TEST REPORT

Report Reference No..................... :	**TRE15120073** R/C..........: 65771
Applicant's name .... :	**SHENZHEN SAMHOO SCI&TECH CO.,LTD.**
Address...:	Room 401, Building 2, Huaqiangyun Industrial Park, Meixiu Rd., Meilin, Futian District, Shenzhen, China
Manufacturer.......................................:	**SHENZHEN SAMHOO SCI&TECH CO.,LTD.**
Address...:	Room 401, Building 2, Huaqiangyun Industrial Park, Meixiu Rd., Meilin, Futian District, Shenzhen, China
Test item description .... :	**Digital Two Way Radio**
Trade Mark ....:	-
Model/Type reference.......................:	ST3
Listed Model(s) ....:	-
Standard .... :	**FCC 47 CFR Part2.1093** **ANSI/IEEE C95.1: 1999** **IEEE 1528: 2013**
Date of receipt of test sample...........:	Dec 11, 2015
Date of testing...............................:	Feb 17, 2016- Feb 18, 2016
Date of issue...................................:	Feb 25, 2016
Result.................. ....:	**PASS**

Compiled by (position+printed name+signature)..:	File administrators:	Candy Liu	Candy Liu
Supervised by (position+printed name+signature)..:	Test Engineer:	Hans Hu	Hans Hu
Approved by (position+printed name+signature)..:	Manager:	Hans Hu	Hans Hu

Testing Laboratory Name .... :	**Shenzhen Huatongwei International Inspection Co., Ltd**
Address...:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1 . Test Standards and Test Desciption

1.1. Test Standards

The tests were performed according to following standards:

EEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.

IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

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

KDB 643646 D01: SAR Test for PTT Radios v01r03 :SAR Test Reduction Considerations for Occupational PTT Radios

1.2. Test Description

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power

2. Summary

2.1. Client Information

Applicant:	SHENZHEN SAMHOO SCI&TECH CO.,LTD.
Address:	Room 401,Building 2th,Huaqiangyun Industrial Park,Meixiu Road, Meilin, Futian District,Shenzhen,China
Manufacturer:	SHENZHEN SAMHOO SCI&TECH CO.,LTD.
Address:	Room 401,Building 2th,Huaqiangyun Industrial Park,Meixiu Road, Meilin, Futian District,Shenzhen,China

2.2. Product Description

Name of EUT:	Digital Two Way Radio						
Trade mark:	-						
Model/Type reference:	ST3						
Listed mode(s):	-						
Device Category:	Portable						
RF Exposure Environment:	Occupational / Controlled Exposure Environment						
Power supply:	DC 3.6V from Internal battery						
Accessory:	Headset and belt clip(contains no meta)						
Adapter information:	Model:GEO061T-050100 Input:100-240Va.c.,50/60Hz,0.2A Output:5.0Vd.c., 1000mA						
Maximum SAR Value							
Separation Distance:	Body:	0mm					
	Face:	25mm					
Maximun SAR Value (1g):	Body:	**4.424 W/Kg**					
	Face:	**1.328 W/Kg**					
Operation Frequency Range:	406.1MHz to 420MHz, 421MHz to 470MHz						
Rated Output Power:	1 W (30dBm)						
Modulation Type:	Analog	FM					
	Digital:	4FSK					
Channel Separation:	Analog:	☒	12.5kHz	☐	20kHz	☐	25kHz
	Digital:	☒	6.25kHz	☒	12.5kHz		
Digital Type:	DMR						
Antenna type:	Internal						

2.3. Test frequency list

According to KDB 447498 D01
When the frequency channels required for SAR testing are not specified in the published RF exposure KDB procedures, the following should be applied to determine the number of required test channels. The test channels should be evenly spread across the transmission frequency band of each wireless mode:

$$N_c = Round\left\{\left[100\left(f_{high} - f_{low}\right)/f_c\right]^{0.5} \times \left(f_c/100\right)^{0.2}\right\}$$

- N_c is the number of test channels, rounded to the nearest integer;
- f_{high} and f_{low} are the highest and lowest channel frequencies within the transmission band,
- f_c is the mid-band channel frequency,
- all frequencies are in MHz.

Mode	Channel Separation (KHz)	Operation Frequency Range	Channel	Frequency (MHz)
Analog	12.5	406.1MHz~420MHz	CH_L	406.1125
			CH_H	419.9875
		421MHz~470MHz	CH_L	421.0125
			CH_{M1}	437.0000
			CH_{M2}	453.0000
			CH_H	469.9875
Digtial	12.5	406.1MHz~420MHz	CH_L	406.1125
			CH_H	419.9875
		421MHz~470MHz	CH_L	421.0125
			CH_{M1}	437.0000
			CH_{M2}	453.0000
			CH_H	469.9875

3. Test Environment

3.1. Address of the test laboratory

Laboratory:Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
Phone: 86-755-26748019 Fax: 86-755-26748089

3.2. Test Facility

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

CNAS-Lab Code: L1225
Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories
(identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Labo ratories, Date of Registration: February 28, 2015. Valid time is until February 27, 2018.

A2LA-Lab Cert. No. 3902.01
Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for tec hnical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional progra m requirements in the identified field of testing. Valid time is until December 31, 2016.

FCC-Registration No.: 317478
Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully descri bed in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FC C is maintained in our files. Registration 317478, Renewal date Jul. 18, 2014, valid time is until Jul. 18, 2017.

IC-Registration No.: 5377A&5377B
The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A on Dec. 31, 2013, valid time is until Dec. 31, 2016.
Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B on Dec.03, 2014, valid time is until Dec.03, 2017.

ACA
Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Aust ralian C-Tick mark as a result of our A2LA accreditation.

VCCI
The 3m Semi-
anechoic chamber (12.2m×7.95m×6.7m) of Shenzhen Huatongwei International Inspection Co., Ltd.
has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2484. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 29, 2015.
Radiated disturbance above 1GHz measurement of Shenzhen Huatongwei International Inspection Co., Ltd. h as been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2013. Valid time is until Dec. 23, 2016.
Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 19, 2015.
Telecommunication Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspe ction Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with R egistration No.: T-1837. Date of Registration: May 07, 2013. Valid time is until May 06, 2016.

DNV
Shenzhen Huatongwei International Inspection Co., Ltd. has been found to comply with the requirements of D NV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Di rectives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-
ups according to relevant parts of ISO/IEC Guide 17025 (2005), in accordance with the requirements of the D NV Laboratory Quality Manual towards subcontractors. Valid time is until Aug. 24, 2016.

3.3. Environmental conditions

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

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

4. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	2015/07/22	1
E-field Probe	SPEAG	ES3DV3	3292	2015/08/15	1
System Validation Dipole D450V3	SPEAG	D450V3	1079	2015/02/28	1
Dielectric Probe Kit	Agilent	85070E	US44020288	/	/
Power meter	Agilent	E4417A	GB41292254	2015/10/26	1
Power sensor	Agilent	8481H	MY41095360	2015/10/26	1
Power sensor	Agilent	E9327A	US40441621	2015/10/26	1
Network analyzer	Agilent	8753E	US37390562	2015/10/25	1
Signal Generator	ROHDE & SCHWARZ	SMBV100A	258525	2015/10/23	1
Power Divider	ARRA	A3200-2	N/A	N/A	N/A
Dual Directional Coupler	Agilent	778D	50783	Note	
Attenuator 1	PE	PE7005-10	N/A	Note	
Attenuator 2	PE	PE7005-10	N/A	Note	
Attenuator 3	PE	PE7005-3	N/A	Note	
Power Amplifier	AR	5S1G4M2	0328798	Note	

Note:

1. *The Probe,Dipole and DAE calibration reference to the Appendix A.*
2. *Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.*

5. Measurement Uncertainty

No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.0%	N	1	1	1	6.0%	6.0%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.90%	3.90%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.70%	2.70%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
7	RF ambient conditions-noise	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	RF ambient conditions-reflection	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Response time	B	0.80%	R	$\sqrt{3}$	1	1	0.50%	0.50%	∞
10	Integration time	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
11	RF ambient	B	3.00%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
12	Probe positioned mech. restrictions	B	0.40%	R	$\sqrt{3}$	1	1	0.20%	0.20%	∞
13	Probe positioning with respect to phantom shell	B	2.90%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
14	Max.SAR evalation	B	3.90%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
Test Sample Related										
15	Test sample positioning	A	1.86%	N	1	1	1	1.86%	1.86%	∞
16	Device holder uncertainty	A	1.70%	N	1	1	1	1.70%	1.70%	∞
17	Drift of output power	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
19	Liquid conductivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
20	Liquid conductivity (meas.)	A	0.50%	N	1	0.64	0.43	0.32%	0.26%	∞
21	Liquid permittivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
22	Liquid cpermittivity (meas.)	A	0.16%	N	1	0.64	0.43	0.10%	0.07%	∞
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	9.79%	9.67%	∞
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		R	K=2	/	/	19.57%	19.34%	∞

6. SAR Measurements System Configuration

6.1. 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.

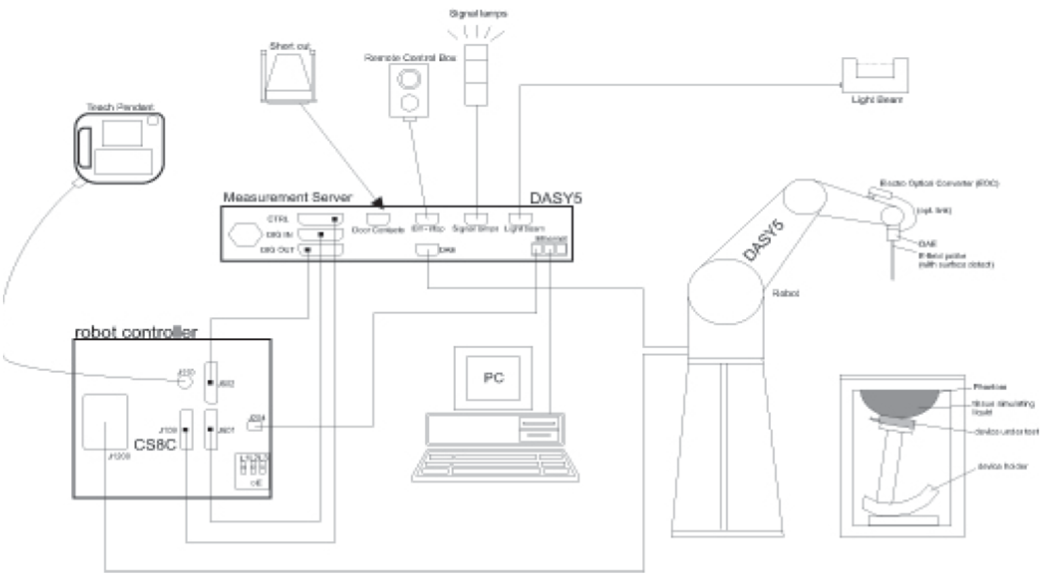
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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.



6.2. DASY5 E-field Probe System

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

- **Probe Specification**

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

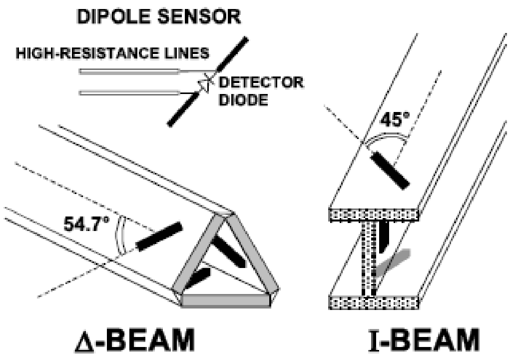
CalibrationISO/IEC 17025 calibration service available.

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: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

- **Isotropic E-Field Probe**

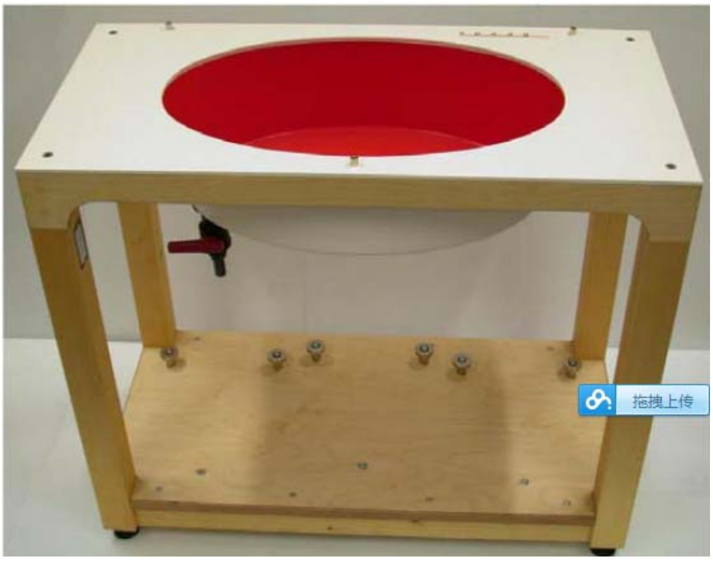
The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

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



6.3. Phantoms

For body mounted and frontal held push-to-talk devices, compliant Oval Flat Phantom (ELI V4.0) with a base plate thickness of 2mm is used.



ELI V4.0 Phantom

6.4. Device Holder

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

Device holder supplied by SPEAG

7. SAR Test Procedure

7.1. 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 of 15 mm x 15 mm is set. During the 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

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x5 points within a cube whose base is centered around the maxima found in the preceding area scan.

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. For a grid using 7x7x5 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x5 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

7.2. Data Storage and Evaluation

Data Storage

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

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [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.

Data Evaluation

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

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

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the 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:

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

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

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

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

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

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

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

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

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

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

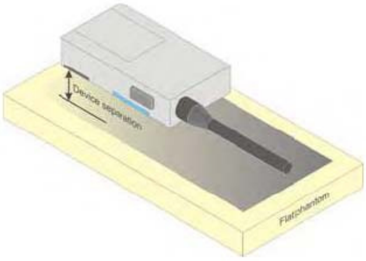
SAR: local specific absorption rate in mW/g
Etot: total field strength in V/m
σ: conductivity in [mho/m] or [Siemens/m]
ρ: equivalent tissue density in g/cm3

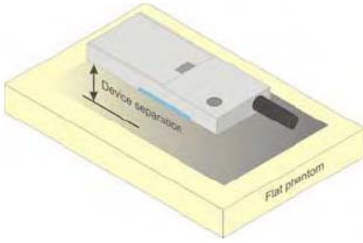
Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

8. Position of the wireless device in relation to the phantom

8.1. Front-of-face

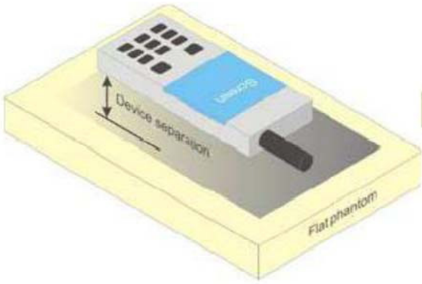
A typical example of a front-of-face device is a two-way radio that is held at a distance from the face of the user when transmitting. In these cases the device under test shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions. If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.

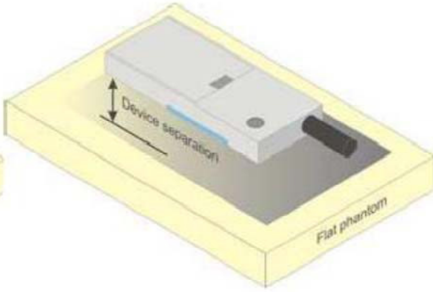




8.2. Body Position

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.





9. SAR System Validation

Per FCC KDB 865664 D02 ,SAR system validadion status should be documented to confirm measurement accuracy.The SAR systems (including SAR probes,system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements.Reference dipoles were used with the required tissue-equivalent media for system validation,according to the procedures outlined in FCC KDB 865664 D01 and IEEE 1528-2013.Since SAR probe calibrations are frequency dependent,each probe calibration point,using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s),measurement frequencies, SAR probes and tissue dielectric parameters has been included.

SAR System Validation Summary

Probe	Probe type	Probe Calibration Point		Dielectric Parameters		CW Validation			Modulation Validation			Date
				Conductivity	Permittivity	Sensitivity	Probe linearity	Probe Isotropy	Moduation type	Duty factor	PAR	
3292	ES3DV3	450	Head	0.89	43.64	PASS	PASS	PASS	4FSK/FM	PASS	N/A	02-17
3292	ES3DV3	450	Body	0.95	56.50	PASS	PASS	PASS	4FSK/FM	PASS	N/A	02-17

NOTE:
While the probes have been calibrated for both CW and modulated signals,all measurements were performed using communication systems calibrated for CW signals only.Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01 for scenarios when CW probe calibrations are used with other signal types.

10. System Verification

10.1. Tissue Dielectric Parameters

The liquid used for the frequency consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 1 and 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664 D01.

Table 1. Composition of the Tissue Equivalent Matter

Ingredients (% by weight)	450MHz	
	Head	Body
Water	38.56	52
Sugar	56.32	45.65
Salt	3.95	1.75
Hec	0.98	0.5
Bacteriacide	0.19	0.1

Table 2. Targets for tissue simulating liquid

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	Ơ (S/m)	εr	Ơ (S/m)
450	43.5	0.87	56.7	0.94

Check Result:

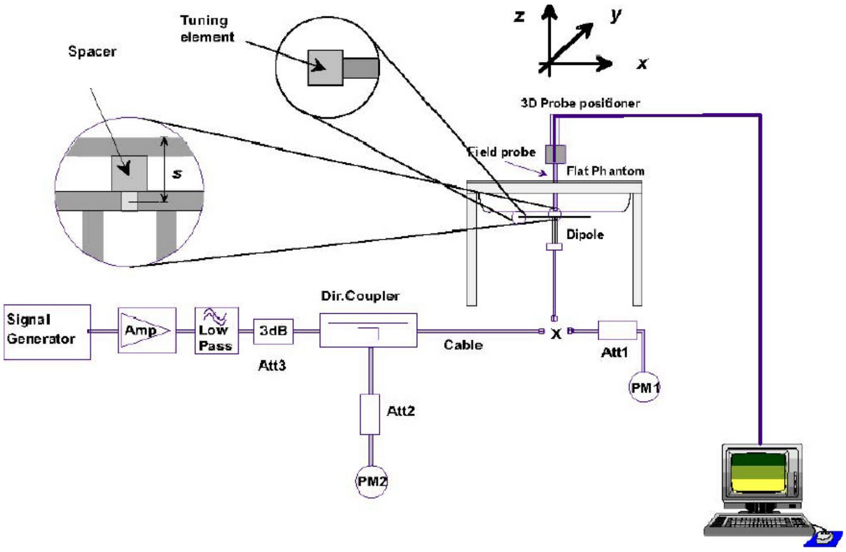
Dielectric performance of Head tissue simulating liquid				
Frequency (MHz)	Description	DielectricParameters		Temp
		εr	σ(s/m)	℃
450	Recommended result ±5% window	43.50 41.32 - 45.67	0.87 0.83–0.91	/
	Measurement value 2016-02-17	43.64	0.89	21

Dielectric performance of Body tissue simulating liquid				
Frequency (MHz)	Description	DielectricParameters		Temp
		εr	σ(s/m)	℃
450	Recommended result ±5% window	56.7 53.87 - 59.53	0.94 0.89–0.98	/
	Measurement value 2016-02-17	56.50	0.95	21

10.2. SAR System Verification

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

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).
System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



The output power on dipole port must be calibrated to 26 dBm (398mW) before dipole is connected.

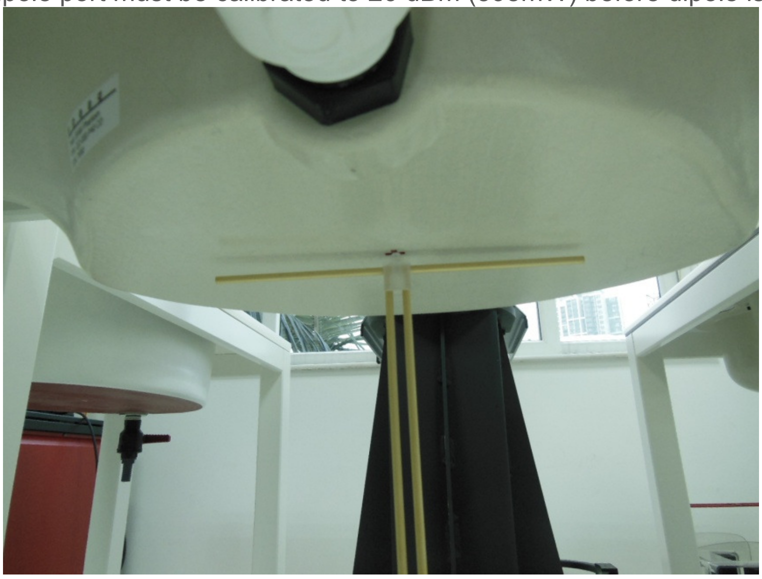


Photo of Dipole Setup

Check Result:

System Validation Result for Head				
Frequency (MHz)	Description	SAR(W/kg)		Temp
		1g	10g	℃
450	Recommended result ±10% window	1.81 1.63 – 1.99	1.21 1.09 - 1.33	/
	Measurement value 2016-02-17	1.78	1.17	21
	1 W Target Value ±10% window	4.63 4.17 – 5.09	3.09 2.78 – 3.40	/
	1 W Normalized Value	4.47	2.94	/

System Validation Result for Body				
Frequency (MHz)	Description	SAR(W/kg)		Temp
		1g	10g	℃
450	Recommended result ±10% window	1.74 1.57 – 1.91	1.16 1.04 - 1.27	/
	Measurement value 2016-02-17	1.69	1.12	21
	1 W Target Value ±10% window	4.45 4.01 – 4.90	2.97 2.67 – 3.27	/
	1 W Normalized Value	4.25	2.81	/

Note:

1. *the graph results see follow.*
2. *Recommended Values used derive from the calibration certificate and 398 mW is used as feeding power to the calibrated dipole.*

System Performance Check at 450 MHz Head

DUT: Dipole 450 MHz; Type: D450V3; Serial: 4d134
Test date: 2016-02-17 am 8:22

Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.89 S/m; ε_r = 43.64; ρ = 1000 kg/m^3

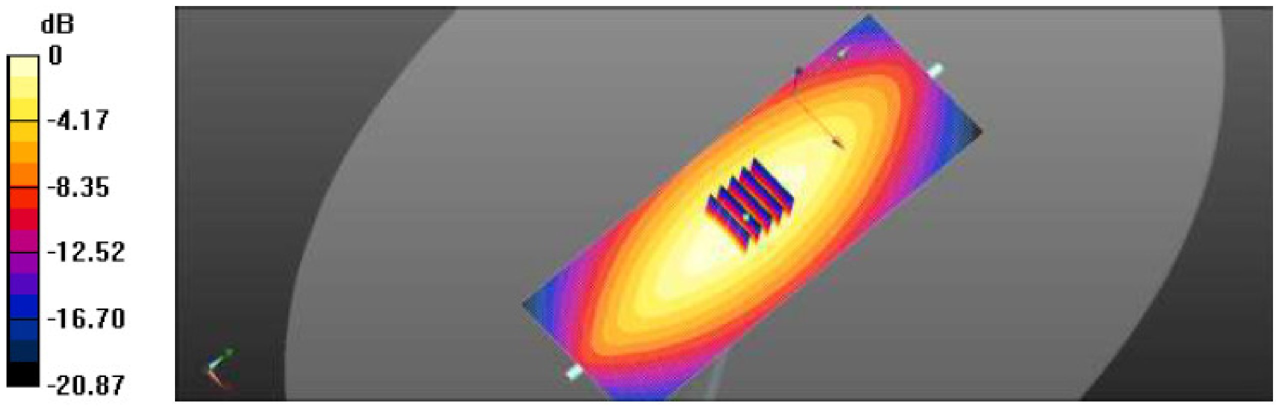
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV3 - SN3292; ConvF(6.71, 6.71, 6.71); Calibrated: 15/08/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
Phantom: ELI v4.0; Type: QDOVA001BB;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)
Area Scan (61x171x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.58 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.994 V/m; Power Drift = 0.082 dB
Peak SAR (extrapolated) = 3.542 W/kg

SAR(1 g) = 1.78 mW/g SAR(10 g) = 1.17 mW/g

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



System Performance Check 450MHz Head 398mW

System Performance Check at 450 MHz Body

DUT: Dipole 450 MHz; Type: D450V3; Serial: 4d134
Test date: 2016-02-17 pm 15:30

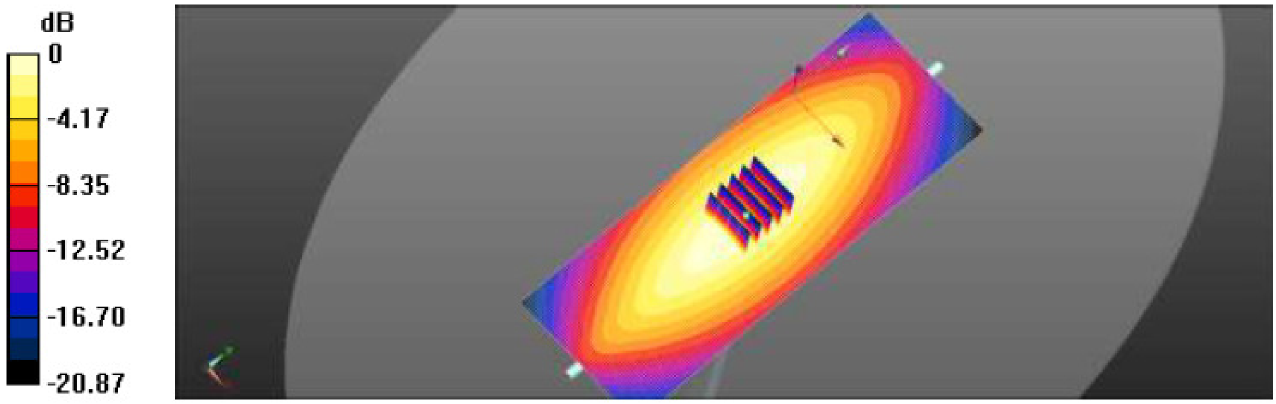
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.95 S/m; ε_r = 56.50; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV3 - SN3292; ConvF(7.10, 7.10, 7.10); Calibrated: 15/08/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
Phantom: ELI v4.0; Type: QDOVA001BB;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)
Area Scan (61x171x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.15 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.528 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.262 W/kg

SAR(1 g) = 1.69 mW/g SAR(10 g) = 1.12 mW/g

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



System Performance Check 450MHz Body 398mW

11. SAR Exposure Limits

Type Exposure	Limit (W/kg)	
	General Population / Uncontrolled Exposure Environment	Occupational / Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (10g cube tissue for head and trunk)	1.60	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

Population/Uncontrolled Environments: are defined as locations where there is the exposure of individual 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).

12. Conducted Power Measurement Results

Mode	Channel Separation (KHz)	Operation Frequency Range	Channel	Frequency (MHz)	Conducted power (dBm)
Analog	12.5	406.1MHz~420MHz	CH_L	406.1125	29.48
			CH_H	419.9875	29.55
		421MHz~470MHz	CH_L	421.0125	29.68
			CH_{M1}	437.0000	29.79
			CH_{M2}	453.0000	29.51
			CH_H	469.9875	29.64
Digtial	12.5	406.1MHz~420MHz	CH_L	406.1125	29.75
			CH_H	419.9875	29.58
		421MHz~470MHz	CH_L	421.0125	29.52
			CH_{M1}	437.0000	29.63
			CH_{M2}	453.0000	29.35
			CH_H	469.9875	29.42

13. Maximum Tune-up Limit

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01

Mode	Channel Separation (KHz)	Operation Frequency Range	Tune up power
Analog / Digtial	12.5	406.1MHz~420MHz 421MHz~470MHz	29.00dBm~30.00dBm

14. SAR Measurement Results

Front of Face										
Frequency range (MHz)	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode										
406.1~420	CH_L	406.1125	29.48	30.00	-0.08	1.15	2.314	2.657	1.328	AF1
	CH_H	419.9875	29.55	30.00	-	-	-	-	-	-
421~470	CH_L	421.0125	29.68	30.00	-	-	-	-	-	-
	CH_{M1}	437.0000	29.79	30.00	-0.07	1.07	1.968	2.099	1.050	AF2
	CH_{M2}	453.0000	29.51	30.00	-	-	-	-	-	-
	CH_H	469.9875	29.64	30.00	0.06	1.07	1.849	1.981	0.991	-
Diatigal mode										
406.1~420	CH_L	406.1125	29.75	30.00	-0.06	1.07	1.976	2.122	1.061	DF1
	CH_H	419.9875	29.58	30.00	-	-	-	-	-	-
421~470	CH_L	421.0125	29.52	30.00	-	-	-	-	-	-
	CH_{M1}	437.0000	29.63	30.00	-0.04	1.10	1.648	1.811	0.906	DF2
	CH_{M2}	453.0000	29.35	30.00	-	-	-	-	-	-
	CH_H	469.9875	29.42	30.00	-0.11	1.17	1.377	1.614	0.807	-

Note:

1. *The value with blue color is the maximum SAR Value of each test band.*
2. *Batteries are fully charged at the beginning of the SAR measurements*
3. *The EUT was tested for face-held SAR with a 2.5cm separation distance between the front of the EUT and the outer surface of the planer phantom*
4. *When the SAR for all antennas tested using the default battery is ≤ 3.5 W/kg (50% PTT duty factor), testing of all other required channels is not necessary.*
5. *When the SAR of an antenna tested on the highest output power using the default battery is > 3.5 W/Kg and ≤ 4.0 W/Kg (50% PTT duty factor), testing of the immediately adjacent channel(s) is not necessary, but testing of other required channels may still be required.*
6. *When the SAR for all antennas tested using the default battery ≤ 4.0 W/kg(50% PTT duty factor), test additional batteries using the antenna and channel configuration that resulted in the highest SAR.*

Body-worn										
Frequency range (MHz)	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode(with headset)										
406.1~420	CH_L	406.1125	29.48	30.00	-0.01	1.13	7.832	8.849	4.424	AB1
	CH_H	419.9875	29.55	30.00	0.05	1.10	7.419	8.135	4.067	-
421~470	CH_L	421.0125	29.68	30.00	-0.11	1.10	6.326	6.984	3.492	-
	CH_{M1}	437.0000	29.79	30.00	-0.03	1.06	7.113	7.540	3.770	AB2
	CH_{M2}	453.0000	29.51	30.00	0.04	1.11	6.131	6.800	3.400	-
	CH_H	469.9875	29.64	30.00	-0.12	1.12	5.997	6.698	3.349	-
Diatigal mode										
406.1~420	CH_L	406.1125	29.75	30.00	-0.04	1.07	7.572	8.095	4.047	DB1
	CH_H	419.9875	29.58	30.00	-0.08	1.12	7.218	8.099	4.049	-
421~470	CH_L	421.0125	29.52	30.00	-0.06	1.13	6.721	7.611	3.805	-
	CH_{M1}	437.0000	29.63	30.00	-0.06	1.10	6.380	7.044	3.522	DB2
	CH_{M2}	453.0000	29.35	30.00	-	-	-	-	-	-
	CH_H	469.9875	29.42	30.00	0.03	1.14	6.062	6.880	3.440	-
Analog mode										
406.1~420	CH_L	406.1125	29.48	30.00	-0.04	1.14	7.730	8.794	4.397	-
	CH_H	419.9875	29.55	30.00	-	-	-	-	-	-

Note:

1. *The value with blue color is the maximum SAR Value of each test band.*
2. *Batteries are fully charged at the beginning of the SAR measurements*
3. *The Body-worn SAR evaluation was performed with the Leather Case body-worn accessory attached to the DUT and touching the outer surface of the planar phantom*
4. *When the SAR for all antennas tested using the default battery is ≤ 3.5 W/kg (50% PTT duty factor), testing of all other required channels is not necessary.*
5. *When the SAR of an antenna tested on the highest output power using the default battery is > 3.5 W/Kg and ≤ 4.0 W/Kg (50% PTT duty factor), testing of the immediately adjacent channel(s) is not necessary, but testing of other required channels may still be required.*
6. *When the SAR for all antennas tested using the default battery ≤ 4.0 W/kg(50% PTT duty factor), test additional batteries using the antenna and channel configuration that resulted in the highest SAR.*

Repeated SAR measurement:

Body-worn										
Frequency range (MHz)	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode										
406.1~420	CH_L	406.1125	29.48	30.00	-0.05	1.14	7.771	8.861	4.430	-
Diatigal mode										
406.1~420	CH_L	406.1125	29.75	30.00	-0.11	1.09	7.514	8.163	4.082	-

SAR Test Data Plots

Test Plot:	AF1	Test Position:	Front of Face

Test date: 2016-02-17 am 9:45

Communication System: Customer System; Frequency: 406.1125 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 406.1125 MHz; σ = 0.89 S/m; εr = 43.63; ρ=1000 kg/m3
Phantom section : Flat Section

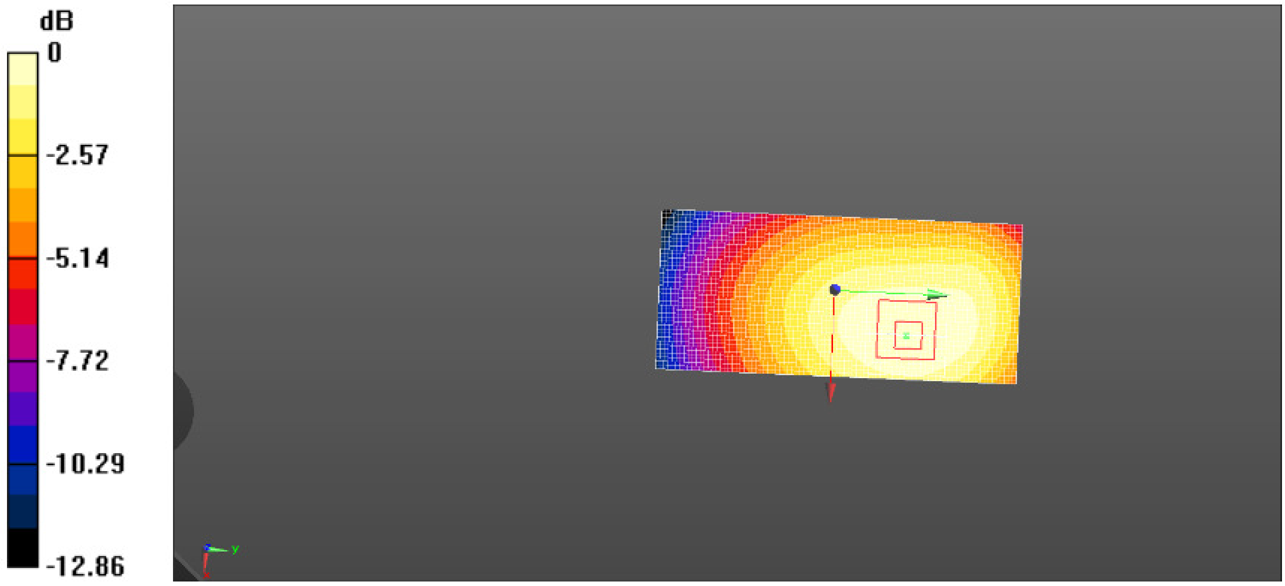
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(6.71, 6.71, 6.71); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.335 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value =39.433 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 4.282 mW/g

SAR(1 g) = 2.314 mW/g; SAR(10 g) = 1.413 mW/g

Maximum value of SAR (measured) = 2.320 W/kg



Test Plot:	AF2	Test Position:	Front of Face

Test date: 2016-02-17 am 10:20

Communication System: Customer System; Frequency: 437.0000 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 437.0000 MHz; σ = 0.89 S/m; εr = 43.63; ρ=1000 kg/m3
Phantom section : Flat Section

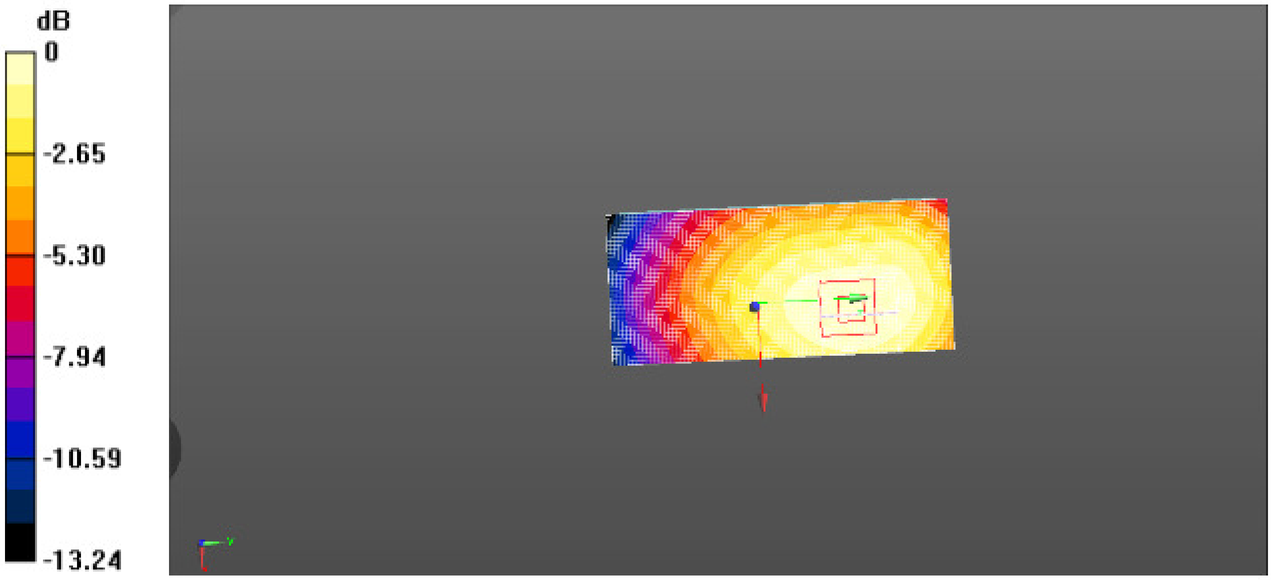
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(6.71, 6.71, 6.71); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.011 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value =36.625 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.762 mW/g

SAR(1 g) = 1.968 mW/g; SAR(10 g) = 1.056 mW/g

Maximum value of SAR (measured) = 1.975 W/kg



Test Plot:	DF1	Test Position:	Front of Face

Test date: 2016-02-17 am 11:11

Communication System: Customer System; Frequency: 406.1125 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 406.1125 MHz; σ = 0.89 S/m; εr = 43.63; ρ=1000 kg/m3
Phantom section : Flat Section

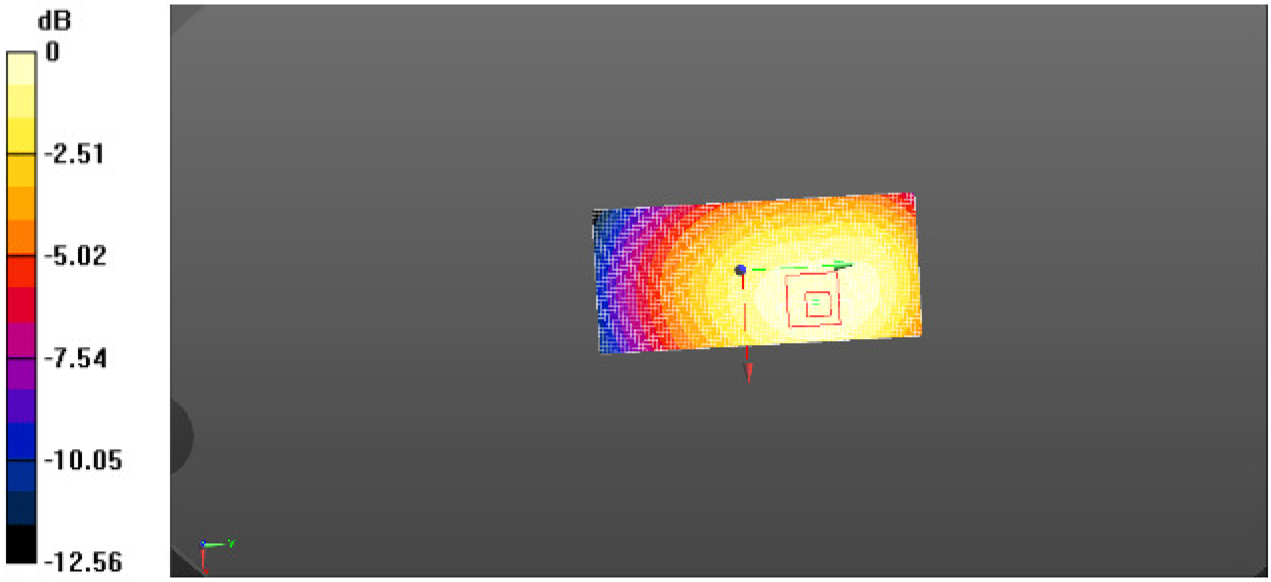
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(6.71, 6.71, 6.71); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.988 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value =34.125 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.683 mW/g

SAR(1 g) = 1.976 mW/g; SAR(10 g) = 1.008 mW/g

Maximum value of SAR (measured) = 1.979 W/kg



Test Plot:	DF2	Test Position:	Front of Face

Test date: 2016-02-17 am 13:22

Communication System: Customer System; Frequency: 437.0000 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 437.0000 MHz; σ = 0.89 S/m; εr = 43.63; ρ=1000 kg/m3
Phantom section : Flat Section

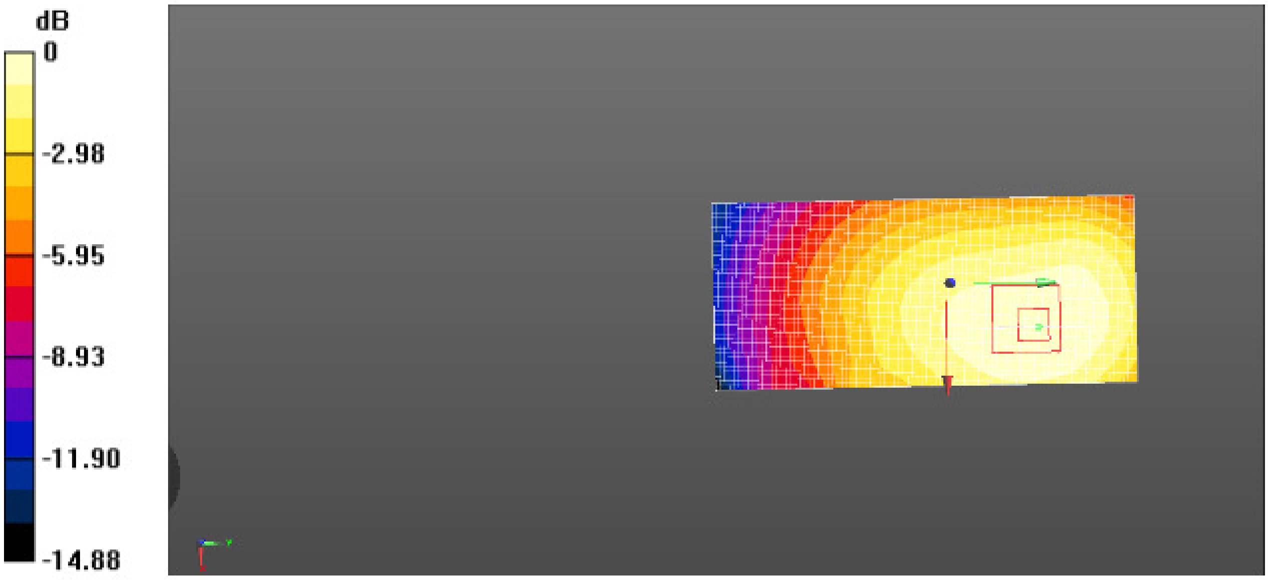
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(6.71, 6.71, 6.71); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.651 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value =31.044 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.122 mW/g

SAR(1 g) = 1.648 mW/g; SAR(10 g) = 0.963 mW/g

Maximum value of SAR (measured) = 1.655 W/kg



Test Plot:	AB1	Test Position:	Body-worn

Test date: 2016-02-17 pm 16:31

Communication System: Customer System; Frequency: 406.1125 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f =406.1125 MHz; σ = 0.95 S/m; εr = 56.50; ρ=1000 kg/m3
Phantom section : Flat Section

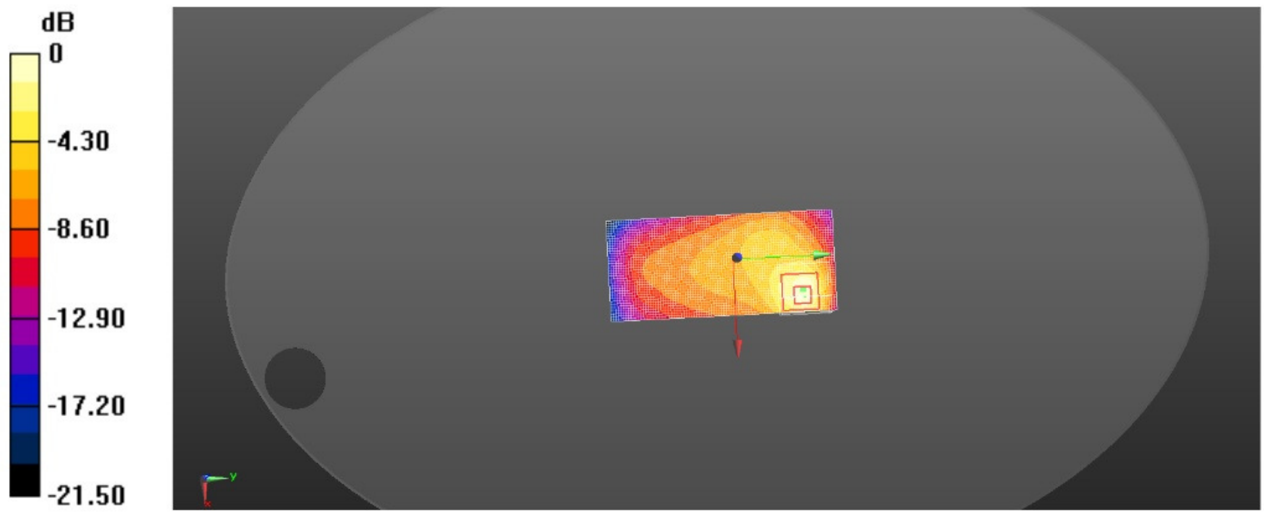
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.10, 7.10, 7.10); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) =8.017 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value =44.700 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 15.586 mW/g

SAR(1 g) =7.832 mW/g; SAR(10 g) = 3.834 mW/g

Maximum value of SAR (measured) = 7.848 W/kg



Test Plot:	AB2	Test Position:	Body-worn

Test date: 2016-02-17 pm 17:17

Communication System: Customer System; Frequency: 437.0000 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 437.0000 MHz; σ = 0.89 S/m; εr = 43.63; ρ=1000 kg/m3
Phantom section : Flat Section

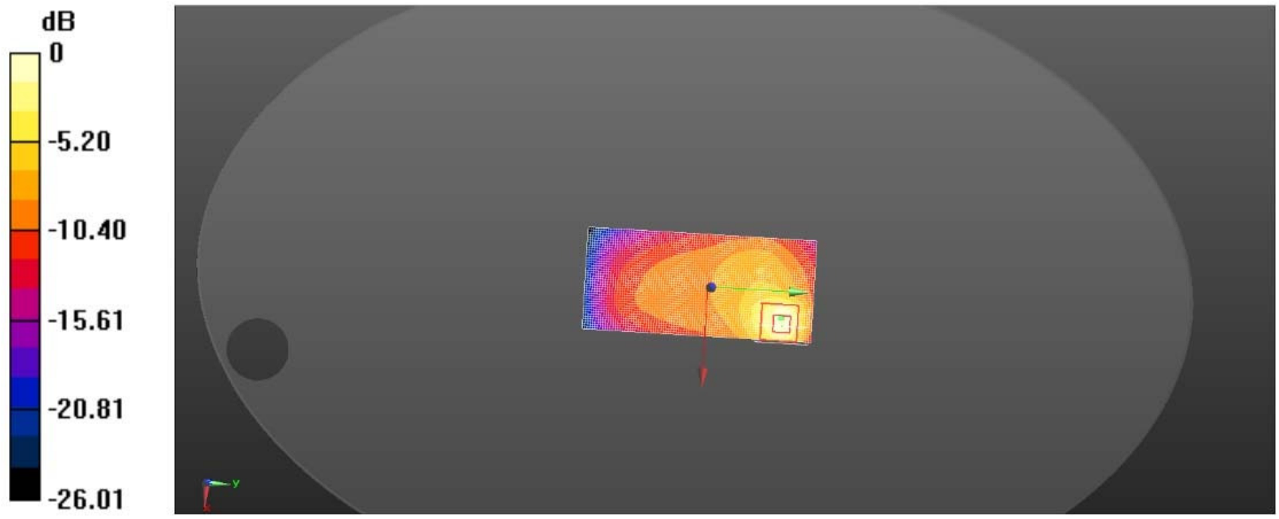
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.10, 7.10, 7.10); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) =7.223 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value =39.478 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 14.851 mW/g

SAR(1 g) =7.113 mW/g; SAR(10 g) = 3.652 mW/g

Maximum value of SAR (measured) = 7.178 W/kg



Test Plot:	DB1	Test Position:	Body-worn

Test date: 2016-02-18 am 9:14

Communication System: Customer System; Frequency: 406.1125 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f =406.1125 MHz; σ = 0.95 S/m; εr = 56.50; ρ=1000 kg/m3
Phantom section : Flat Section

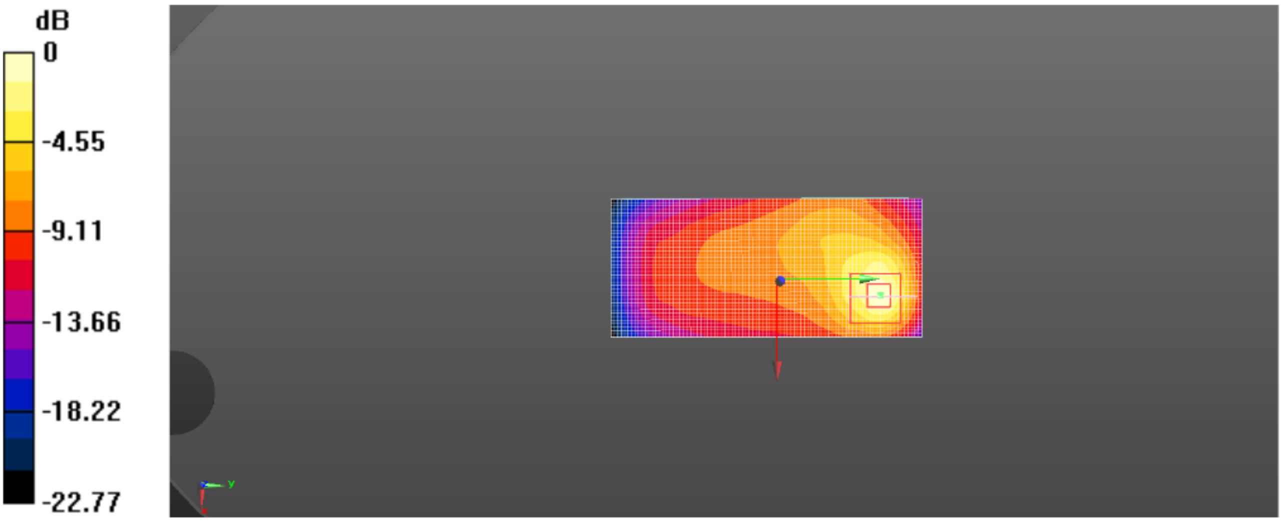
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.10, 7.10, 7.10); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 7.591 W/kg

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value = 40.174 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 15.638 mW/g

SAR(1 g) = 7.572 mW/g; SAR(10 g) = 3.931 mW/g

Maximum value of SAR (measured) = 7.583W/kg



Test Plot:	DB2	Test Position:	Body-worn

Test date: 2016-02-18 am 10:32

Communication System: Customer System; Frequency: 437.0000 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 437.0000 MHz; σ = 0.89 S/m; εr = 43.63; ρ=1000 kg/m3
Phantom section : Flat Section

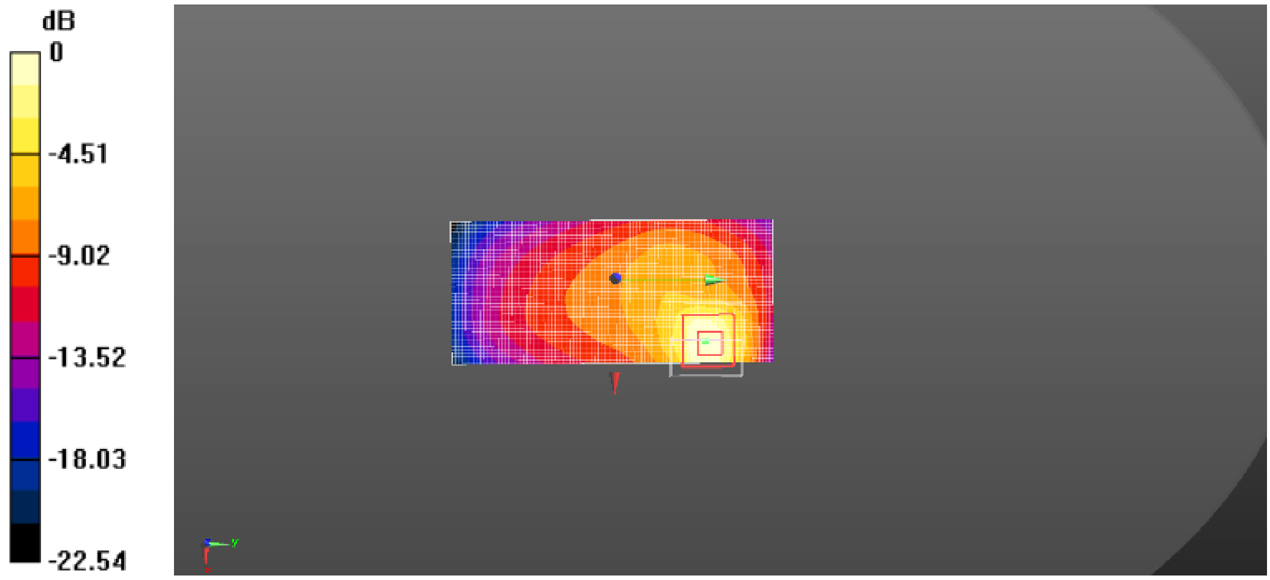
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.10, 7.10, 7.10); Calibrated: 15/08/2015;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 22/07/2015
• Phantom: ELI v4.0; Type: QDOVA001BB
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 6.401 W/kg

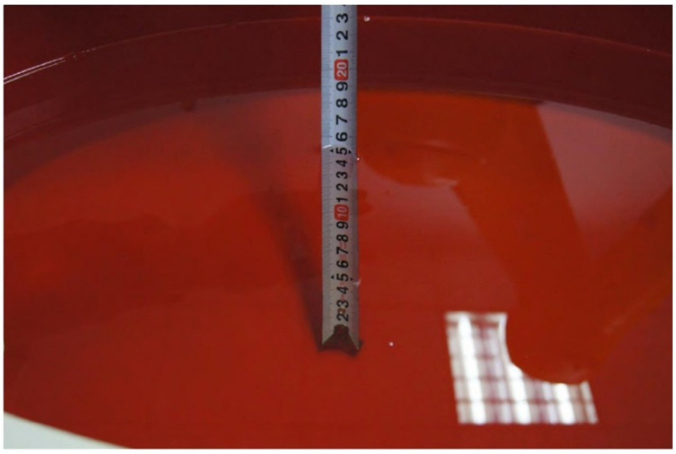
Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value = 35.854 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 12.598 mW/g

SAR(1 g) = 6.380 mW/g; SAR(10 g) = 3.077 mW/g

Maximum value of SAR (measured) = 6.392W/kg



15. TestSetup Photos



Liquid depth in the flat Phantom (450MHz) (15.3cm deep)

Body with headset (0mm)

Face (25mm)

16. Photos of the EUT

Please referce to the test report No.: TRE15120074

---------End of Report---------

1.1. Probe 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**
Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **CIQ (Auden)**

Certificate No: **ES3-3292_Aug15**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3292

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

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

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

Issued: August 15, 2015

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

Certificate No: ES3-3292_Aug15 Page 1 of 11

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

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Certificate No: ES3-3292_Aug15 Page 2 of 11

Probe ES3DV3

SN:3292

Manufactured: July 6, 2010
Repaired: July 28, 2015
Calibrated: August 15, 2015

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	209.7	±3.8 %
		Y	0.0	0.0	1.0		218.8	
		Z	0.0	0.0	1.0		198.5	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
450	43.5	0.87	6.71	6.71	6.71	0.18	1.80	± 13.3 %
835	41.5	0.90	6.23	6.23	6.23	0.80	1.11	± 12.0 %
900	41.5	0.97	6.71	6.71	6.10	6.71	1.17	± 12.0 %
1810	40.0	1.40	5.07	5.07	5.07	0.61	1.36	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.45	1.55	± 12.0 %
2100	39.8	1.49	5.04	5.04	5.04	0.77	1.17	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.73	1.23	± 12.0 %

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

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

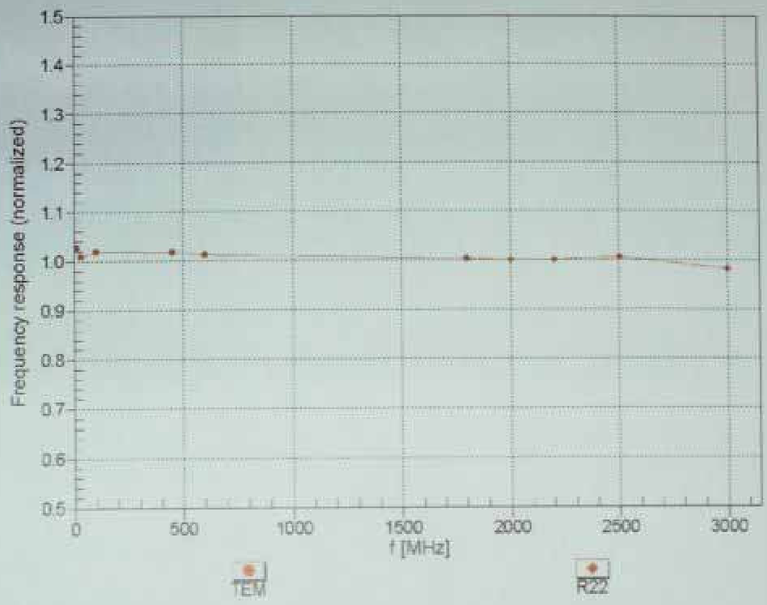
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF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

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

ES3DV3– SN:3292 August 15, 2015

Frequency Response of E-Field

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



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

Certificate No: ES3-3292_Aug15 Page 7 of 11

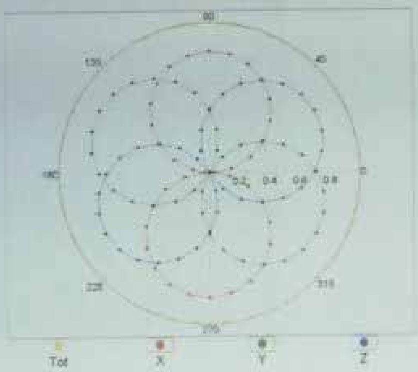
ES3DV3– SN:3292

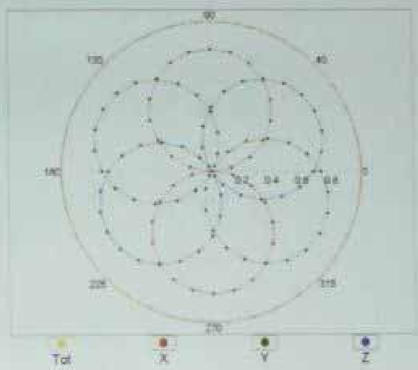
August 15, 2015

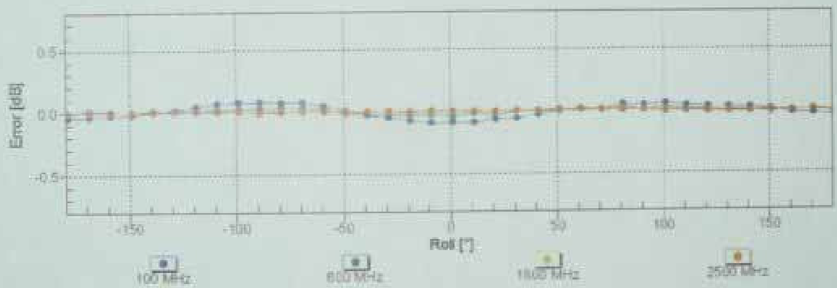
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM

f=1800 MHz,R22







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

Certificate No: ES3-3292_Aug15

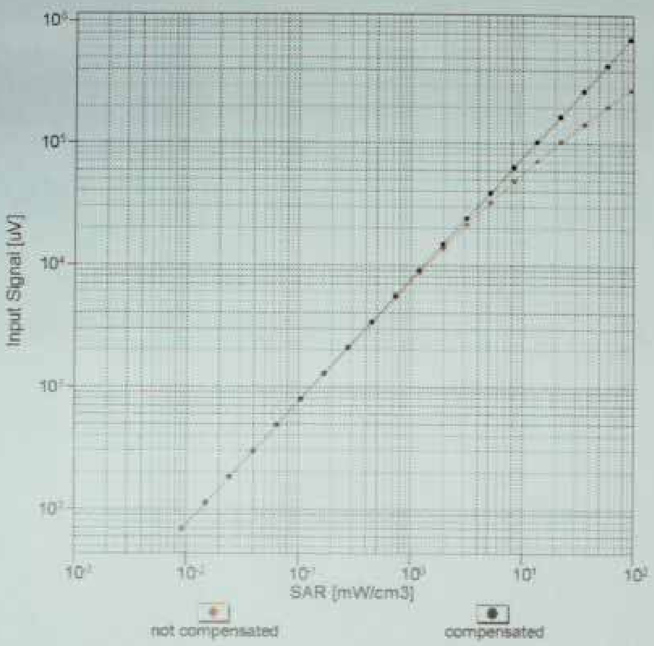
Page 8 of 11

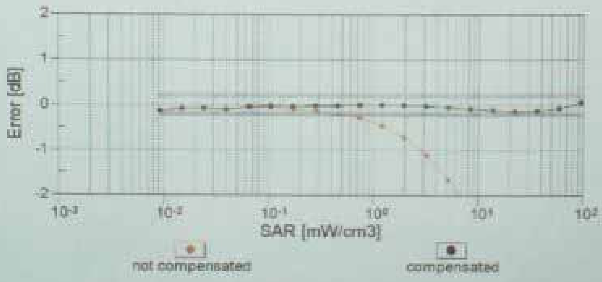
ES3DV3– SN:3292

August 15, 2015

Dynamic Range f(SAR$_{head}$)

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





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

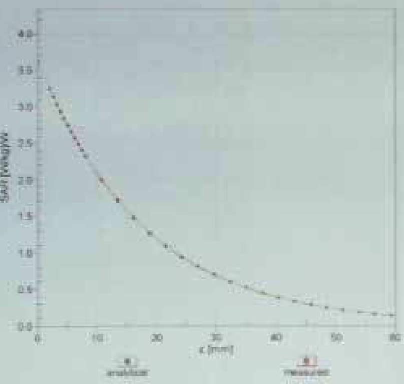
Certificate No: ES3-3292_Aug15

Page 9 of 11

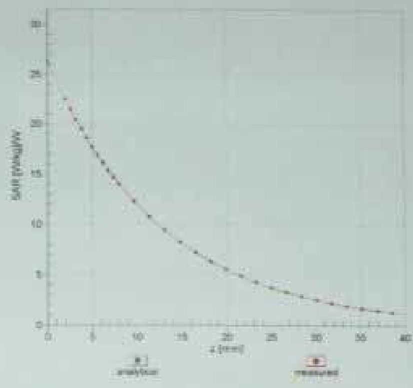
ES3DV3– SN:3292 August 15, 2015

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

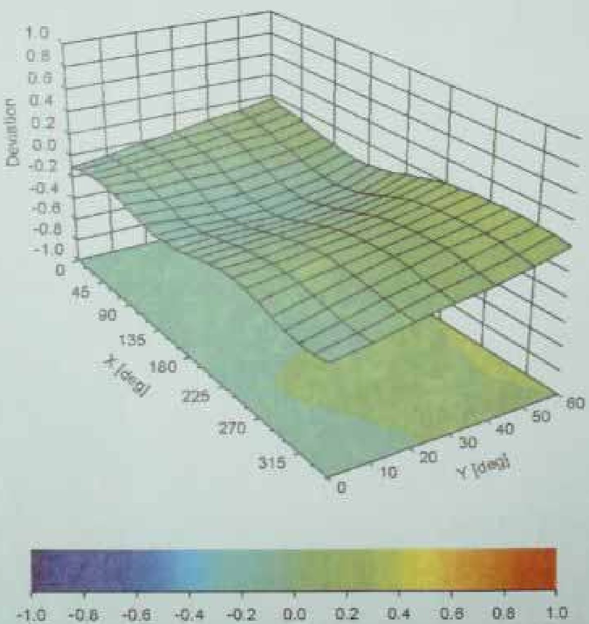


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: ES3-3292_Aug15 Page 10 of 11

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

Other Probe Parameters

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

1.2. D450V3 Dipole Calibration Certificate

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

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

Accreditation No.: SCS 108

Client **CIQ SZ (Auden)**

Certificate No: D450V3-1079_Feb15

CALIBRATION CERTIFICATE

Object	D450V3 - SN: 1079
Calibration procedure(s)	QA CAL-15.v6 Calibration procedure for dipole validation kits below 700 MHz
Calibration date:	February 28, 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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-14 (No. 217-01372)	Apr-15
Power sensor E4412A	MY41498087	31-Mar-14 (No. 217-01372)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-14 (No. 217-01369)	Apr-15
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-14 (No. 217-01367)	Apr-15
Type-N mismatch combination	SN: 5047.3 / 06327	29-Mar-14 (No. 217-01168)	Apr-15
Reference Probe ET3DV6	SN: 1507	30-Dec-14 (No. ET3-1507_Dec11)	Dec-15
DAE4	SN: 654	03-May-14 (No. DAE4-654_May11)	May-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-12 (in house check Oct-14)	In house check: Oct-15
RF generator R&S SMT-06	100005	04-Aug-12 (in house check Oct-14)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-12 (in house check Oct-14)	In house check: Oct-15

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

Issued: February 28, 2015

Certificate No: D450V3-1079_Feb15 Page 1 of 8

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

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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**

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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
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	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.6 ± 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	1.81 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**4.63 mW /g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.21 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	3.09 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	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.91 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	1.74 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**4.45 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**2.97 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	59.8 Ω - 0.5 jΩ
Return Loss	- 21.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.4 Ω - 5.9 jΩ
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.350 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 03, 2011

DASY5 Validation Report for Head TSL

Date/Time: 28.02.2015

Test Laboratory: SPEAG

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1079

Communication System: CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; σ = 0.85 mho/m; ε_r = 43.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

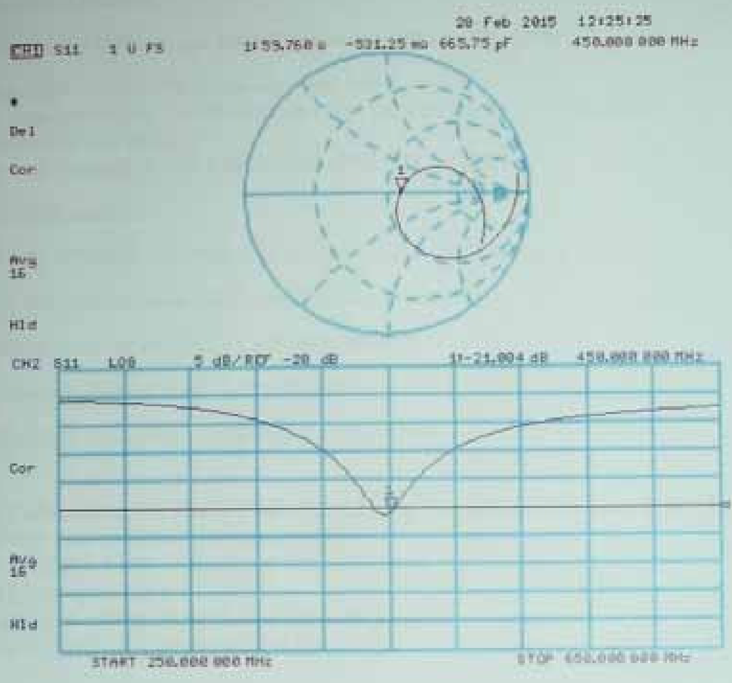
- Probe: ET3DV6 - SN1507; ConvF(6.59, 6.59, 6.59); Calibrated: 30.12.2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Head Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 49.699 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.7560
SAR(1 g) = 1.81 mW/g; SAR(10 g) = 1.21 mW/g
Maximum value of SAR (measured) = 1.936 mW/g

0 dB = 1.940mW/g = 5.76 dB mW/g

Certificate No: D450V3-1079_Feb15 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D450V3-1079_Feb15 Page 6 of 8

DASY5 Validation Report for Body TSL

Date/Time: 28.02.2015

Test Laboratory: SPEAG

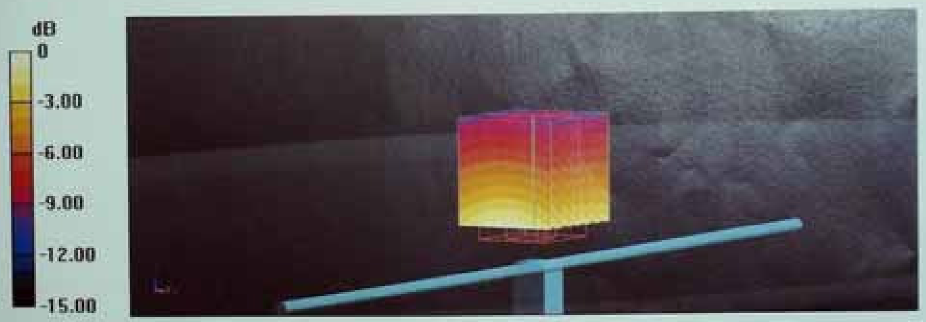
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1079

Communication System: CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; $\sigma = 0.91$ mho/m; $\varepsilon_r = 55$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

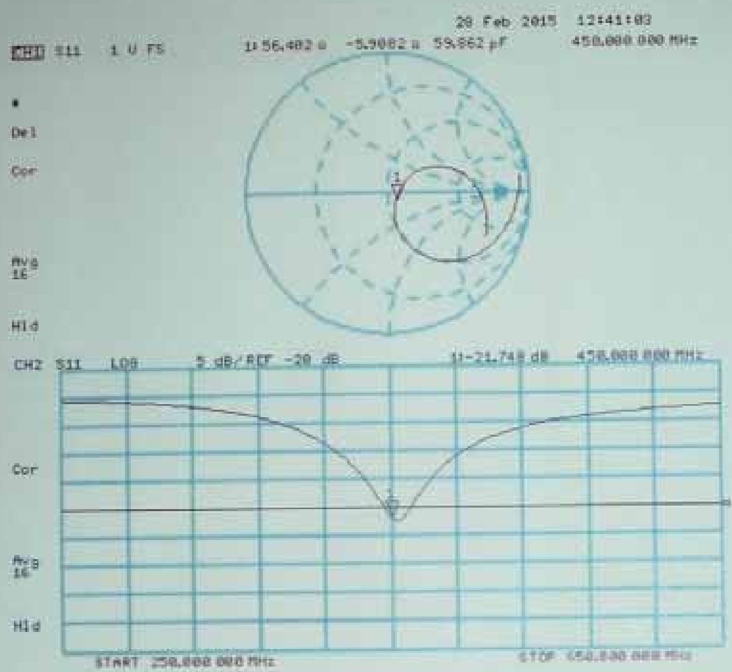
- Probe: ET3DV6 - SN1507; ConvF(7.05, 7.05, 7.05); Calibrated: 30.12.2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2014
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Body Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.491 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.7360
SAR(1 g) = 1.74 mW/g; SAR(10 g) = 1.16 mW/g
Maximum value of SAR (measured) = 1.861 mW/g



0 dB = 1.860mW/g = 5.39 dB mW/g

Impedance Measurement Plot for Body TSL



Certificate No: D450V3-1079_Feb15 Page 8 of 8

1.3. DAE4 Calibration Certificate

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

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

ilac-MRA CNAS CALIBRATION No. L0570

Client : CIQ-SZ(Auden) Certificate No: Z15-97066

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1315
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	July 22, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Documenting Process Calibrator 753	1971018	01-July-15 (CTTL, No:J14X02147)	July-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: July 23, 2015

Certificate No: Z15-97066 Page 1 of 3

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speag
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E-mail: cttl@chinattl.com Http://www.chinattl.cn

CALIBRATION
No. L0570

Glossary:

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

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.

Certificate No: Z15-97066 Page 2 of 3

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CALIBRATION
No. L0570

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

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

Connector Angle

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

Certificate No: Z15-97066 Page 3 of 3

------End------