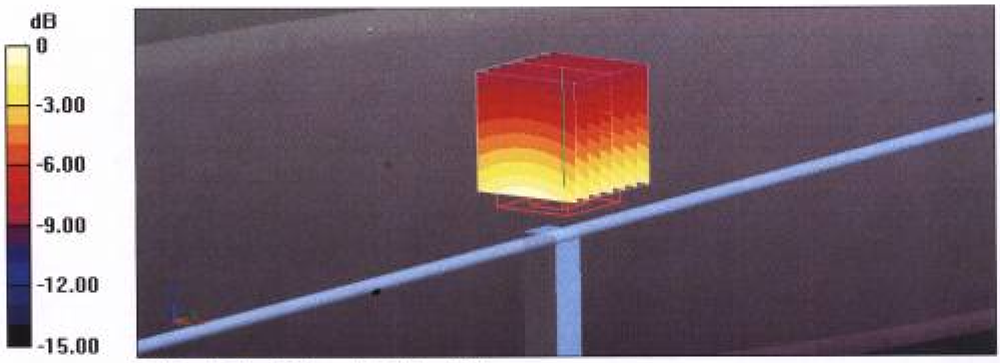
DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN: 1017

Communication System: CW; Frequency: 300 MHz
Medium parameters used: f = 300 MHz; σ = 0.93 mho/m; ε_r = 58.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

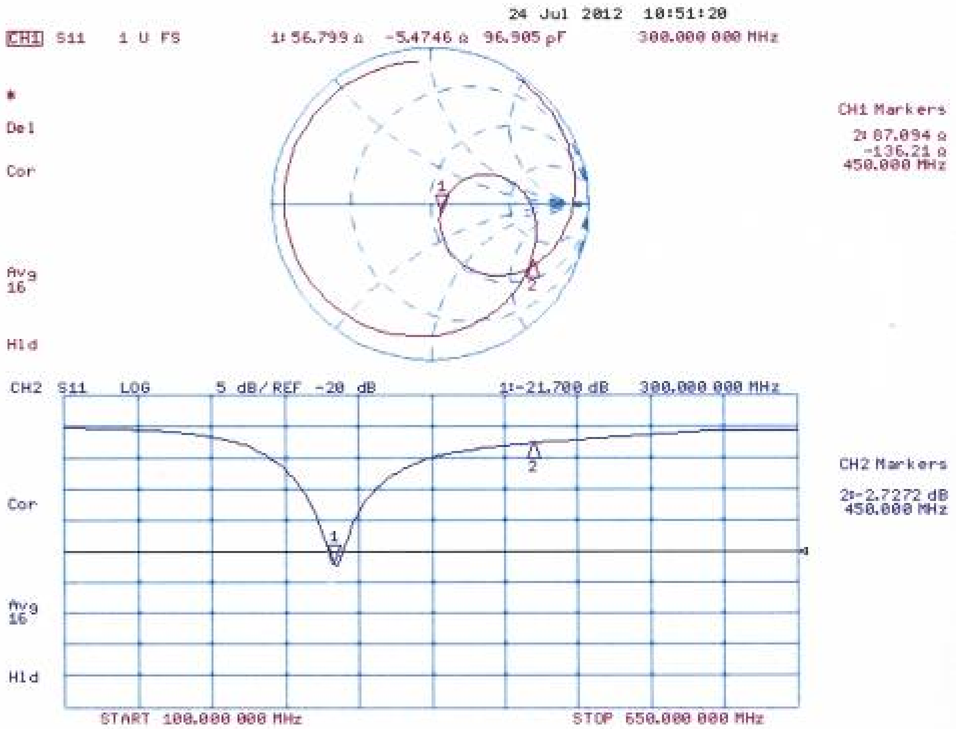
- Probe: ET3DV6 - SN1507; ConvF(7.15, 7.15, 7.15); Calibrated: 30.12.2011;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.04.2012
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

Dipole Calibration for Body Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.172 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.778 mW/g
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.765 mW/g
Maximum value of SAR (measured) = 1.21 mW/g



0 dB = 1.21 mW/g = 1.66 dB mW/g

Impedance Measurement Plot for Body TSL



ANNEX F: DAE4 Calibration Certificate

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 **Auden** Certificate No: **DAE4-905_Jun12**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BK - SN: 905

Calibration procedure(s): QA CAL-06.v24
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: June 21, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-11 (No:11450)	Sep-12
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V2.1	SE UWS 053 AA 1001	05-Jan-12 (in house check)	In house check: Jan-13

	Name	Function	Signature
Calibrated by:	Roland Mayoraz	Technician	R. Mayoraz
Approved by:	Fin Bomholt	R&D Director	i.V. B. Klimer

Issued: June 21, 2012

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

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	404.744 ± 0.1% (k=2)	405.295 ± 0.1% (k=2)	404.875 ± 0.1% (k=2)
Low Range	3.97983 ± 0.7% (k=2)	4.00269 ± 0.7% (k=2)	3.99654 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	270 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199996.94	-1.27	-0.00
Channel X	+ Input	20000.14	-0.07	-0.00
Channel X	- Input	-19997.83	3.06	-0.02
Channel Y	+ Input	199996.34	-1.76	-0.00
Channel Y	+ Input	19997.45	-2.66	-0.01
Channel Y	- Input	-20000.85	0.11	-0.00
Channel Z	+ Input	199999.43	1.31	0.00
Channel Z	+ Input	19998.09	-2.03	-0.01
Channel Z	- Input	-20000.38	0.66	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.20	-0.38	-0.02
Channel X	+ Input	201.23	0.09	0.04
Channel X	- Input	-197.80	0.90	-0.45
Channel Y	+ Input	2000.37	-0.14	-0.01
Channel Y	+ Input	200.23	-0.93	-0.46
Channel Y	- Input	-199.71	-0.91	0.46
Channel Z	+ Input	2000.07	-0.47	-0.02
Channel Z	+ Input	200.24	-0.94	-0.47
Channel Z	- Input	-199.53	-0.70	0.35

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	10.10	8.39
	- 200	-6.31	-7.87
Channel Y	200	7.67	7.42
	- 200	-9.57	-9.68
Channel Z	200	2.03	1.67
	- 200	-2.67	-3.15

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	-	5.61	-1.03
Channel Y	200	9.77	-	7.17
Channel Z	200	9.96	6.56	-

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	15897	16637
Channel Y	16146	15425
Channel Z	16377	16752

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	0.62	-0.20	1.36	0.34
Channel Y	-0.89	-1.83	-0.02	0.33
Channel Z	-0.59	-2.34	1.15	0.60

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

ANNEX G: The EUT Appearances and Test Configuration

a: EUT

b: EUT with Battery, Antenna and Microphone

c: Battery

d: Microphone

Antenna 1

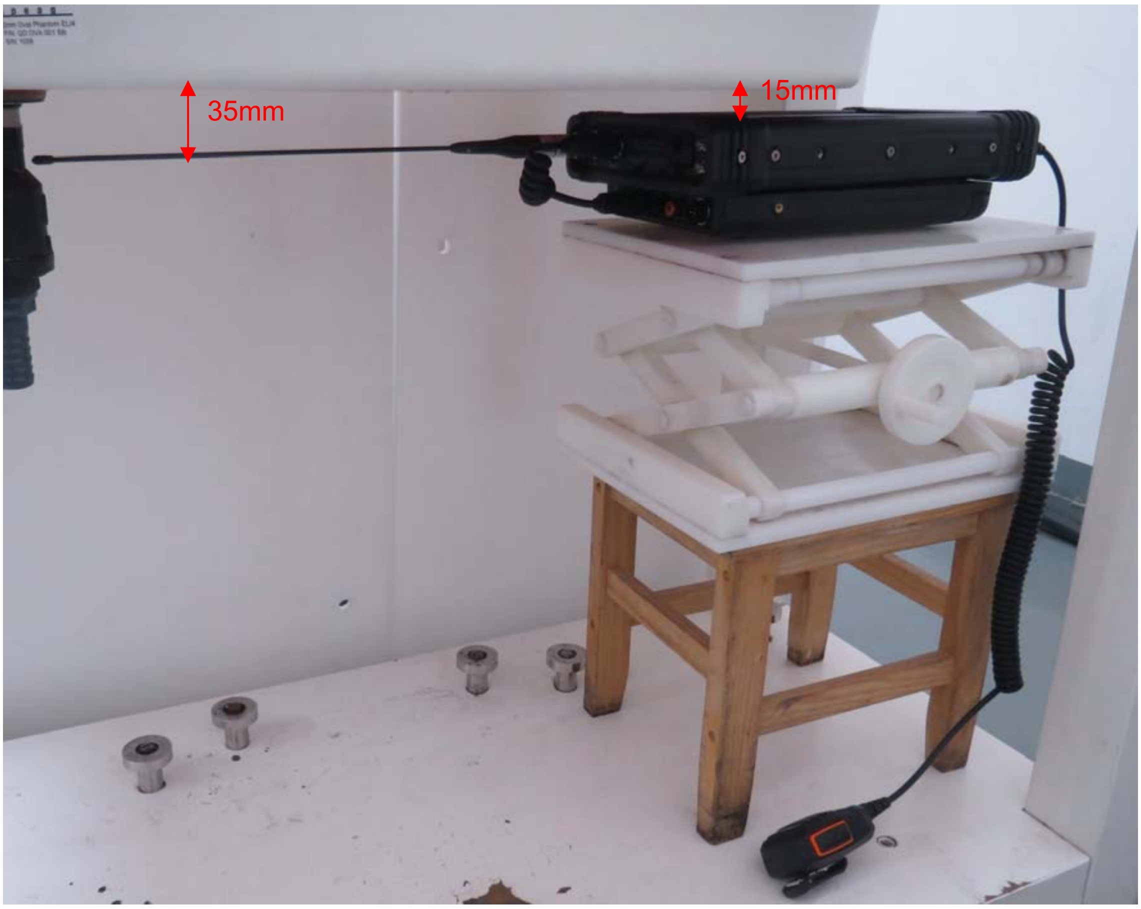
Antenna 2

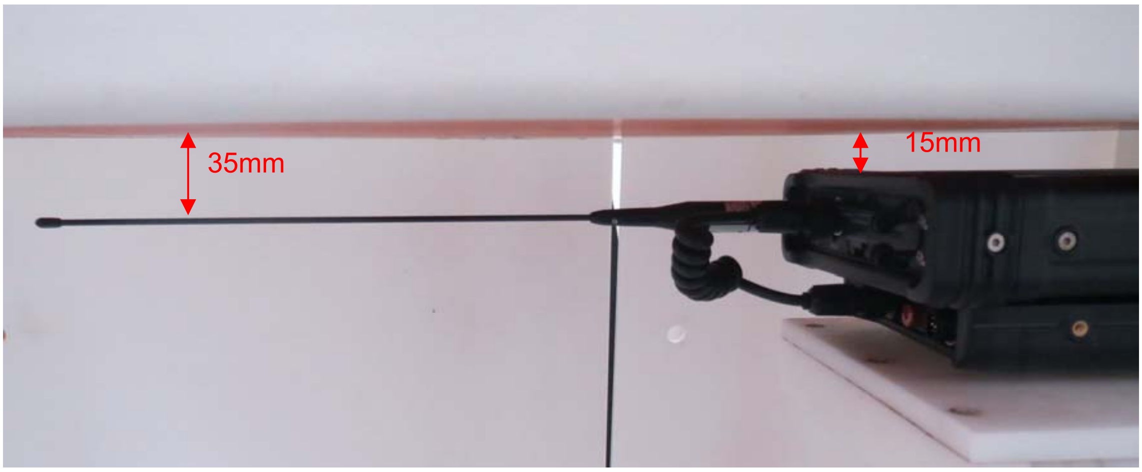
Antenna 3

Antenna 4

e: Antenna

Picture 3: Constituents of the sample





Antenna position

Body position

Picture 4: Body-worn, the front side of the EUT is towards ground. The distance from the EUT Antenna to the bottom of the Phantom is 35mm

Antenna position

Picture 5: Body-worn, the back side of the EUT is towards ground. The distance from the EUT Antenna to the bottom of the Phantom is 78mm

ANNEX H: Permit but Ask

Currently Displaying Inquiry Tracking Number: 868998

Inquiry Details on 03/10/2013:

First category: General* (RF Exposure)

Second category:

Third category:

Subject: 150MHZ SAR test inquiry

Inquiry: Dear sir or madam,

Recently ,I received a project of 150 MHz PTT, now I have some question about this project for SAR testing.

According to the establishing a new SAR target of KDB 865664:

c) The SAR probe must be calibrated at the offset (device testing) frequency and the probe conversion
factors at the tuned dipole frequency and device testing frequencies must be within 5% of each other.

My SAR measurement system is DASY 5 system, we also had calibrated the SAR probe at 150MHz and 300MHz from DASY manufacture. The conversion factors is 7.3 at 150MHz,and the conversion factors is 6.53 at 300MHz, and the different conversion factor is more than 5%.

Please kindly give me a hand and give me a suggestion for SAR testing or this project as soon as possible.

Thanks and best regards

Yours sincerely

Jeff Ling

---Reply from Customer on 03/13/2013---

Dear sir or madam,

I had submit an inquiry about the 150MHz SAR testing.

This project have some urgent

Please kindly give me a hand and give me a suggestion for SAR testing or this project.

Thanks and best regards

Yours sincerely

Jeff Ling

FCC Response on 03/14/2013:

As long as both probe calibration certificates are included in the SAR report and the difference in probe conversion factor between 150 and 300 MHz [(7.3-635)/6.53 = 11.8%] is < 12 %, you may apply the 150 MHz SAR system verification procedures in KDB 865664. A copy of this KDB inquiry must be provided to the TCB to facilitate review and approval.