Report No: DDT-RE130201

Issued Date: 2013/8/20

OET65 SAR TEST REPORT

FOR

Applicant	:	SHENZHEN ZOWEE TECHNOLOGY CO.,LTD
Address	:	Science&Technology Industrial Park of Privately Owned Enterprises,Pingshan,Xili,Nanshan District,Shenzhen,PR CHINA
Equipment under Test	:	Internet Tablet
Model No	:	M7026,EM63,TM-7S448,AP-7S448,TM-7S228, AP-7S228,TM-7S338,AP-7S338,DG-63,DM-63,D7688, M7688,AP-7S118,DM7688,DG7658,M7100,EM63-BLK, EM63-BLU,EM63-PNK,EM63-PUR,EM63-RED
FCC ID	:	2AAP6M7026
Manufacturer	:	SHENZHEN ZOWEE TECHNOLOGY CO.,LTD
Address	:	Science&Technology Industrial Park of Privately Owned Enterprises,Pingshan,Xili,Nanshan District,Shenzhen,PR CHINA

Issued By: Dongguan Dongdian Testing Service Co., Ltd.

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REPORT

TEST REPORT DECLARE

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Address	:	Science&Technology Industrial Park of Privately Owned Enterprises,Pingshan,Xili,Nanshan District,Shenzhen,PR CHINA

Test Standard Used: OET 65C

Test procedure used: KDB 447498 D01 Mobile Portable RF Exposure v05r01; KDB 616217 D04 SAR for laptop and Internet Tablets v01; KDB 248227 D01: SAR meas for 802 11 a b g v01r02;FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

We Declare:

The equipment described above is evaluation by Dongguan Dongdian Testing Service Co., Ltd and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above standards.

Report No:	DDT-RE130201		
Date of Test:	2013/08/13~2013/08/14	**Date of Report**:	2013/8/20

Prepared By: ***Approved By:***

Leo Liu/Engineer ***Jamy Yu/EMC Manager***

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

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

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

KDB 447498 D01 Mobile Portable RF Exposure v05r01: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB 616217 D04 SAR for laptop and Internet Tablets v01: SAR Evaluation Considerations for Laptop, Notebook, Netbook and Internet Tablet Computers

FCC Part 2:2012: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

KDB 248227 D01: SAR meas for 802 11 a b g v01r02.

2. SUMMARY

2.1. Product Description

EUT* Name	:	Internet Tablet
Model Number	:	M7026,EM63,TM-7S448,AP-7S448,TM-7S228, AP-7S228,TM-7S338,AP-7S338,DG-63,DM-63,D7688, M7688,AP-7S118,DM7688,DG7658,M7100,EM63-BLK, EM63-BLU,EM63-PNK,EM63-PUR,EM63-RED
Difference of Model number	:	Cabinent color and trade marke for different client, the actual product is same.
EUT function description	:	Please reference user manual of this device
Power supply	:	DC 3.7V from built-in battery or DC 5V from power adapter.
FCC ID	:	2AAP6M7026
Radio Technology	:	IEEE802.11b/g/n(HT20)
FCC Operation frequency	:	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz
Modulation	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)
Maximum SAR Values	:	**0.314W/Kg**
Antenna Type	:	Integrated FPC Antenna, 1.35dBi maximum gain
Date of Receipt	:	2013/07/26
Sample Type	:	Series production

Note1: EUT is the ab.of equipment under test.

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number or Type	Serial No.	Other
USB Cable 1	/	/	/	15cm
USB Cable 2	/	/	/	90cm
Power adapter 1	JUKE	JK050200-S04USA	/	/
Power adapter 2	Shenzhen FRECOM ELECTRONICS	F12W-050200SPAU	/	/

2.3. Short description of the Equipment under Test (EUT)

MID with WLAN functions;

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

2.4. TEST Configuration

Body-worn Configuration

For body-worn measurements, the EUT was tested at the lowest, middle and highest frequencies in the transmit band.

The back of the EUT towards phantom, the EUT directed tightly to touch the bottom of the flat phantom

The bottom of the EUT towards phantom, the EUT directed tightly to touch the bottom of the flat phantom

IEEE 802.11b/g/n: Eleven channels are provided to the EUT.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	**2412**	8	2447
2	2417	9	**2452**
3	**2422**	10	2457
4	2427	11	**2462**
5	2432	12	2467
6	**2437**	13	2472
7	2442		

2.5. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
○	Multimeter	Manufacturer :	/
		Model No. :	/

Battery1#: Model: XRZ357095P
output: DC 3.7V 2500mAh

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

The test was subcontracted to The Testing and Technology Center for Industrial Products of Shenzhen Entry-Exit Inspection and Quarantine Bureau
No.289, 8th Industry Road, Nanshan District, Shenzhen, Guangdong, China

The sites are constructed in conformance with the requirements
of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

3.2. Environmental conditions

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

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

3.3. SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	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).

3.4. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	2013/02/27	1
E-field Probe	SPEAG	ES3DV3	3292	2013/02/24	1
System Validation Dipole D2450V3	SPEAG	D2450V2	884	2013/2/29	1
Network analyzer	Agilent	8753E	US37390562	2013/03/26	1
Dielectric Probe Kit	Agilent	85070E	US44020288	/	/
Power meter	Agilent	E4417A	GB41292254	2013/03/26	1
Power sensor	Agilent	8481H	MY41095360	2013/03/26	1
Signal generator	IFR	2032	203002/100	2012/10/27	1
Amplifier	AR	75A250	302205	2012/10/27	1

4. SAR Measurements System configuration

4.1. 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.

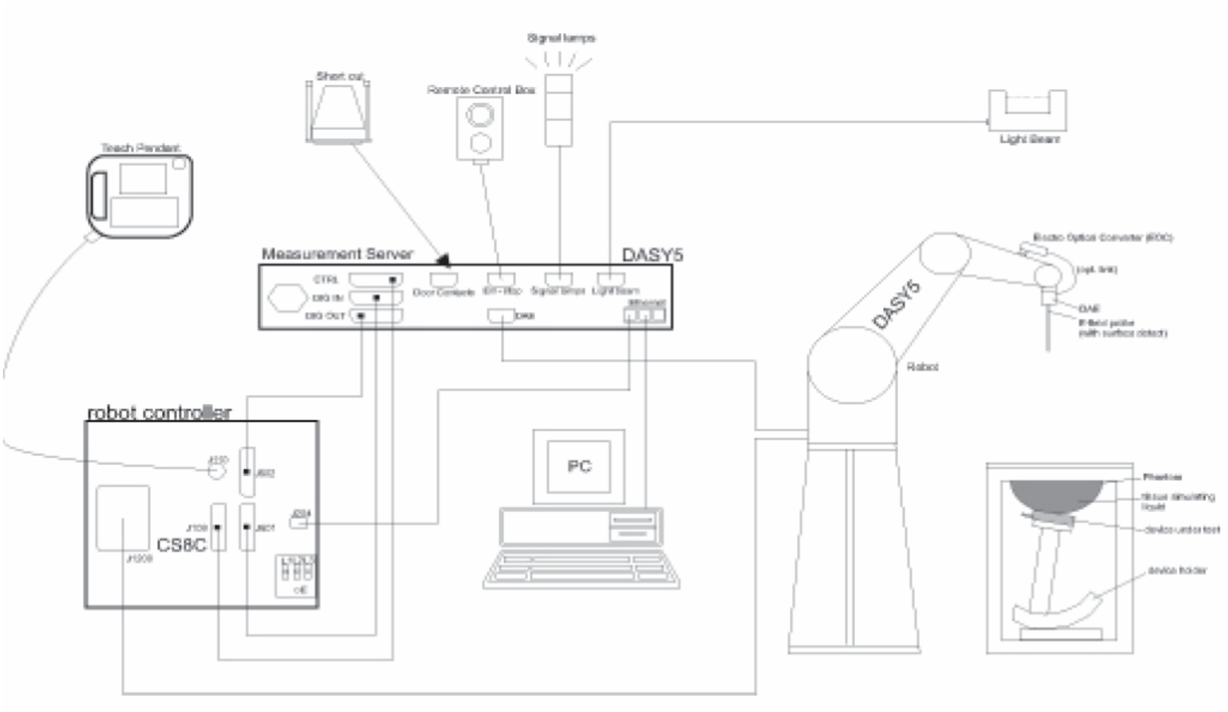
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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.



4.2. DASY5 E-field Probe System

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

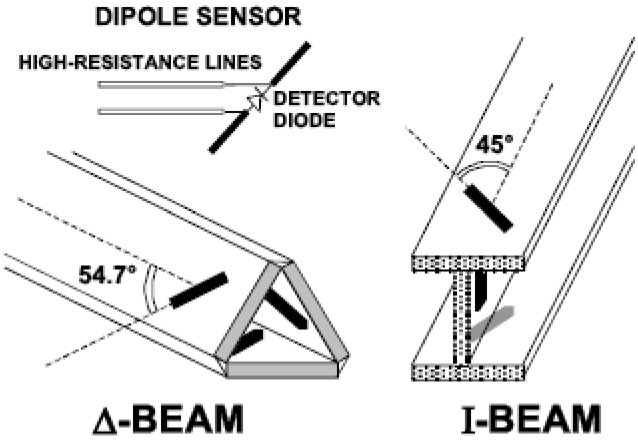
Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100 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:



4.3. Phantoms

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

SAM Twin Phantom

4.4. 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

4.5. Scanning Procedure

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

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

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

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 7x7x7 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 7x7x7 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 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

4.6. Data Storage and Evaluation

Data Storage

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

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

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

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

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

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

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

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

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

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

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

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

with SAR = local specific absorption rate in 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.

4.7. SAR Measurement System

The SAR measurement system being used is the DASY5 system, the system is controlled remotely from a PC, which contains the software to control the robot and data acquisition equipment. The software also displays the data obtained from test scans.

In operation, the system first does an area (2D) scan at a fixed depth within the liquid from the inside wall of the phantom. When the maximum SAR point has been found, the system will then carry out a 3D scan centred at that point to determine volume averaged SAR level.

4.7.1 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	Ơ (S/m)	εr	Ơ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92

450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

4.8. Tissue equivalent liquid properties

Dielectric performance of Body tissue simulating liquid
.

Table 3: Dielectric Performance of Body Tissue Simulating Liquid

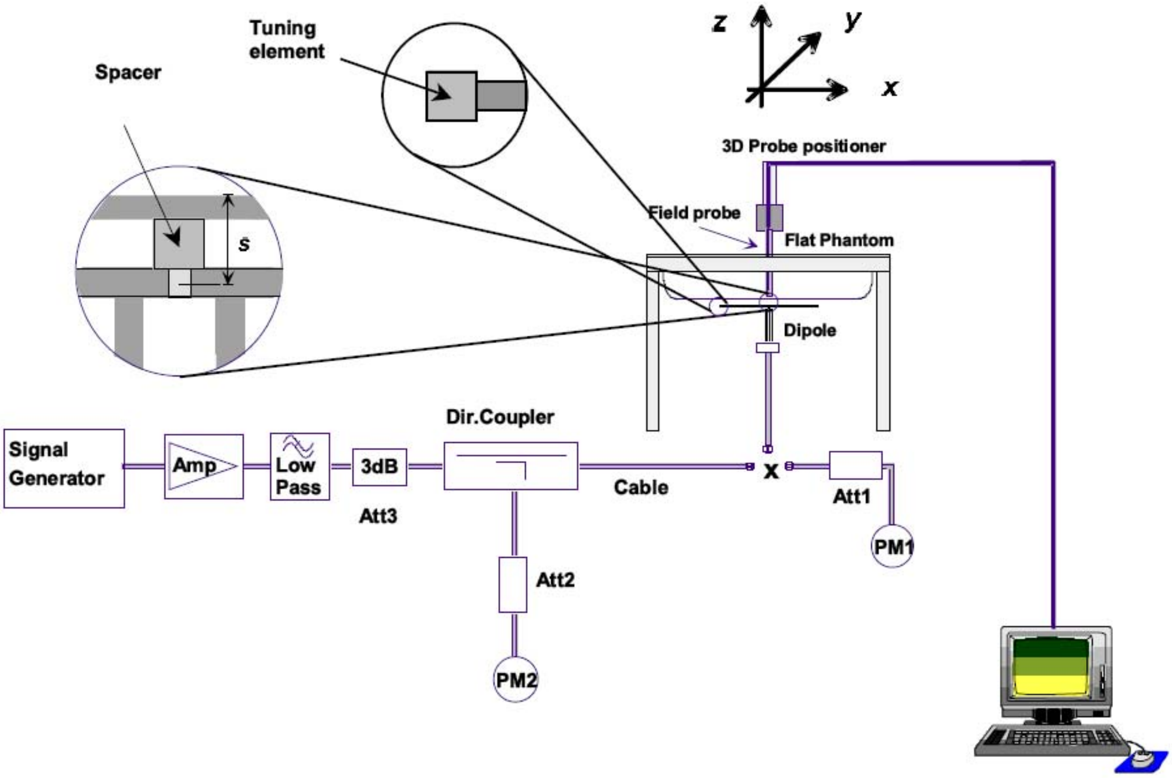
Frequency	Description	Dielectric paramenters	
		ε_r	σ
2450MHz(Body)	Target Value ±5%	52.70 (50.07-55.33)	1.95 (1.85-2.05)
	Measurement Value 2013-08-05	51.88	1.942

4.9. System Check

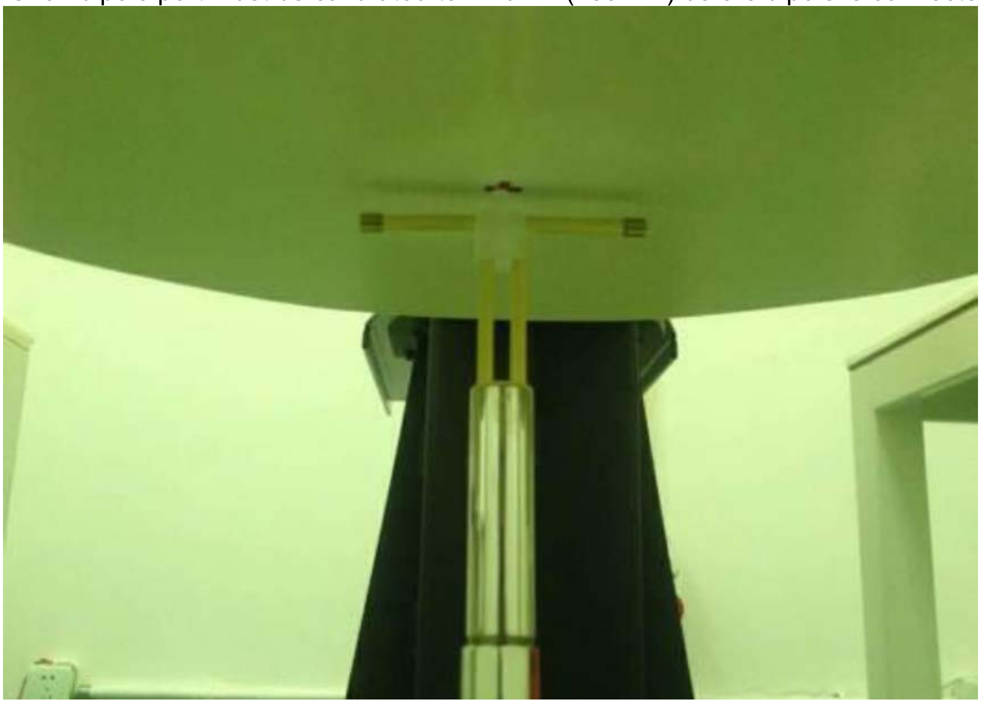
The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

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 24 dBm (250mW) before dipole is connected.



System Validation of Body

Measurement is made at temperature 22.0 ℃ and relative humidity 55%.							
Measurement is made at temperature 22.0 ℃ and relative humidity 55%.							
Measurement Date: 2450 MHz Aug 05th							
Verification results	Frequency (MHz)	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
	2450	5.98	12.80	6.20	13.80	3.68%	7.81%

4.10. SAR measurement procedure

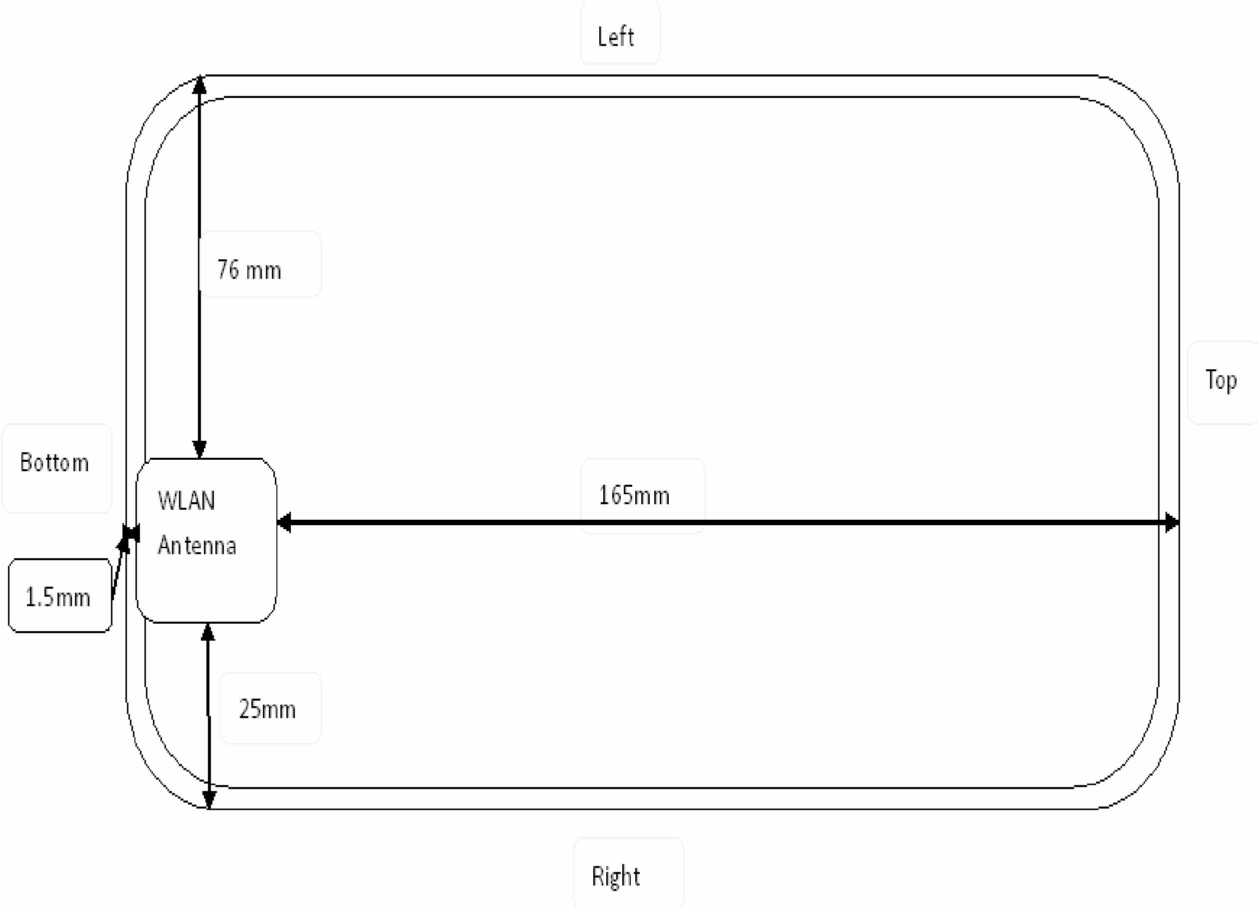
The SAR test was carried out as follow:

The EUT was controlled to operate in 802.11b mode in channel 1 with the maximum output power.
After an area scan has been done at a fixed distance of 8mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.
Above is the scanning procedure flow chart and table from the IEEEp1528 standard. This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behaviour are tested.
The same procedure should be also executed for 802.11b in channel 6 and 11, and the mode 802.11g and 802.11n-20MHz in bottom channel, middle channel and top channel, respectively.

Transmitting antenna information

There's WLAN with only one antenna inside the EUT, and it is the transmitting source. The following pictures showed the diagonal dimension (21.5cm>20cm) of the EUT and position of the antenna:

Diagonal dimension of the display



Position of the antennas

WLAN Test Configuration

The EUT should be tested under the following positions according to KDB 616217 and KDB447498:
(1).Back side: the back side of the EUT towards and contacted to the phantom.
(2).Bottom side: SAR test was required. Beacuse the distance between WLAN antenna and Bottom side was 1.5mm,maximum average output power (including tune-up tolerance)11.5dBm>10dBm(10mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(3).Left side: SAR test was not required. Beacuse the distance between WLAN antenna and Left side was 76mm,maximum output power (including tune-up tolerance) 11.5dBm<24.71dBm(296mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(4).Top side:SAR test was not required. Beacuse the distance between WLAN antenna and Top side was 165mm,maximum output power (including tune-up tolerance) 11.5dBm<30.77dBm(1196mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(5).Right Side: SAR test was not required. Beacuse the distance between WLAN antenna and Right side was 25mm,maximum output power (including tune-up tolerance)11.5dBm<16.02dBm(40mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(6).Front Side: SAR test was not required.
(7).The 3/4/5 positions are not the most conservative antenna - to – user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)
(8).According to KDB248227 SAR is not required for 802.11g and 801.11 n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

5. TEST CONDITIONS AND RESULTS

5.1. Conducted Power Results

Conducted power measurement results

Mode	Channel	Frequency (MHz)	Worst case Data rate of worst case	Conducted Output Power (dBm)	
				Average	Peak
802.11b	1	2412	1Mbps	10.29	16.05
	6	2437	1Mbps	10.42	16.43
	11	2442	1Mbps	10.42	16.21
802.11g	1	2412	6Mbps	9.33	17.29
	6	2437	6Mbps	9.34	17.39
	11	2442	6Mbps	9.22	17.46
802.11n(20MHz)	1	2412	MCS0 Mbps	9.07	17.43
	6	2437	MCS0 Mbps	9.44	17.38
	11	2442	MCS0 Mbps	9.21	17.36

Manufacturing tolerance (Average power)

802.11b			
Test Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.50	10.50	10.50
Tolerance ±(dB)	1.00	1.00	1.00
802.11g			
Target (dBm)	9.00	9.00	9.00
Tolerance ±(dB)	1.00	1.00	1.00
802.11n(20MHz)			
Target (dBm)	9.00	9.00	9.00
Tolerance ±(dB)	1.00	1.00	1.00

5.2. SAR Measurement Results

Since the 802.11b operating mode resulted in the maximum RF output power, the SAR measurement was executed only at this operating mode. The following table showed the SAR measurement results at 802.11b operating mode, according to the worst-case of each channel at 1Mbps data rate.

Table 4: SAR Values (WLAN2450 Band-Body)

Test Frequency		Mode/Band	Test Configuration	Average SAR over1g(W/kg) (Including power drift)	Scaling Factor	Average SAR over1g(W/kg) (Including Power Drift and Scaling factor)	SAR limit 1g (W/kg)	Ref. Plot #
Channel	MHz							
1	2412	Body- worn	Back	0.203	1.32	0.268	1.60	1
6	2437	Body- worn	Back	0.226	1.28	0.289	1.60	2
11	2462	Body- worn	Back	0.132	1.28	0.169	1.60	3
1	2412	Body- worn	Bottom	0.210	1.32	0.277	1.60	4
6	2437	Body- worn	Bottom	**0.245**	1.28	**0.314**	1.60	5
11	2462	Body- worn	Bottom	0.140	1.28	0.179	1.60	6

5.3. Measurement Uncertainty

Uncertainty Component	Unc. vaule ±%	Prob Dist.	Div.	C_i 1g	C_i 10g	Std.Unc. ±%.1g	Std.Unc. ±%.10g	V_i
Measurement System								
Probe Calibration	5.9	N	1	1	1	5.9	5.9	∞
Axial Isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
Boundary Effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
System Detection Limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
Integration Time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test Sample Related								
Test Sample Positioning	2.1	N	1	1	1	2.1	2.1	150
Device Holder Uncertainty	3.6	N	1	1	1	3.6	3.6	5
Output Power Variation - SAR drift measurement	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
Conductivity Target - tolerance	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
Conductivity - measurement uncertainty	2.5	N	1	0.64	0.43	1.6	1.1	∞
Permittivity Target - tolerance	5.0	R	$\sqrt{3}$	0.60	0.49	1.7	1.4	∞
Permittivity - measurement uncertainty	1.9	N	1	0.60	0.49	1.5	1.2	5
Combined Standard Uncertainty		R				**±11.2%**	**±10.8%**	387
Coverage Factor for 95%			2					
Expanded STD Uncertainty						**+22.4%**	**±21.6%**	

5.4. System Check Results

System Performance Check_2450MHz-Body

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

Date/Time: 08/05/2013 10:05:01 AM

Communication System: INTERNET TABLET; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz; σ =1.942 mho/m; ε r = 51.88; ρ = 1000 kg/m

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2012

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x131x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) =14.08 mW/g

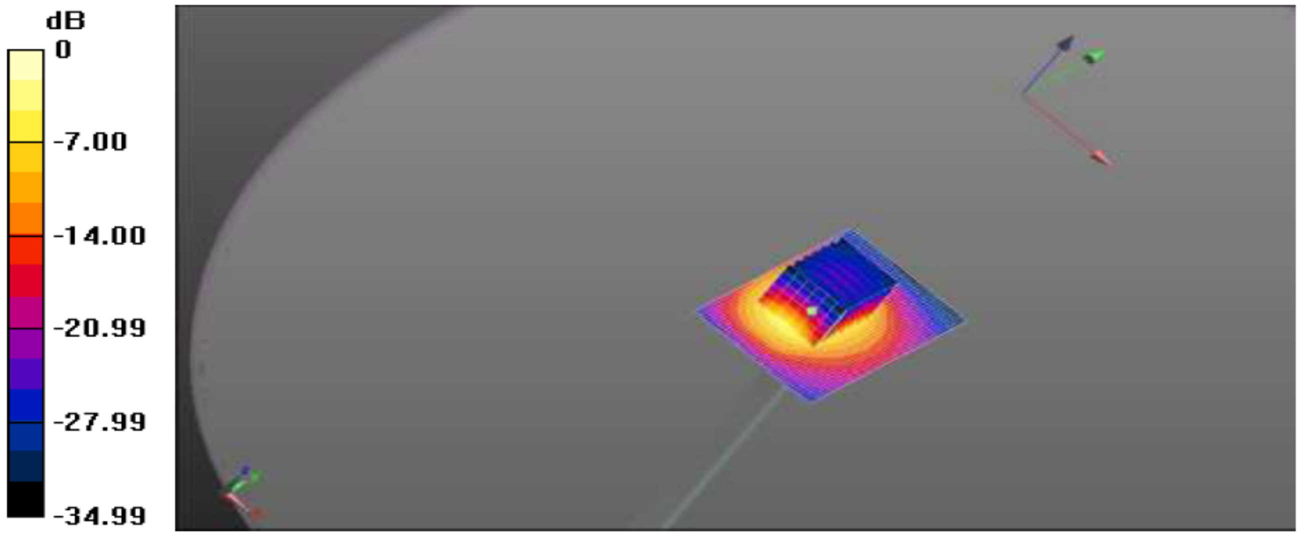
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.243 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 31.088 mW/g

SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.20 mW/g

Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 13.76mW/g

System Performance Check 2450MHz

5.5. SAR Test Graph Results

Body- worn Back side-802.11b-Channel 1-2412MHz(1Mbps)

Communication System: INTERNET TABLET; Frequency: 2412 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2412 MHz; σ = 1.96 mho/m; εr = 51.17; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 0.126 W/kg

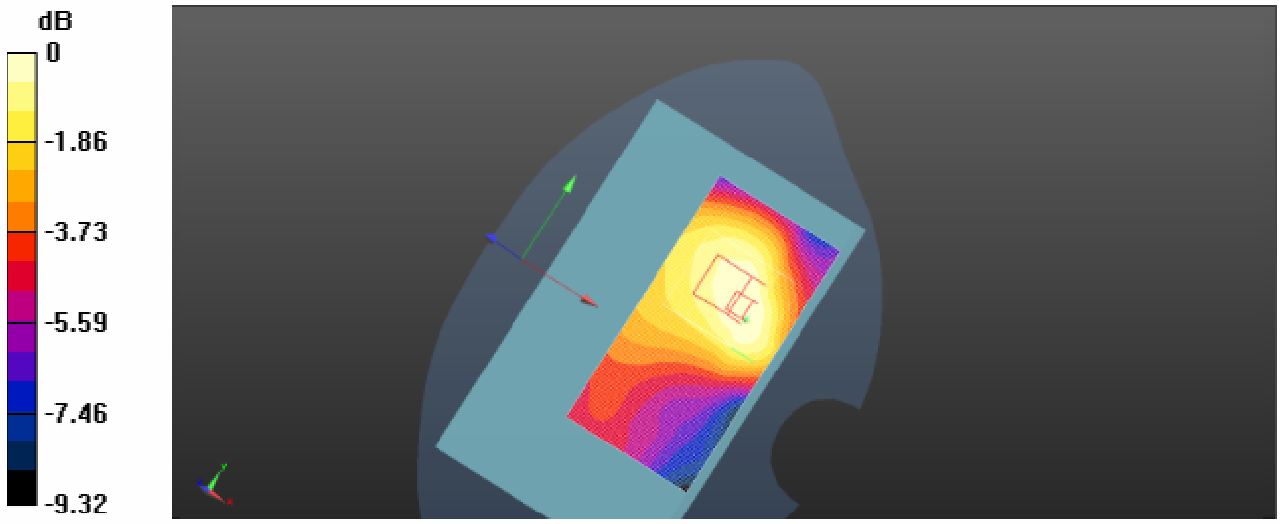
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =17.152 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.216 mW/g

SAR(1 g) = 0.203 mW/g; SAR(10 g) = 0.108 mW/g

Maximum value of SAR (measured) = 0.327 W/kg



0 dB = 0.127 W/kg = -19.41dB W/kg

Figure 1: Body- worn Back-802.11b -Channel 1-2412MHz(1Mbps)

Body- worn Back side-802.11b-Channel 6-2437MHz(1Mbps)

Communication System: INTERNET TABLET; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.92 mho/m; εr = 50.85; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 0.110 W/kg

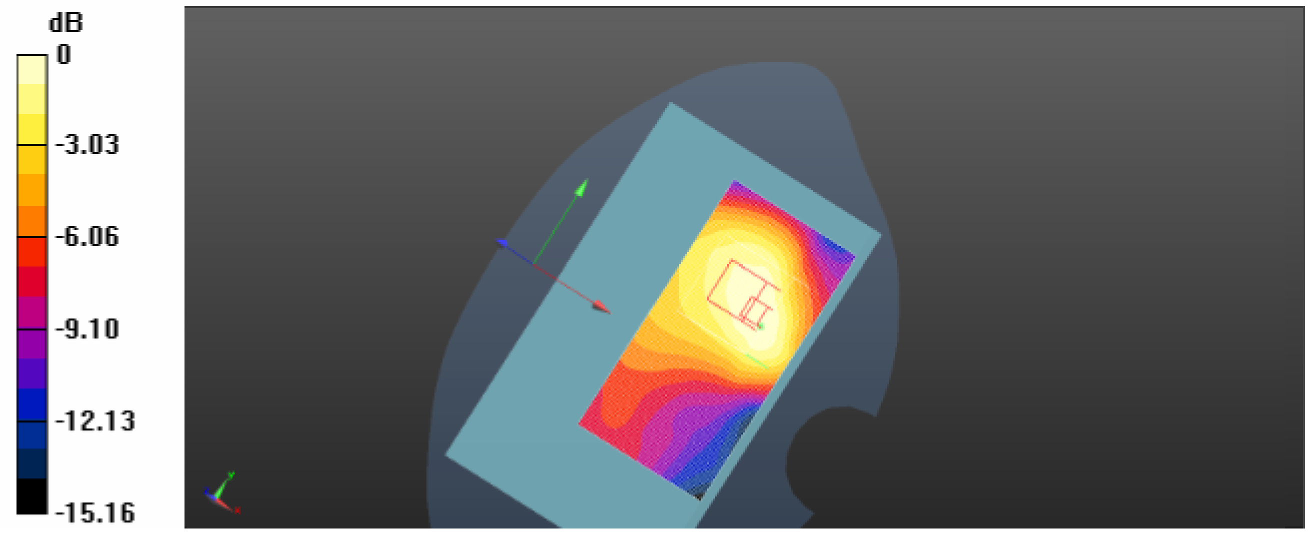
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.306 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.179 mW/g

SAR(1 g) = 0.226 mW/g; SAR(10 g) = 0.136 mW/g

Maximum value of SAR (measured) = 0.309 W/kg



0 dB = 0.109 W/kg = -13.25 dB W/kg

Plot 2: Body- worn Back-802.11b-Channel 6-2437MHz(1Mbps)

Body- worn Back side-802.11b-Channel 11-2462MHz(1Mbps)

Communication System: INTERNET TABLET; Frequency: 2462 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2462 MHz; σ = 1.99 mho/m; εr = 51.23; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) =0.111 W/kg

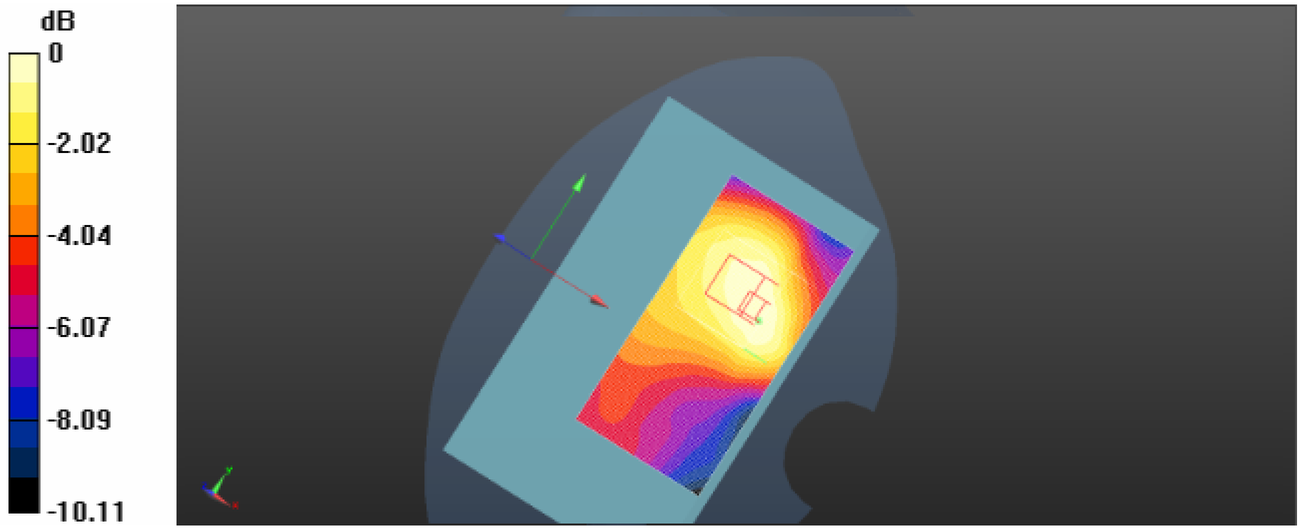
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.308 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.644 mW/g

SAR(1 g) = 0.132 mW/g; SAR(10 g) = 0.074 mW/g

Maximum value of SAR (measured) = 0.213 W/kg



0 dB = 0.113 W/kg = -19.58 dB W/kg

Plot 3: Body- worn Back-802.11b-Channel 11-2462MHz(1Mbps)

Body- worn Bottom side-802.11b-Channel 1-2412MHz(1Mbps)

Communication System: INTERNET TABLET; Frequency: 2412 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2412 MHz; σ = 1.96 mho/m; εr = 51.17; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 0.211 W/kg

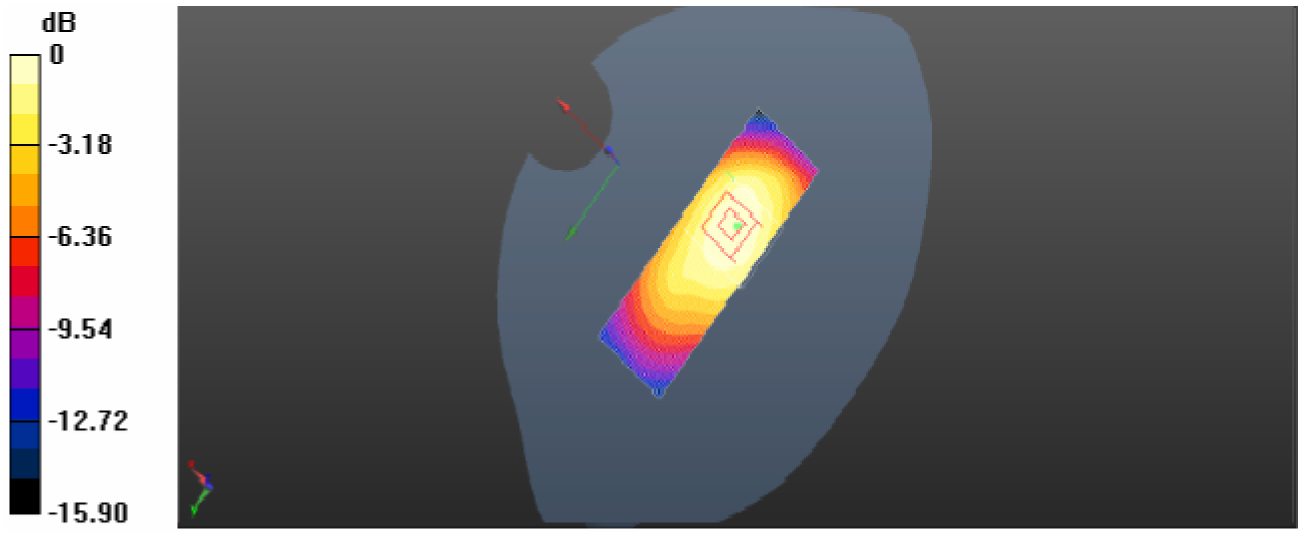
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.885 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.330 mW/g

SAR(1 g) = 0.210 mW/g; SAR(10 g) = 0.130 mW/g

Maximum value of SAR (measured) = 0.225 W/kg



0 dB = 0.225 W/kg = -16.96 dB W/kg

Figure 4: Body- worn Bottom-802.11b -Channel 1-2412MHz(1Mbps)

Body- worn Bottom side-802.11b-Channel 6-2437MHz(1Mbps)

Communication System: INTERNET TABLET; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.92 mho/m; εr = 50.85; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) =0.269 W/kg

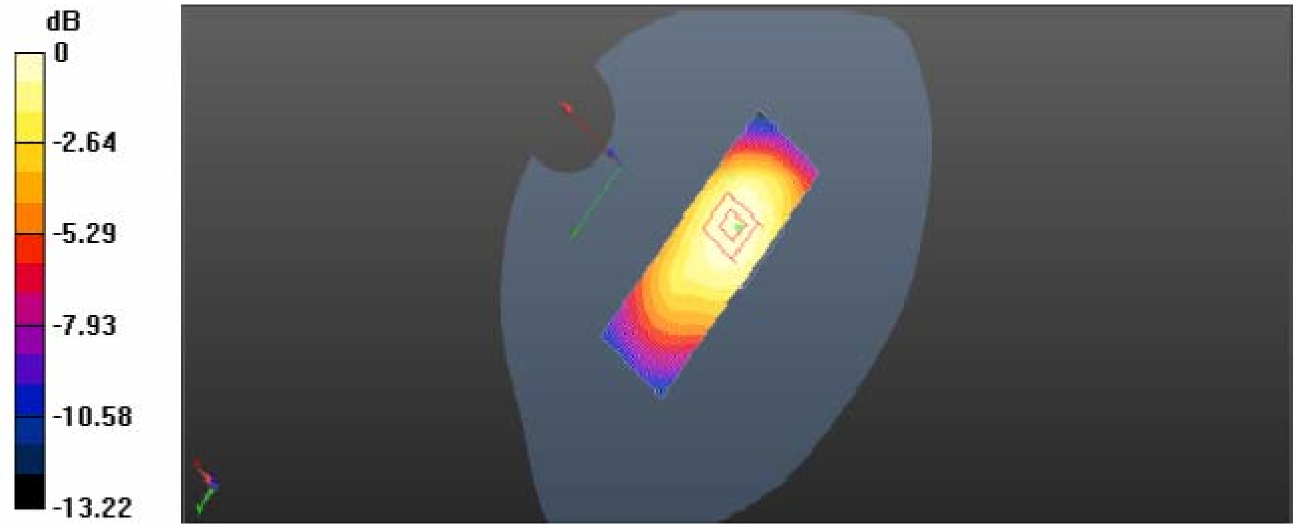
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.364 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.379 mW/g

SAR(1 g) = 0.245 mW/g; SAR(10 g) = 0.157 mW/g

Maximum value of SAR (measured) = 0.268 W/kg



0 dB = 0.407 W/kg = -7.80 dB W/kg

Plot 5: Body- worn Bottom-802.11b-Channel 6-2437MHz(1Mbps)

Body- worn Bottom side-802.11b-Channel 11-2462MHz(1Mbps)

Communication System: INTERNET TABLET; Frequency: 2462 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2462 MHz; σ = 1.99 mho/m; εr = 51.23; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 2/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (41x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) =0.116 W/kg

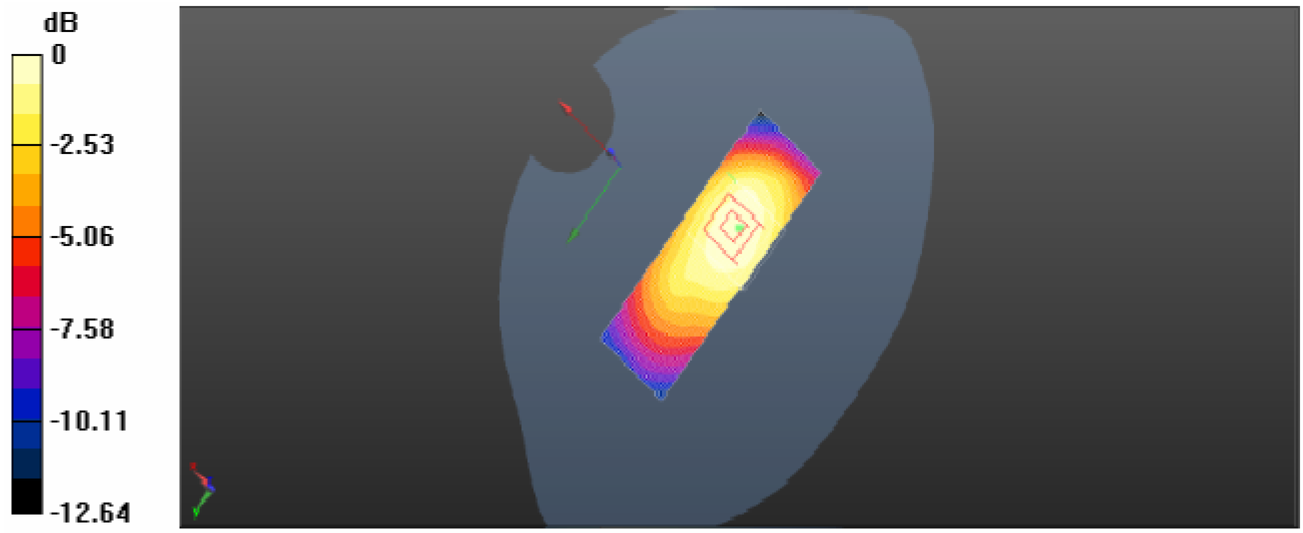
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =7.650 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.177 mW/g

SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.090 mW/g

Maximum value of SAR (measured) = 0.187 W/kg



0 dB = 0.117 W/kg = -19.74 dB W/kg

Figure 6: Body- worn Bottom-802.11b-Channel 11-2462MHz(1Mbps)

6. Calibration Certificate

6.1. Probe Calibration Ceriticate

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 SZ (Auden)**

Certificate No: **ES3-3292_Feb13**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3292

Calibration procedure(s): QA CAL-01.v8, QA CAL-14.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: February 24, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-12 (No. 217-01372)	Apr-13
Power sensor E4412A	MY41498087	31-Mar-12 (No. 217-01372)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-12 (No. 217-01369)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-12 (No. 217-01367)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-12 (No. 217-01370)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 654	3-May-12 (No. DAE4-654_May12)	May-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-12)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: February 27, 2013

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

Certificate No: ES3-3292_Feb13 Page 1 of 11

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

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

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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	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:3292

Manufactured: July 6, 2010
Calibrated: February 24, 2013

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 (μV/(V/m)^2)[A]	0.81	0.90	1.18	± 10.1 %
DCP (mV)[B]	105.9	104.7	102.0	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	117.3	±2.2 %
			Y	0.00	0.00	1.00	94.2	
			Z	0.00	0.00	1.00	108.2	

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	Depth (mm)	Unct. (k=2)
450	43.5	0.87	6.71	6.71	6.71	0.15	1.80	± 13.4 %
835	41.5	0.90	6.06	6.06	6.06	0.26	2.19	± 12.0 %
900	41.5	0.97	6.03	6.03	6.03	0.29	2.00	± 12.0 %
1810	40.0	1.40	5.25	5.25	5.25	0.80	1.17	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.63	1.38	± 12.0 %
2100	39.8	1.49	5.15	5.15	5.15	0.80	1.20	± 12.0 %
2450	39.2	1.80	4.47	4.47	4.47	0.63	1.50	± 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:3292

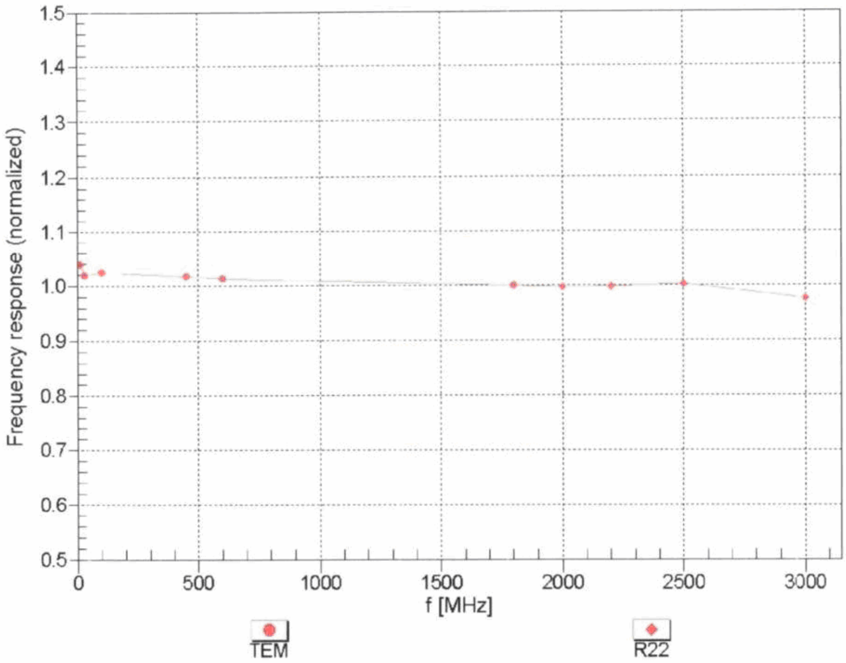
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.10	7.10	7.10	0.09	1.00	± 13.4 %
835	55.2	0.97	6.14	6.14	6.14	0.42	1.57	± 12.0 %
900	55.0	1.05	6.07	6.07	6.07	0.48	1.49	± 12.0 %
1810	53.3	1.52	4.86	4.86	4.86	0.62	1.42	± 12.0 %
1900	53.3	1.52	4.66	4.66	4.66	0.47	1.75	± 12.0 %
2100	53.2	1.62	4.76	4.76	4.76	0.70	1.39	± 12.0 %
2450	52.7	1.95	4.25	4.25	4.25	0.80	1.03	± 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.

ES3DV3– SN:3292 February 24, 2013

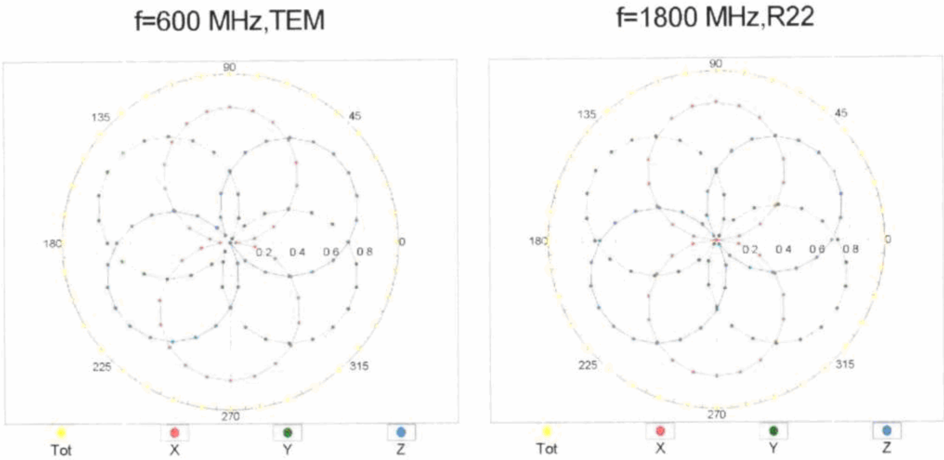
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

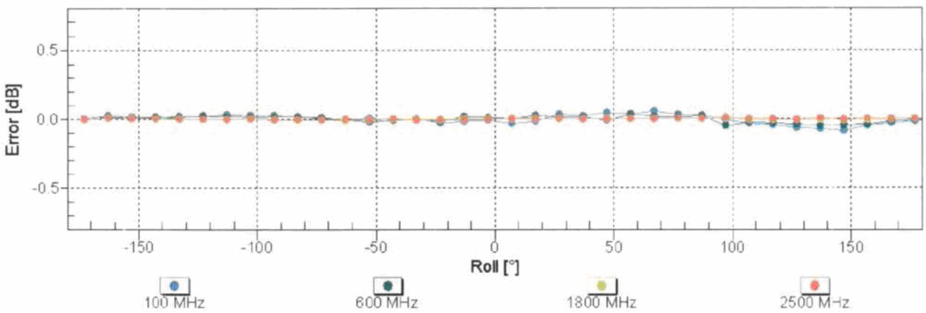


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Certificate No: ES3-3292_Feb13 Page 7 of 11

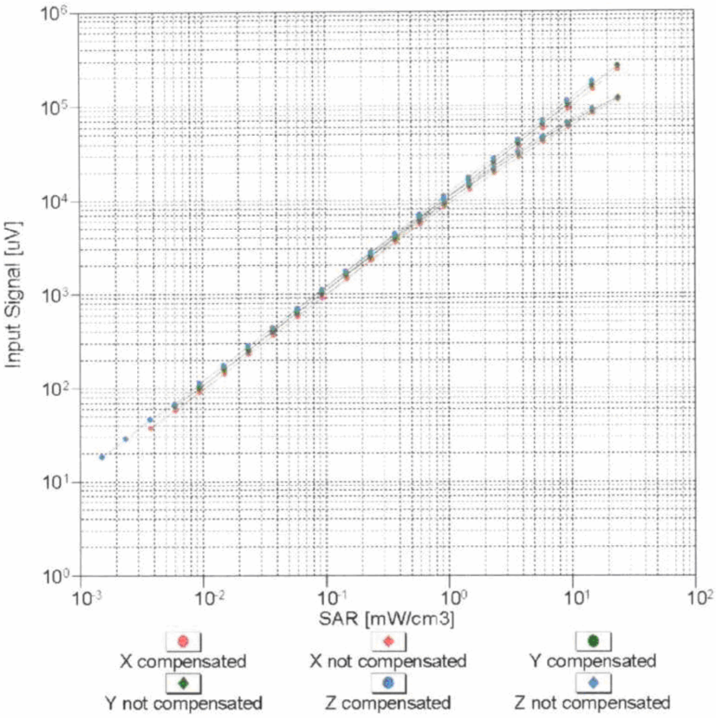
Receiving Pattern (ϕ), $\vartheta = 0°$

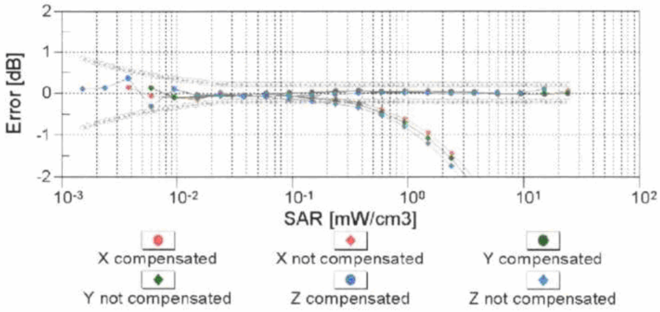




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

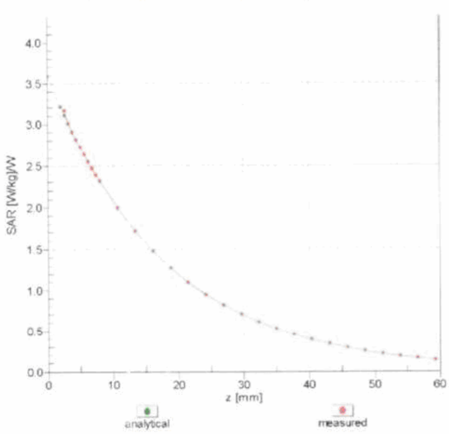
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

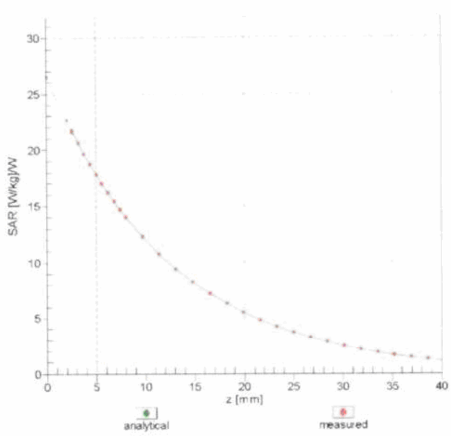




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

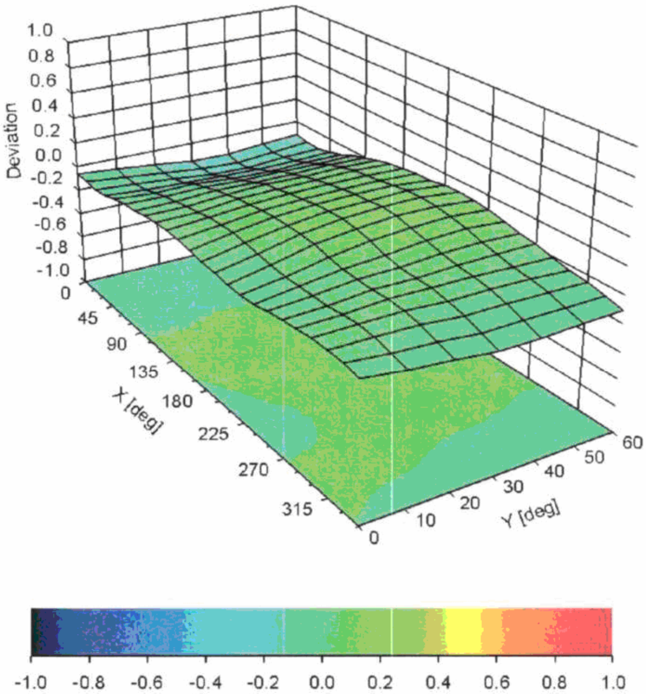
Conversion Factor Assessment





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:3292

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
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

6.2. D2450V2 Dipole Calibration Ceriticate

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

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Accreditation No.: SCS 108

Client **CIQ SZ (Auden)**

Certificate No: D2450V2-884_Feb13

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 884
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 29, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-12 (No. 217-01451)	Oct-13
Power sensor HP 8481A	US37292783	05-Oct-12 (No. 217-01451)	Oct-13
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-12 (No. 217-01368)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-12 (No. 217-01371)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	04-Jul-12 (No. DAE4-601_Jul12)	Jul-13

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

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

Issued: February 29, 2013

Calibration Laboratory of
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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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.9 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	concition	
SAR measured	250 mW input power	6.36 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.2 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.3 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	concition	
SAR measured	250 mW input power	5.98 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.7 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω + 2.1 jΩ
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.7 Ω + 3.7 jΩ
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 ns

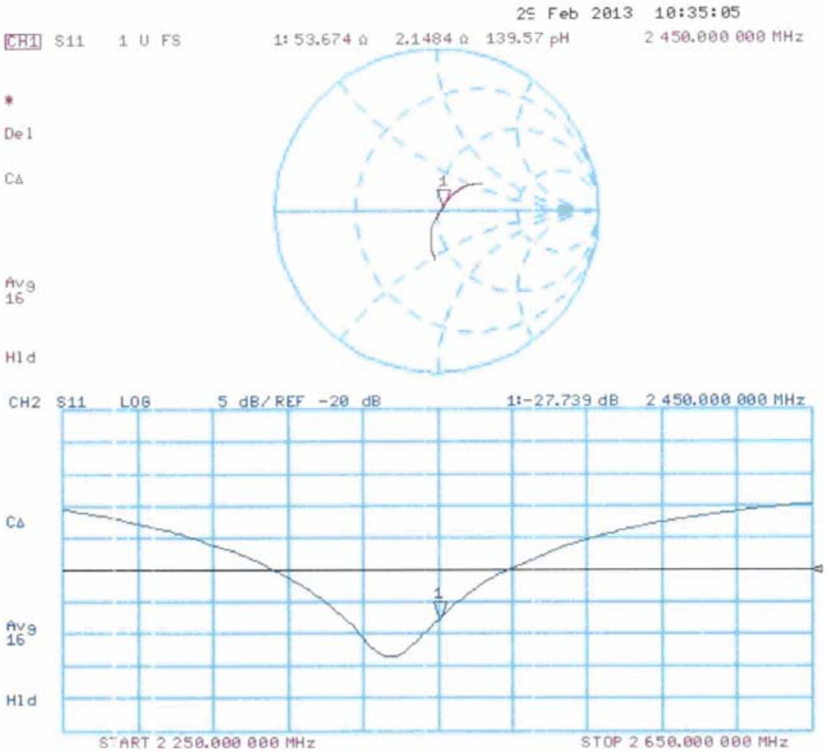
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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	October 06, 2011

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

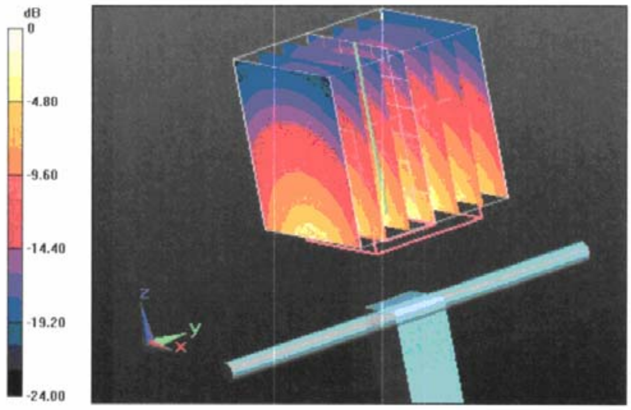
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 52.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

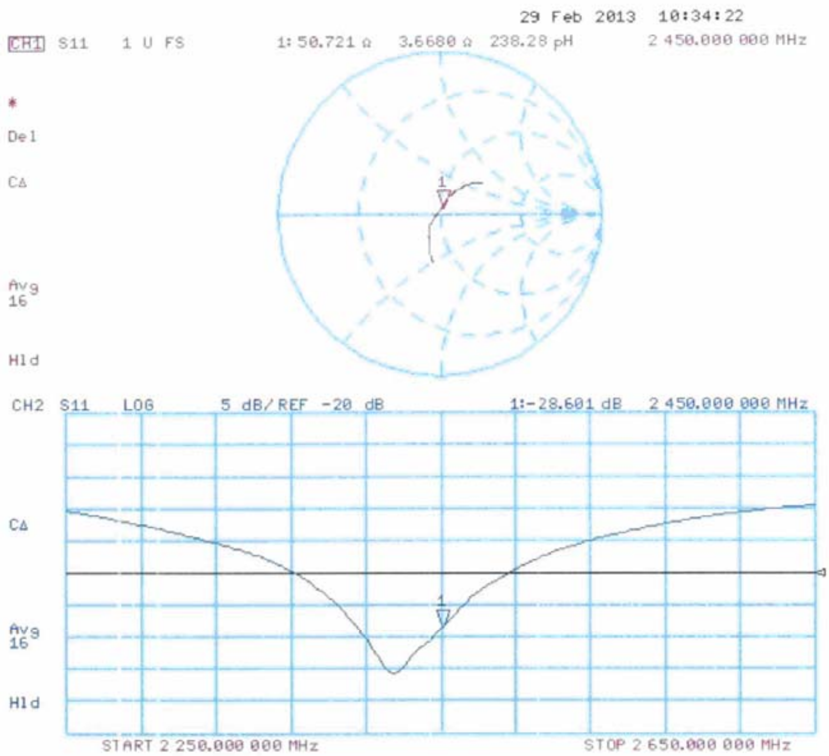
- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.956 V/m; Power Drift = 0.0027 dB
Peak SAR (extrapolated) = 26.2360
SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.98 mW/g
Maximum value of SAR (measured) = 16.972 mW/g



0 dB = 16.970mW/g = 24.59 dB mW/g

Impedance Measurement Plot for Body TSL



6.3. DAE4 Calibration Ceriticate

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client CIQ SZ (Auden)

Certificate No: DAE4-1315_Feb13

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 1315
Calibration procedure(s)	QA CAL-06.v24 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	February 27, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-12 (No:11450)	Sep-13
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:	Andrea Guntli	Technician	
Approved by:	Fin Bomholt	R&D Director	i.V.

Issued: February 27, 2013

Calibration Laboratory of
Schmid & Partner
Engineering AG
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Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	405.194 ± 0.1% (k=2)	405.031 ± 0.1% (k=2)	405.006 ± 0.1% (k=2)
Low Range	4.00179 ± 0.7% (k=2)	3.99504 ± 0.7% (k=2)	4.00535 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	20.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199993.07	-0.46	-0.00
Channel X	+ Input	19998.21	0.29	0.00
Channel X	- Input	-19997.04	5.94	-0.03
Channel Y	+ Input	199992.78	-1.05	-0.00
Channel Y	+ Input	19995.99	-1.88	-0.01
Channel Y	- Input	-20001.41	1.50	-0.01
Channel Z	+ Input	199996.23	3.02	0.00
Channel Z	+ Input	19996.75	-0.72	-0.00
Channel Z	- Input	-20003.50	-0.24	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	1999.32	-1.73	-0.09
Channel X	+ Input	200.22	-1.03	-0.51
Channel X	- Input	-198.55	0.32	-0.16
Channel Y	+ Input	1997.53	-3.28	-0.16
Channel Y	+ Input	199.64	-1.21	-0.60
Channel Y	- Input	-199.77	-0.78	0.39
Channel Z	+ Input	1997.90	-2.04	-0.10
Channel Z	+ Input	199.23	-1.21	-0.61
Channel Z	- Input	-200.63	-1.12	0.56

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	-1.10	-3.09
	- 200	4.35	3.23
Channel Y	200	-22.09	-22.46
	- 200	21.74	22.31
Channel Z	200	-4.46	-4.92
	- 200	3.65	2.86

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-2.62	-3.29
Channel Y	200	6.73	-	-2.17
Channel Z	200	8.11	5.38	-

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	16132	15682
Channel Y	16251	15151
Channel Z	15551	15659

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	1.32	0.22	2.38	0.46
Channel Y	-1.23	-2.04	-0.58	0.36
Channel Z	-1.89	-3.56	-1.12	0.39

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

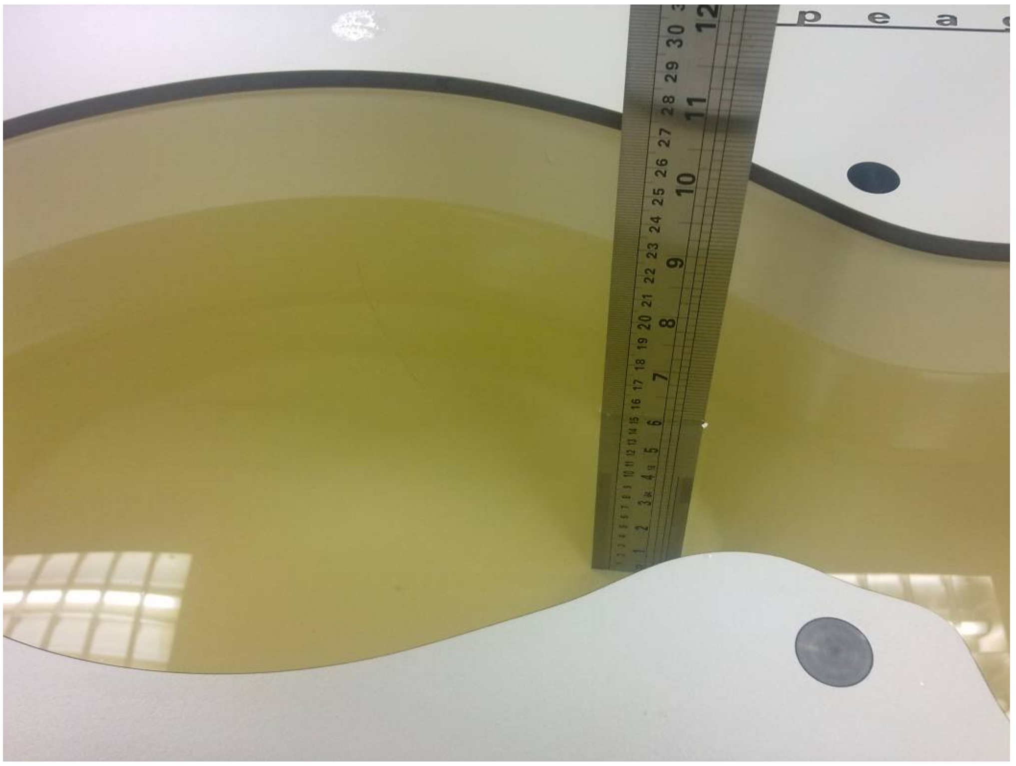
8. Low Battery Alarm Voltage (Typical values for information)

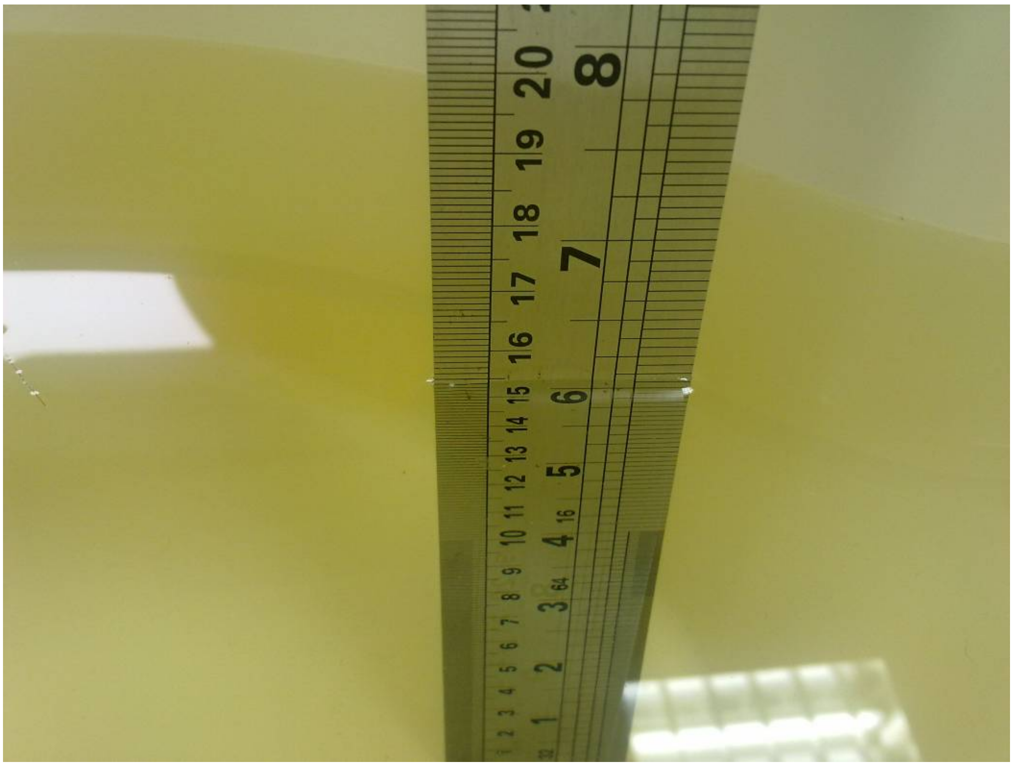
Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

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

7. Test Setup Photos





Liquid depth in the Flat Phantom (2450MHz)

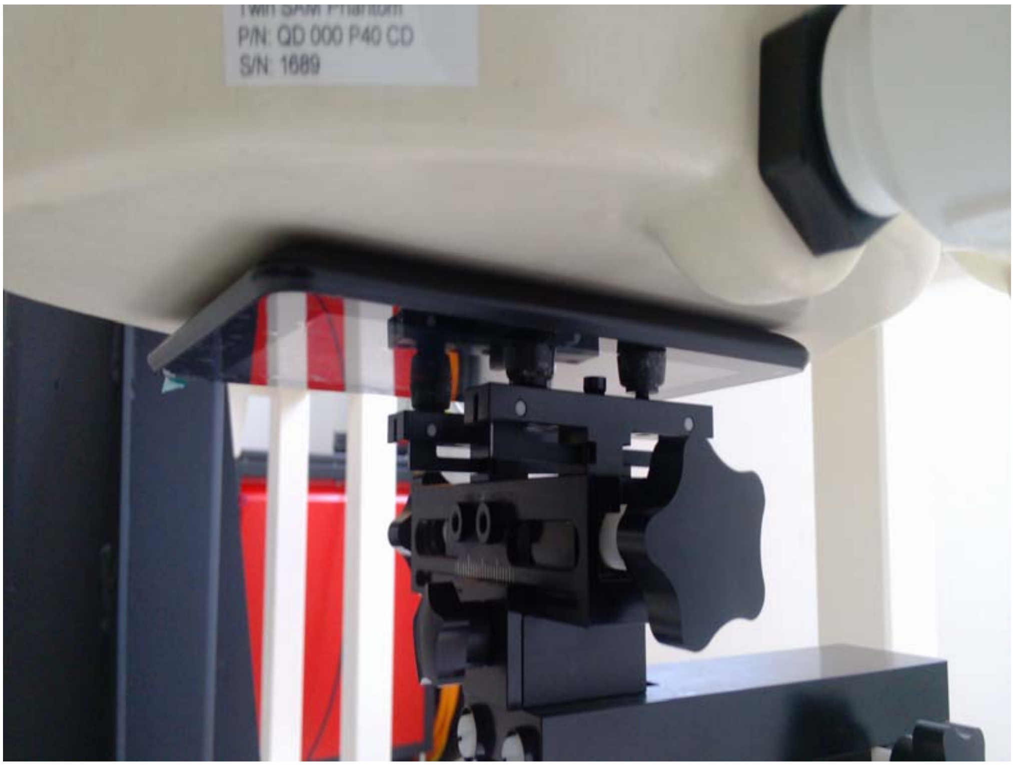


Fig.2 Body Position (Back side)(The distance was 0cm)

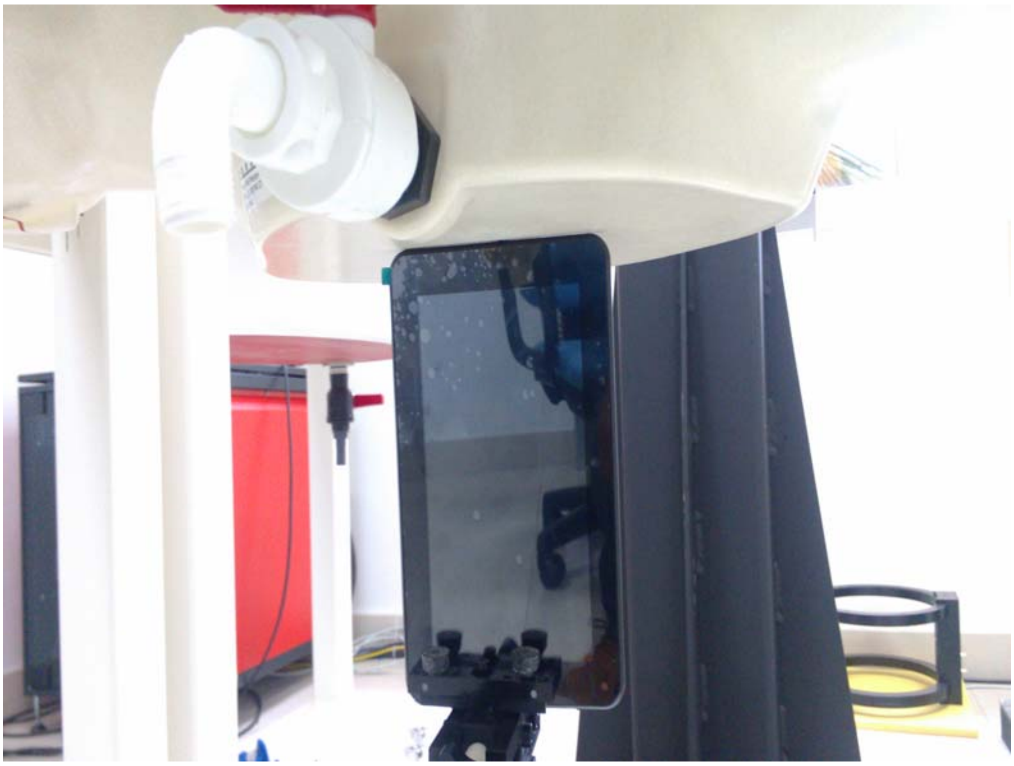
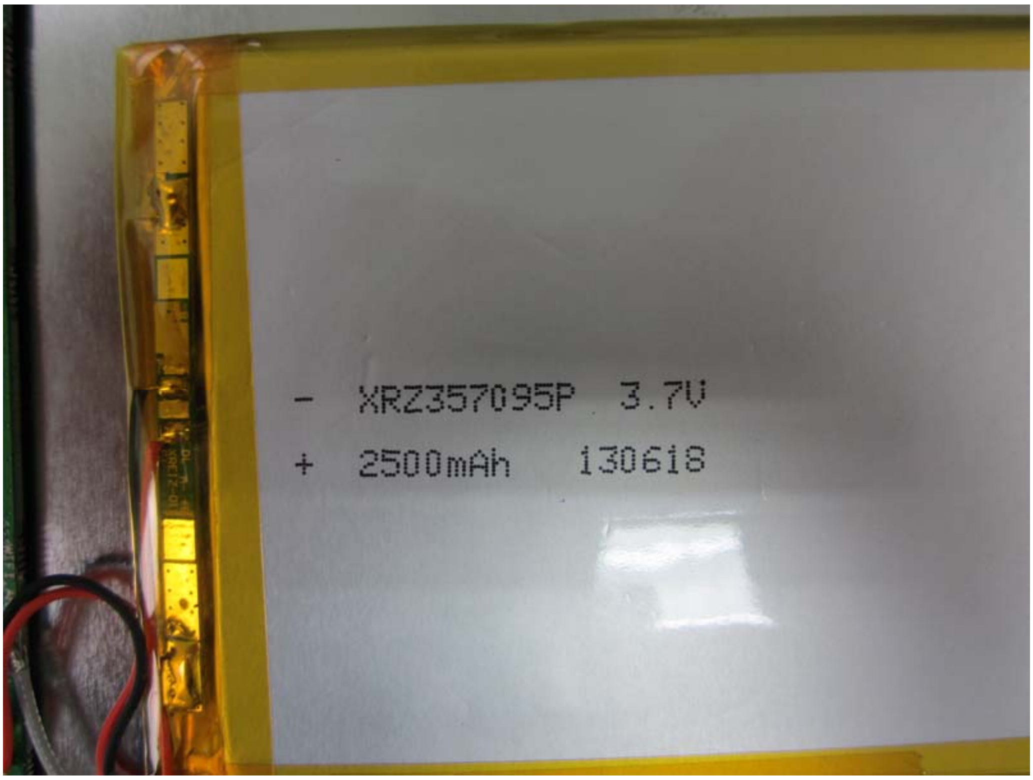


Fig.3 Body Position (Bottom side) (The distance was 0cm)

8. External Photos of the EUT


HDMI


RESET
HDMI
+5V DC



....................End of Report........................