FIC SAR Test Report

FCC ID: QT7TSBDTQ112

IC: 11515A-TSBDTQ112

Project No.	:	1402C005
Equipment	:	Canvio AERO Mobile
Model Name for FCC	:	DTQ112; DTQ1XX
Model Name for IC		DTQ112
Applicant	:	Power7 Technology(Dongguan) Co.,Ltd
Address	:	No. 28 Binjiang St. Shishuikou Village, Qiaotou Town, Dongguan City, Guangdong Province P.R.China

Tested by: Neutron Engineering Inc. EMC Laboratory

Date of Receipt: Feb. 10, 2014

Date of Test: Feb. 10, 2014 ~ Feb. 21, 2014

Date of Issue: Feb. 25, 2014

Testing Engineer : (Super Jiang)

Technical Manager : (Leo Hung)

Authorized Signatory : (Steven Lu)

Neutron Engineering Inc.
No.3,Jinshagang 1st Road, ShiXia,
Dalang Town, Dong Guan, China.
TEL: 0769-8318-3000
FAX: 0769-8319-6000

Declaration

Neutron represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**), or National Institute of Standards and Technology (**NIST**) .

Neutron's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **Neutron** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **Neutron** issued reports.

Neutron's reports must not be used by the client to claim product endorsement by the authorities or any agency of the Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and **Neutron-self**, extracts from the test report shall not be reproduced except in full with **Neutron**'s authorized written approval.

Neutron's laboratory quality assurance procedures are in compliance with the **ISO Guide 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Table of Contents Page

1 . GENERAL SUMMARY 6

2 . RF EMISSIONS MEASUREMENT 7

2.1 TEST FACILITY 7

2.2 MEASUREMENT UNCERTAINTY 7

3 . GENERAL INFORMATION 8

3.1 GENERAL DESCRIPTION OF EUT 8

3.2 THE MAXIMUM SAR_{1G} VALUES 9

3.3 LABORATORY ENVIRONMENT 9

3.4 MAIN TEST INSTRUMENTS 10

4 . SAR MEASUREMENTS SYSTEM CONFIGURATION 11

4.1 SAR MEASUREMENT SET-UP 11

4.2 DASY5 E-FIELD PROBE SYSTEM 12

5 . TISSUE-EQUIVALENT LIQUID 19

5.1 TISSUE-EQUIVALENT LIQUID INGREDIENTS 19

5.2 TISSUE-EQUIVALENT LIQUID PROPERTIES 19

6 . SYSTEM CHECK 20

6.1 DESCRIPTION OF SYSTEM CHECK 20

6.2 DESCRIPTION OF SYSTEM CHECK 21

7 . OPERATIONAL CONDITIONS DURING TEST 22

7.1 GENERAL DESCRIPTION OF TEST PROCEDURES 22

7.2 TEST POSITION 22

8 . TEST RESULT 23

8.1 CONDUCTED POWER RESULTS 23

8.2 SAR TEST RESULTS 26

APPENDIX 27

1. TEST LAYOUT 27

2. SYSTEM CHECK RESULTS 28

3. GRAPH RESULTS 29

4. PROBE CALIBRATION CERTIFICATE 35

5. (1) D2450V2 DIPOLE CALIBRATION CERTIFICATE 46

Table of Contents Page

6. DAE4 CALIBRATION CERTIFICATE 54

7. EUT TESTING POSITION AND ANTENNA LOCATION 59

8. TEST CONFIGURATION 61

REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
NEI-FIC-SAR-1402C005	Original Issue.	Feb. 26, 2014

1. GENERAL SUMMARY

Equipment	Canvio AERO Mobile
Model Name for FCC	DTQ112;DTQ1XX
Model Name for IC	DTQ112
Brand Name	Toshiba Corporation
Model Difference	DTQ112 stands for 128G capacity and DTQ1XX can be any capacity
Manufacturer/Factory	Power7 Technology(Dongguan) Co.,Ltd
Address	No. 28 Binjiang St. Shishuikou Village, Qiaotou Town, Dongguan City, Guangdong Province P.R.China
Standard(s)	**RSS-102 Issue 4 March 2010:** Radio frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands) **FCC 47CFR §2.1093** Radio frequency Radiation Exposure Evaluation: Portable Devices **ANSI C95.1, 1999** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1999) **IEEE 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 **IEC 62209-2-2010** Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz) **KDB 248227 D01 v01r02 SAR meas for 802 11 a b g v01r02:** SAR Measurement Procedures for 802.11a/b/g Transmitters **KDB 447498 D02 General RF Exposure Guidance v05r01**: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies. **KDB 865664 D01 SAR measurement 100 MHz to 6GHz v01r01:** SAR Measurement Requirements for 100MHz to 6GHz

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FIC-SAR-1402C005) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

2. RF EMISSIONS MEASUREMENT

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **SAR room** at the location of No.3,Jinshagang 1st Road, ShiXia, Dalang Town, Dong Guan, China.523792

2.2 MEASUREMENT UNCERTAINTY

Uncertainty Conponent	Uncertainty Value	Probability Distribution	Divisor	C_i (1g)	Standard Uncertainty ±1%	V_i or V_{eff}
Measurement System						
Probe Calibration (*k*=1)	5.9	Normal	1	1	5.9	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
Boundary Effect	1.0	Rectangular	$\sqrt{3}$	1	0.6	∞
Linearity	4.7	Rectangular	$\sqrt{3}$	1	2.7	∞
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	0.6	∞
Readout Electronics	0.3	Normal	1	1	0.3	∞
Response Time	0.8	Rectangular	$\sqrt{3}$	1	0.5	∞
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	1.5	∞
RF Ambient Conditions-Noise	3.0	Rectangular	$\sqrt{3}$	1	1.7	∞
RF Ambient Reflections	3.0	Rectangular	$\sqrt{3}$	1	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	$\sqrt{3}$	1	0.2	∞
Probe Positioning with respect to Phantom Shell	2.9	Rectangular	$\sqrt{3}$	1	1.7	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	1.0	Rectangular	$\sqrt{3}$	1	0.6	∞
Test Sample Related						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Output Power Variation - SAR drift measurement	5.0	Rectangular	$\sqrt{3}$	1	2.9	∞
Phantom and Setup						
Phantom Uncertainty (shape and thickness tolerances)	4.0	Rectangular	$\sqrt{3}$	1	2.3	∞
Liquid Conductivity - deviation from target values	5.0	Rectangular	$\sqrt{3}$	0.64	1.8	∞
Liquid Conductivity - measurement uncertainty	2.5	Normal	1	0.64	1.6	∞
Liquid Permittivity - deviation from target values	5.0	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Liquid Permittivity - measurement uncertainty	2.5	Normal	1	0.6	1.5	∞
Combined standard uncertainty		RSS	-	-	10.9	387
Expanded uncertainty		*k*=2	-	-	21.9	-

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Operation Frequency	2412MHz~2462 MHz
Modulation Technology	802.11b:DSSS 802.11g:OFDM 802.11n:OFDM
Bit Rate of Transmitter	802.11b (DSSS, CCK) 1, 2, 5.5, 11 Mbps 802.11g (OFDM) 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n (OFDM, MCS 0-7) 6.5, 7.2, 13.0, 14.4, 19.5, 21.7, 26.0, 28.9, 39.0, 43.3, 52.0, 57.8, 58.5, 65.0, 72.2 up to 150 Mbps
Number Of Channel	Please refer to note 1
Antenna Type	Please refer to note 2

Note:

1. CH 01 – CH 11 for 802.11b, 802.11g, 802.11n(20MHz)
   CH 03 – CH 09 for 802.11n(40MHz)

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

2. Table for Filed Antenna

Ant.	Manufacturer	Model Name	Antenna Type	Connector	Gain (dBi)	Note
1	JOHANSON TECHNOLOGY	2450AT18A100	Integral	N/A	0.5	

3.2 THE MAXIMUM SAR_{1G} VALUES

Body SAR Configuration

Test Mode	Frequency (MHz)	Test Position	Separation Distance	Test Result SAR_{1g} (W/kg)	Limit SAR_{1g} (W/kg)
802.11b	2462	Test Position 1	0mm	0.339	1.6

Note: Equipment Under Test (EUT) has a WIFI antenna that can be used for TX/RX. During SAR test of the EUT, SAR is only tested for 802.11b. SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

3.3 LABORATORY ENVIRONMENT

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

3.4 MAIN TEST INSTRUMENTS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Data Acquisition Electronics	Speag	DAE4	1390	Sep. 10, 2014
2	E-field Probe	Speag	EX3DV4	3932	Sep. 16, 2014
3	Electro Optical Converter	Speag	ECO90	1151	N/A
4	ELI4 Phantom	Speag	ELI4 Phantom V5.0	1222	N/A
5	System Validation Dipole	Speag	D2450V2	919	Sep. 05, 2014
6	Power Amplifier	Speag	ZHL-42W	N/A	N/A
7	Power Amplifier	Speag	ZVE-8G	N/A	N/A
8	ENA Network Analyzer	Agilent	E5071C	MY46102965	Apr. 25, 2014
9	Dielectric Probe Kit	Agilent	85070E	2593	N/A
10	P-series power meter	Agilent	N1911A	MY45100473	Apr. 25, 2014
11	wideband power sensor	Agilent	N1921A	MY51100041	Apr. 25, 2014
12	power Meter	ANRITSU	ML2495A	1128009	May. 24, 2014
13	Pulse Power Sensor	ANRITSU	MA 2411B	1027500	May. 24, 2014
14	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Nov. 09, 2014

Remark: ” N/A” denotes no model name, serial No. or calibration specified.
All calibration period of equipment list is one year.

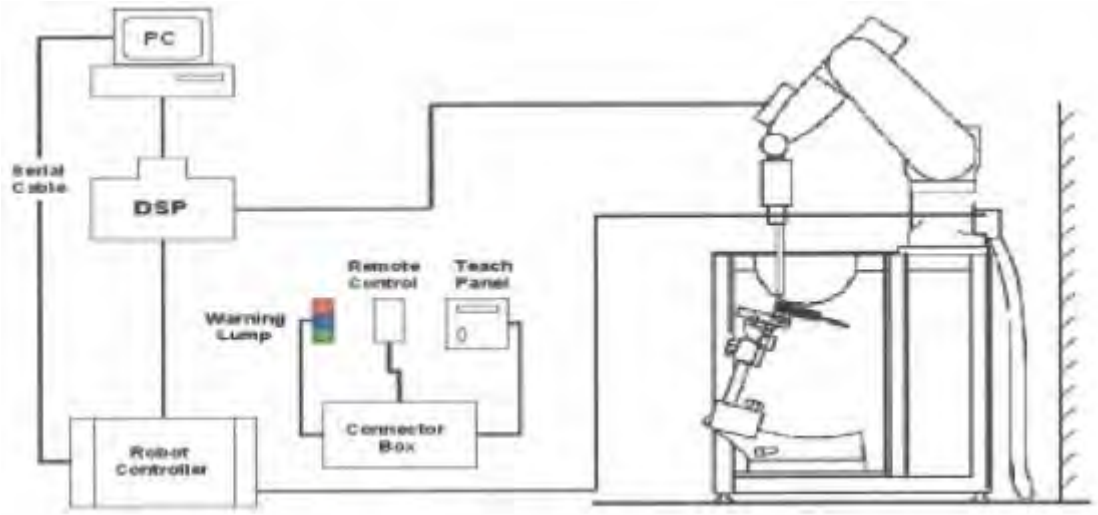
4. SAR MEASUREMENTS SYSTEM CONFIGURATION

4.1 SAR MEASUREMENT SET-UP

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

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. 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.
3. 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.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. 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.
6. 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 7
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

4.1.1 Test Setup Layout



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.

4.2.1 ES3DV3 PROBE SPECIFICATION

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

EX3DV4 E-field Probe

4.2.2 E-FIELD PROBE CALIBRATION

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

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

Where: Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m3).

4.2.3 OTHER TEST EQUIPMENT

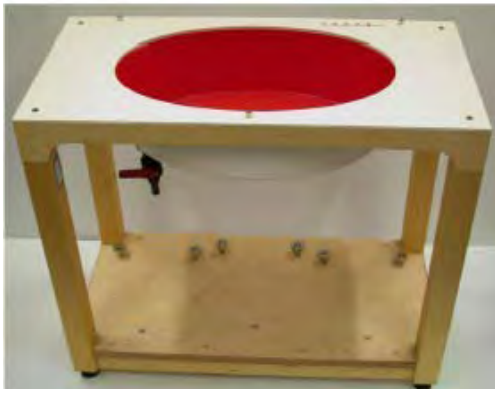
4.2.3.1. Device Holder for Transmitters

Construction: Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.
Material: POM, Acrylic glass, Foam

4.2.3.2 Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible all known tissuesimulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

Shell Thickness	2±0.1 mm
Filling Volume	Approx. 30 liters
Dimensions	190 X 600 X 0 mm (H x L x W)
Aailable	Special



ELI4 Phantom

4.2.4 SCANNING PROCEDURE

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

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

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

- Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 10 mm x 10 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.

4.2.5 DATA STORAGE AND EVALUATION

4.2.5.1 Data Storage

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

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

4.4.2 Data Evaluation by SEMCAD

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

Probe parameters:	Sensitivity	Normi, a_{i0}, a_{i1}, a_{i2}
	Conversion factor	$ConvF_i$
	Diode compression point	Dcp_i
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

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:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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

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

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

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

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

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

ConvF = sensitivity enhancement in solution

aij = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

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

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

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

$$E_{tot} = (E_X^2 + E_Y^2 + E_Z^2)^{1/2}$$

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

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

With SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m
= conductivity in [mho/m] or [Siemens/m]
= equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

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

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

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

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

5. TISSUE-EQUIVALENT LIQUID

5.1 TISSUE-EQUIVALENT LIQUID INGREDIENTS

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed

Composition of the Tissue Equivalent Matter

MIXTURE%	FREQUENCY 2450MHz
Water	62.7
Glycol	36.8
Salt	0.5
Dielectric Parameters Target Value	f=2450MHz ε=39.20 σ=1.80

5.2 TISSUE-EQUIVALENT LIQUID PROPERTIES

Dielectric Performance of Tissue Simulating Liquid

Frequency (MHz)	Description	Dielectric Parameters		Temp ℃
		ε_r	σ(s/m)	
2450	Target value ±5% within	52.70 50.07-55.34	1.95 1.85-2.048	22.0
	Measurement value 2014-02-19	51.82	1.98	20.8

6. SYSTEM CHECK

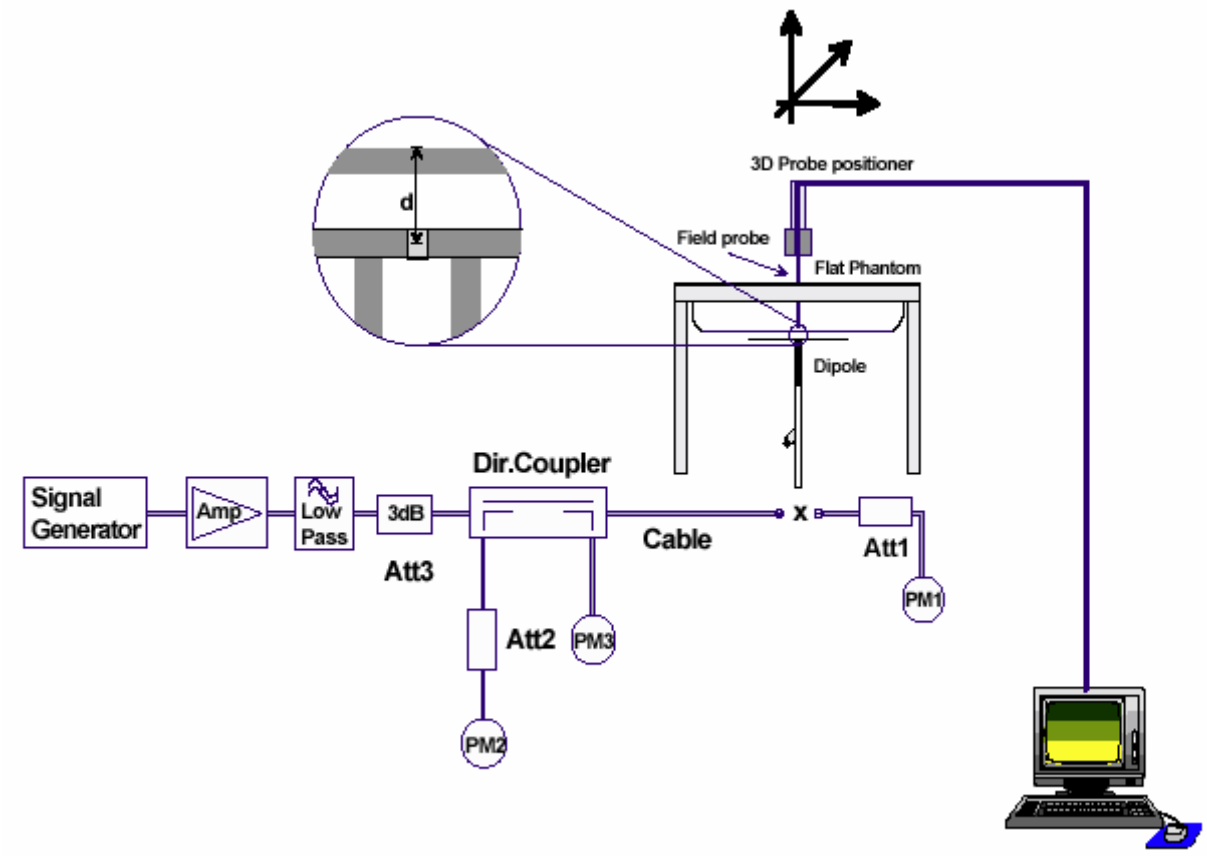
6.1 DESCRIPTION OF SYSTEM CHECK

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the 6.2.

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.

System Check Set-up



6.2 DESCRIPTION OF SYSTEM CHECK

System Check in Tissue Simulating Liquid

Frequency (MHz)	Test Date	Dielectric Parameters		Temp	250mW Measured SAR_{1g}	1W Normalized SAR_{1g}	1W Target SAR_{1g} (±10% deviation)
		εr	σ(s/m)	(℃)	(W/kg)		
2450	2014-02-19	51.82	1.98	20.80	13.20	52.80	49.30 (44.37~54.23)

Note: 1. The graph results see Appendix 2.
2. Target Value derives from the calibration certificate

7. OPERATIONAL CONDITIONS DURING TEST

7.1 General Description of Test Procedures

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WIFI mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frequency band.802.11b/g modes are tested on channels1,6,11; however, if output power reduction is necessary for channels 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

KDB 248227 - SAR is not required for 802.11a HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

7.2 Test Position

For each channel, the EUT is tested at the following 4 test positions:

Test Position 1: The top side of the EUT towards the bottom of the flat phantom distance 0mm. (APPENDIX 8)

Test Position 2: The bottom side of the EUT towards the bottom of the flat phantom distance 0mm. (APPENDIX 8)

Test Position 3: The back side of the EUT towards the bottom of the flat phantom distance 0mm. (APPENDIX 8)

Test Position 4: The left side of the EUT towards the bottom of the flat phantom distance 0mm.

(APPENDIX 8)

8. TEST RESULT

8.1 CONDUCTED POWER RESULTS

Test Mode	Data Rate (Mbps)	Test Results (dBm)		
		Conducted AV		
		2412MHz	2437MHz	2462MHz
802.11b	1	15.83	15.75	15.86
	2	15.74	15.61	15.65
	5.5	15.12	15.09	15.02
	11	14.65	14.54	14.58
802.11g	6	14.76	14.84	15.03
	9	14.59	14.52	14.53
	12	14.55	14.51	14.51
	18	14.56	14.45	14.46
	24	14.53	14.47	14.42
	36	14.5	14.52	14.38
	48	14.49	14.49	14.35
	54	14.45	14.46	14.32

Test Mode	Data Rate (Mbps)	Test Results (dBm)		
		Conducted AV		
		2412MHz	2437MHz	2462MHz
802.11n HT20	MCS0	15.02	14.64	14.93
	MCS1	14.62	14.64	14.56
	MCS2	14.58	14.62	14.52
	MCS3	14.59	14.67	14.49
	MCS4	14.54	14.63	14.46
	MCS5	14.52	14.57	14.42
	MCS6	14.53	14.58	14.45
	MCS7	14.48	14.52	14.38
	MCS8	14.47	14.47	14.39
	MCS9	14.42	14.45	14.34
	MCS10	14.45	14.43	14.32
	MCS11	14.46	14.46	14.35
	MCS12	14.45	14.42	14.28
	MCS13	14.43	14.37	14.24
	MCS14	14.37	14.35	14.25
	MCS15	14.36	14.32	14.22

Test Mode	Data Rate (Mbps)	Test Results (dBm)		
		Conducted AV		
		2422MHz	2437MHz	2462MHz
802.11n HT40	MCS0	14.97	15.02	14.95
	MCS1	14.53	14.65	14.52
	MCS2	14.51	14.63	14.51
	MCS3	14.49	14.58	14.49
	MCS4	14.43	14.59	14.45
	MCS5	14.45	14.54	14.46
	MCS6	14.37	14.52	14.41
	MCS7	14.34	14.5	14.38
	MCS8	14.35	14.47	14.37
	MCS9	14.33	14.43	14.35
	MCS10	14.29	14.46	14.32
	MCS11	14.25	14.38	14.36
	MCS12	14.26	14.39	14.33
	MCS13	14.24	14.35	14.28
	MCS14	14.22	14.34	14.27
	MCS15	14.19	14.31	14.25

8.2 SAR TEST RESULTS

802.11b							
Test Position	Test Mode	Channel Frequency (MHz)	Distance (mm)	Duty Cycle	Drift±0.21dB	Limit SAR 1.6W/kg	
					Drift(dB)	Measured SAR (W/kg)	Graph Results
1	802.11b	2412	0	1:1	-0.01	0.314	1
1	802.11b	2437	0	1:1	0.05	0.332	2
1	**802.11b**	**2462**	**0**	**1:1**	**0.09**	**0.339**	**3**
2	802.11b	2462	0	1:1	0.03	0.245	4
3	802.11b	2462	0	1:1	0.18	0.246	5
4	802.11b	2462	0	1:1	-0.09	0.085	6

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

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ⩽ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

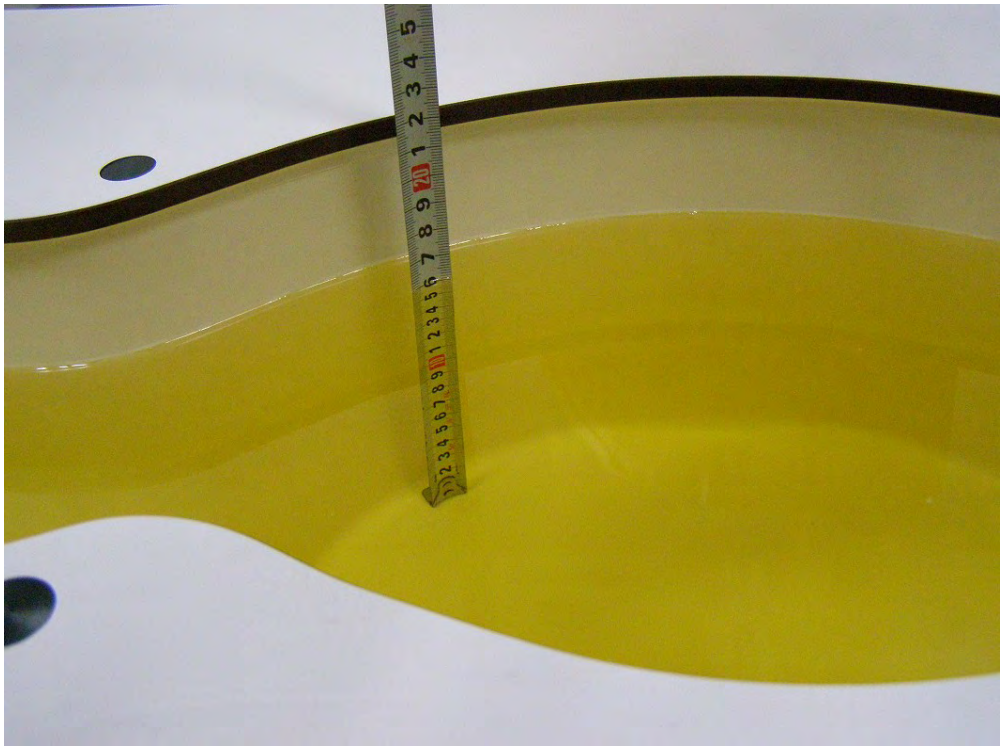
3. KDB 248227-SAR is not required for 802.11g/n channels when the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b channels.

APPENDIX

1. Test Layout

Specific Absorption Rate Test Layout

Liquid depth in the flat Phantom (16cm depth)



2. System Check Results

Date/Time: 02/19/2014 09:18:32

Test Laboratory: Neutron Engineering Inc.

System Performance Check D2450MHz

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:919

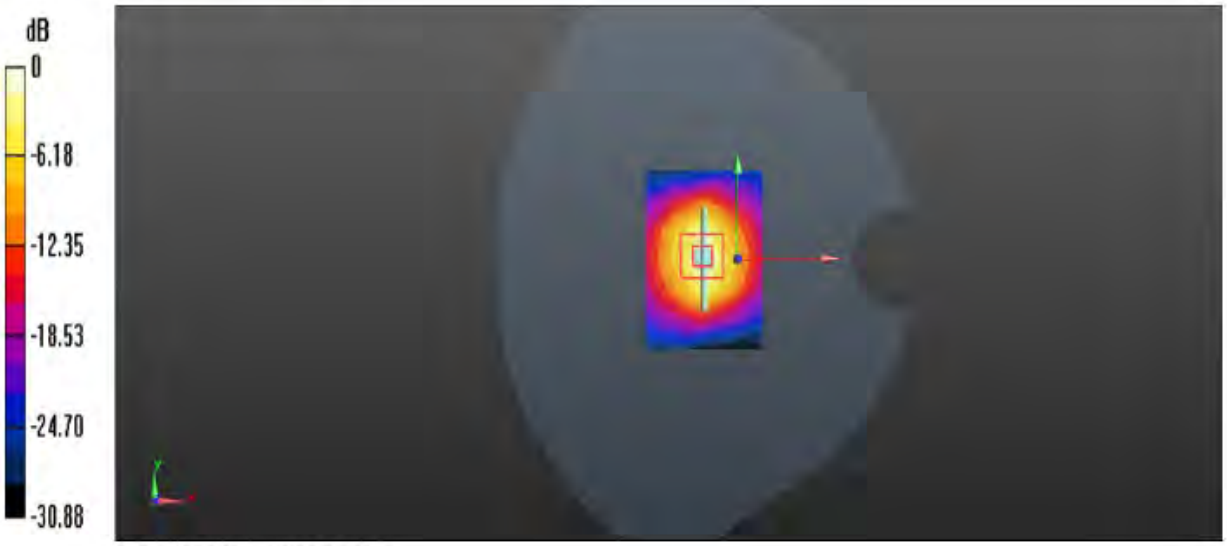
Communication System: UID 0, CW (0); Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.98 S/m; ε_r = 51.82; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at 2450MHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 20.2 W/kg

System Performance Check at 2450MHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.1 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.07 W/kg
Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.2 W/kg = 13.05 dBW/kg

3. Graph Results

Date/Time: 02/19/2014 21:03:47

Test Laboratory: Neutron Engineering Inc.

Canvo AERO Mobile DTQ112 802.11b 2412MHz CH1 Test Position 1

DUT: Canvo AERO Mobile Position1; Type: DTQ112; Serial: NA

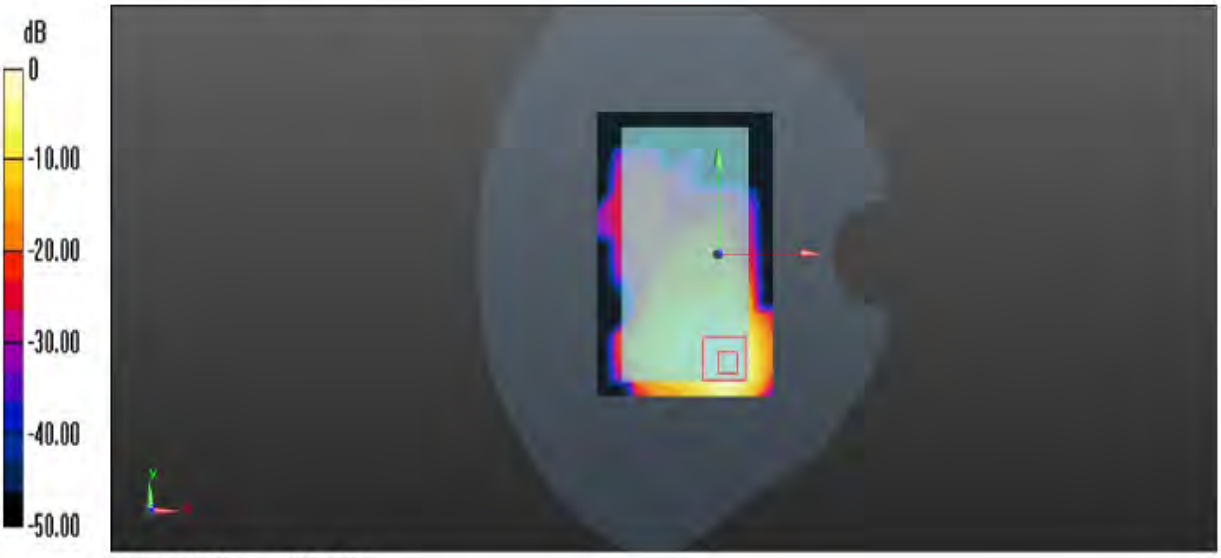
Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2412 MHz
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.972 S/m; ε_r = 52.39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0; 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Test Position 1/DTQ112 802.11b CH1/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.932 W/kg

Test Position 1/DTQ112 802.11b CH1/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.103 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.60 W/kg
SAR(1 g) = 0.314 W/kg; SAR(10 g) = 0.115 W/kg
Maximum value of SAR (measured) = 1.13 W/kg



0 dB = 0.932 W/kg = -0.31 dBW/kg

Date/Time: 02/19/2014 19:46:40

Test Laboratory: Neutron Engineering Inc.

Canvo AERO Mobile DTQ112 802.11b 2437MHz CH6 Test Position 1

DUT: Canvo AERO Mobile Position1; Type: DTQ112; Serial: NA

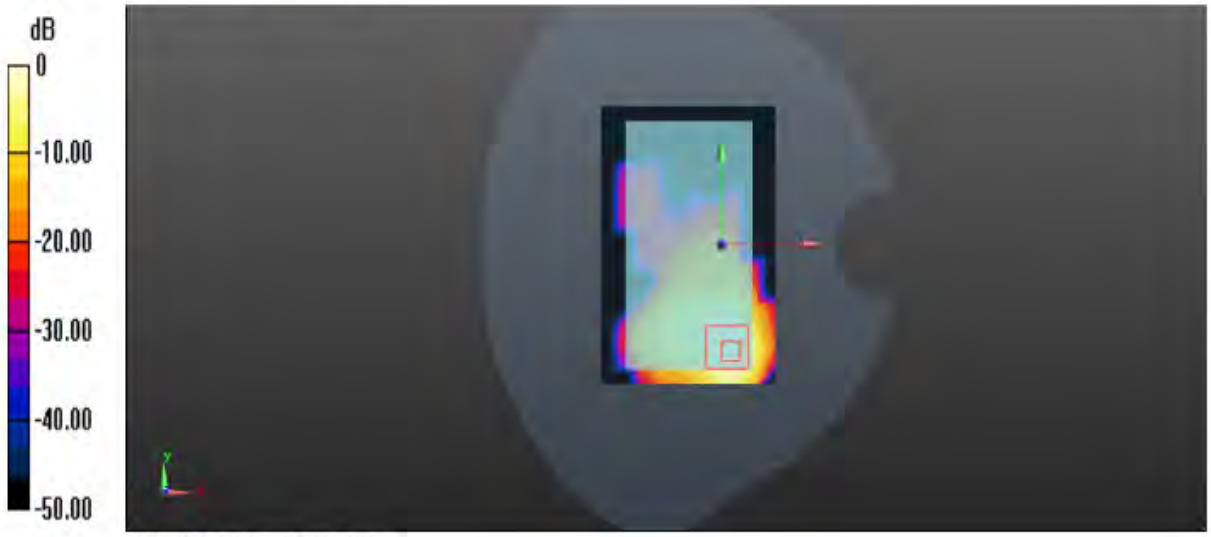
Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2437 MHz
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.997 S/m; ε_r = 51.745; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Test Position 1/DTQ112 802.11b CH6/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.447 W/kg

Test Position 1/DTQ112 802.11b CH6/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.448 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.762 W/kg
SAR(1 g) = 0.332 W/kg; SAR(10 g) = 0.147 W/kg
Maximum value of SAR (measured) = 0.533 W/kg



0 dB = 0.447 W/kg = -3.50 dBW/kg

Date/Time: 02/19/2014 10:30:58

Test Laboratory: Neutron Engineering Inc.

Canvo AERO Mobile DTQ112 802.11b 2462MHz CH11 Test Position 1

DUT: Canvo AERO Mobile Position1; Type: DTQ112; Serial: NA

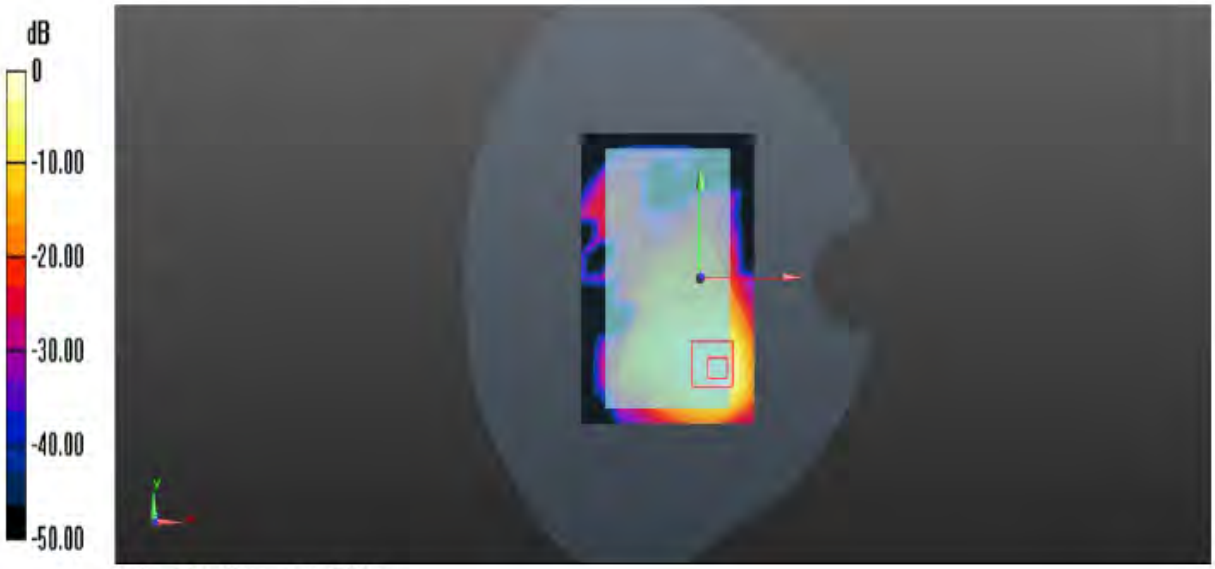
Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.024 S/m; ε_r = 51.672; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Test Position 1/DTQ112 802.11b CH11/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.511 W/kg

Test Position 1/DTQ112 802.11b CH11/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.833 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.787 W/kg
SAR(1 g) = 0.339 W/kg; SAR(10 g) = 0.144 W/kg
Maximum value of SAR (measured) = 0.543 W/kg



0 dB = 0.511 W/kg = -2.92 dBW/kg

Date/Time: 02/19/2014 11:25:43

Test Laboratory: Neutron Engineering Inc.

Canvo AERO Mobile DTQ112 802.11b 2462MHz CH11 Test Position 2

DUT: Canvo AERO Mobile Position1; Type: DTQ112; Serial: NA

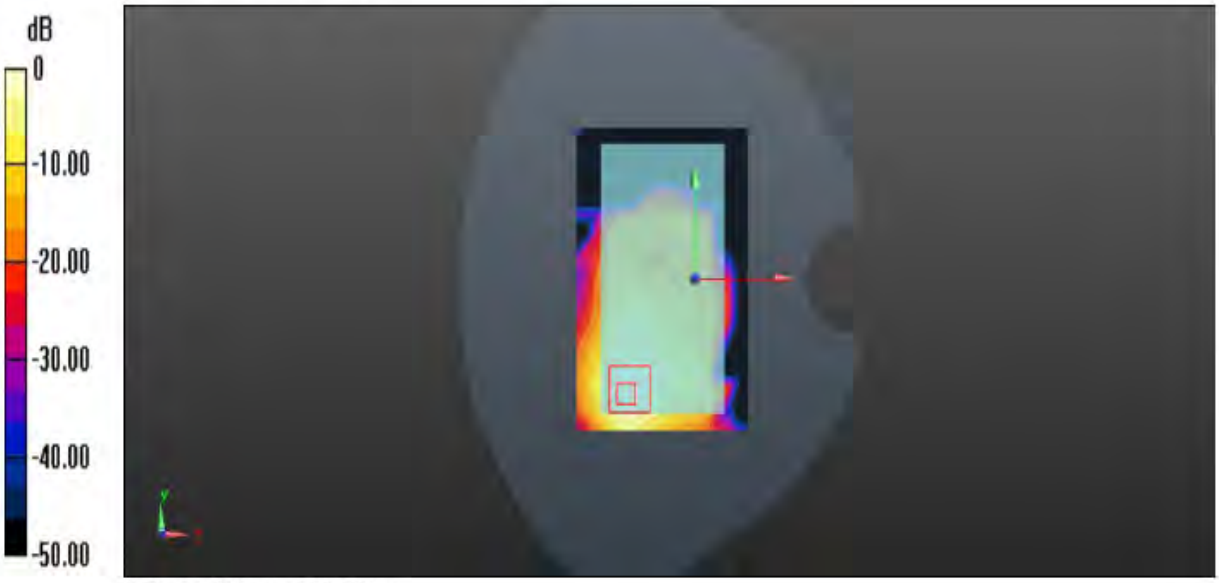
Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.024 S/m; ε_r = 51.672; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Test Position 2/DTQ112 802.11b CH11/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.315 W/kg

Test Position 2/DTQ112 802.11b CH11/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.869 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.562 W/kg
SAR(1 g) = 0.245 W/kg; SAR(10 g) = 0.105 W/kg
Maximum value of SAR (measured) = 0.396 W/kg



0 dB = 0.315 W/kg = -5.02 dBW/kg

Date/Time: 02/19/2014 14:43:06

Test Laboratory: Neutron Engineering Inc.

Canvo AERO Mobile DTQ112 802.11b 2462MHz CH11 Test Position 3

DUT: Canvo AERO Mobile Position 3; Type: DTQ112; Serial: NA

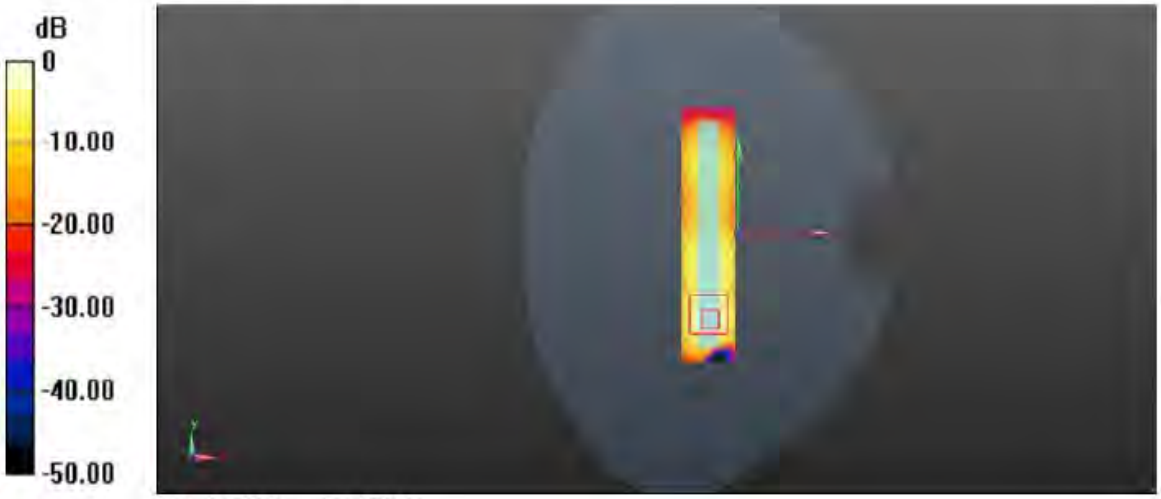
Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.024 S/m; ε_r = 51.672; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Test Position 3/DTQ112 802.11b CH11/Area Scan (4x15x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.325 W/kg

Test Position 3/DTQ112 802.11b CH11/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.160 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.709 W/kg
SAR(1 g) = 0.246 W/kg; SAR(10 g) = 0.091 W/kg
Maximum value of SAR (measured) = 0.419 W/kg



0 dB = 0.325 W/kg = -4.88 dBW/kg

Date/Time: 02/19/2014 17:30:11

Test Laboratory: Neutron Engineering Inc.

Canvo AERO Mobile DTQ112 802.11b 2462MHz CH11 Test Position 4

DUT: Canvo AERO Mobile Position 4; Type: DTQ112; Serial: NA

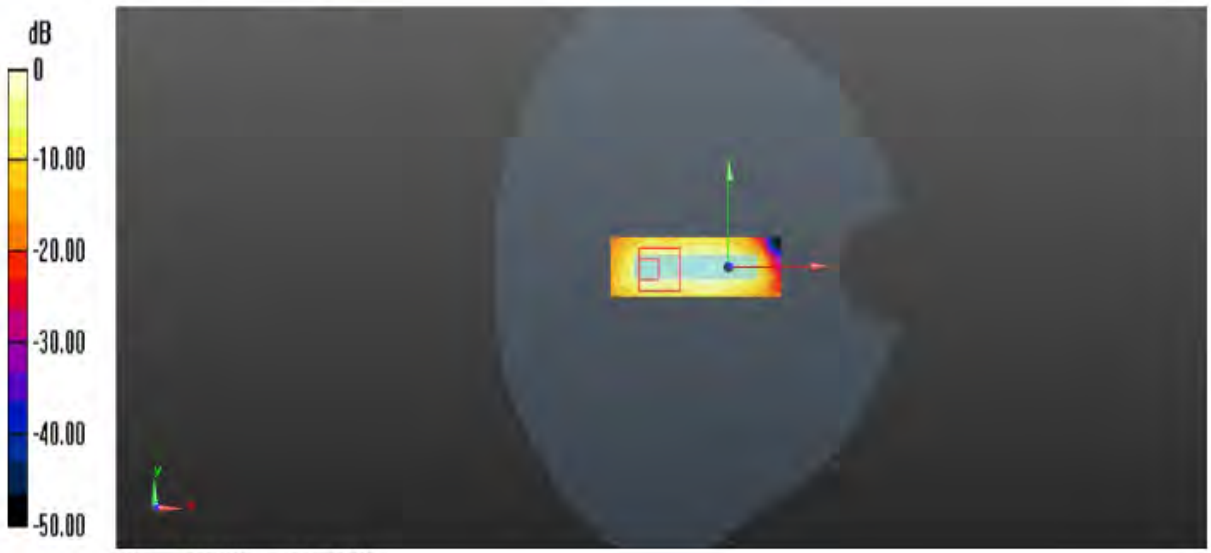
Communication System: UID 0, IEEE 802.11b WiFi 2.4GHz (DSSS,1Mbps) (0); Frequency: 2462 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.024 S/m; ε_r = 51.672; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3932; ConvF(7.34, 7.34, 7.34); Calibrated: 09/16/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1390; Calibrated: 09/10/2013
- Phantom: SAM 1; Type: SAM; Serial: 1784
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Test Position 4/DTQ112 802.11b CH11/Area Scan (10x4x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.138 W/kg

Test Position 4/DTQ112 802.11b CH11/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.285 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.266 W/kg
SAR(1 g) = 0.085 W/kg; SAR(10 g) = 0.028 W/kg
Maximum value of SAR (measured) = 0.152 W/kg



0 dB = 0.138 W/kg = -8.60 dBW/kg

4. Probe Calibration Certificate

EX3DV4

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 **Neutron Engineering (Auden)**

Certificate No: **EX3-3932_Sep13**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3932

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: September 16, 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	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Apr-14
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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 17, 2013

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

Certificate No: EX3-3932_Sep13 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, 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

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; 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.

Probe EX3DV4

SN:3932

Manufactured: July 24, 2013
Calibrated: September 16, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3932

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.52	0.55	0.46	± 10.1 %
DCP (mV)[B]	102.3	102.8	101.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	167.8	±3.0 %
		Y	0.0	0.0	1.0		179.9	
		Z	0.0	0.0	1.0		157.1	

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: EX3DV4 - SN:3932

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)
750	41.9	0.89	10.36	10.36	10.36	0.20	1.35	± 12.0 %
835	41.5	0.90	9.89	9.89	9.89	0.29	1.02	± 12.0 %
900	41.5	0.97	9.67	9.67	9.67	0.21	1.33	± 12.0 %
1750	40.1	1.37	8.47	8.47	8.47	0.33	0.89	± 12.0 %
1900	40.0	1.40	8.21	8.21	8.21	0.12	1.47	± 12.0 %
2100	39.8	1.49	8.31	8.31	8.31	0.80	0.50	± 12.0 %
2300	39.5	1.67	7.75	7.75	7.75	0.43	0.70	± 12.0 %
2450	39.2	1.80	7.40	7.40	7.40	0.36	0.81	± 12.0 %
2600	39.0	1.96	7.16	7.16	7.16	0.44	0.78	± 12.0 %

[F] 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: EX3DV4 - SN:3932

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)
750	55.5	0.96	9.92	9.92	9.92	0.21	1.47	± 12.0 %
835	55.2	0.97	9.92	9.92	9.92	0.30	1.12	± 12.0 %
900	55.0	1.05	9.67	9.67	9.67	0.51	0.79	± 12.0 %
1750	53.4	1.49	8.14	8.14	8.14	0.56	0.73	± 12.0 %
1900	53.3	1.52	7.80	7.80	7.80	0.42	0.80	± 12.0 %
2100	53.2	1.62	8.12	8.12	8.12	0.29	1.01	± 12.0 %
2300	52.9	1.81	7.57	7.57	7.57	0.59	0.68	± 12.0 %
2450	52.7	1.95	7.34	7.34	7.34	0.80	0.50	± 12.0 %
2600	52.5	2.16	7.08	7.08	7.08	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.69	4.69	4.69	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.48	4.48	4.48	0.45	1.90	± 13.1 %
5500	48.6	5.65	4.15	4.15	4.15	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.07	4.07	4.07	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.19	4.19	4.19	0.55	1.90	± 13.1 %

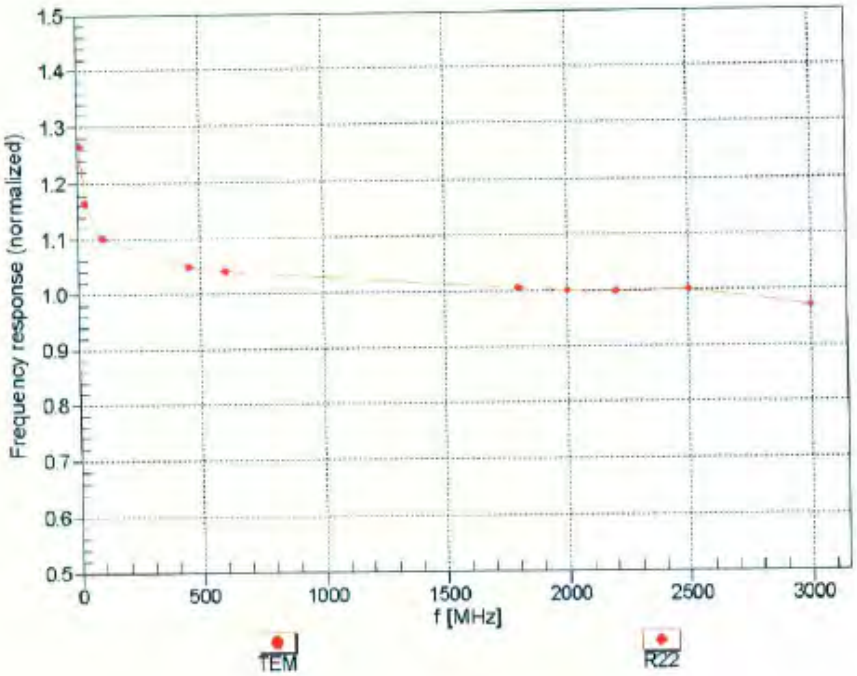
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of 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.

EX3DV4– SN:3932

September 16, 2013

Frequency Response of E-Field

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

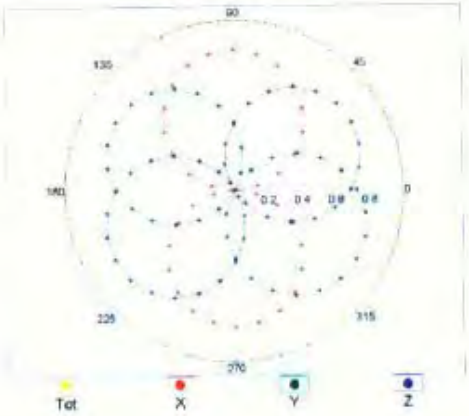


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

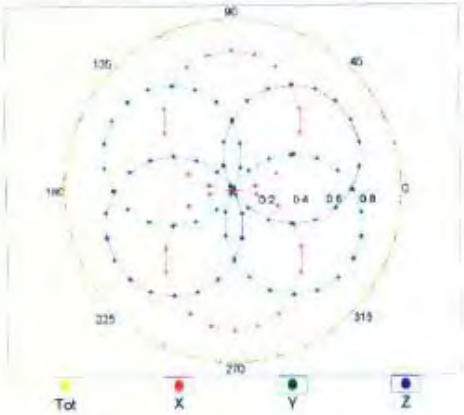
EX3DV4– SN:3932 September 16, 2013

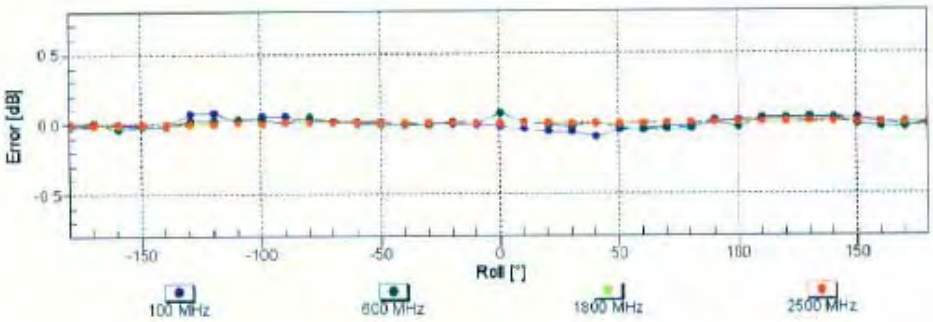
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22



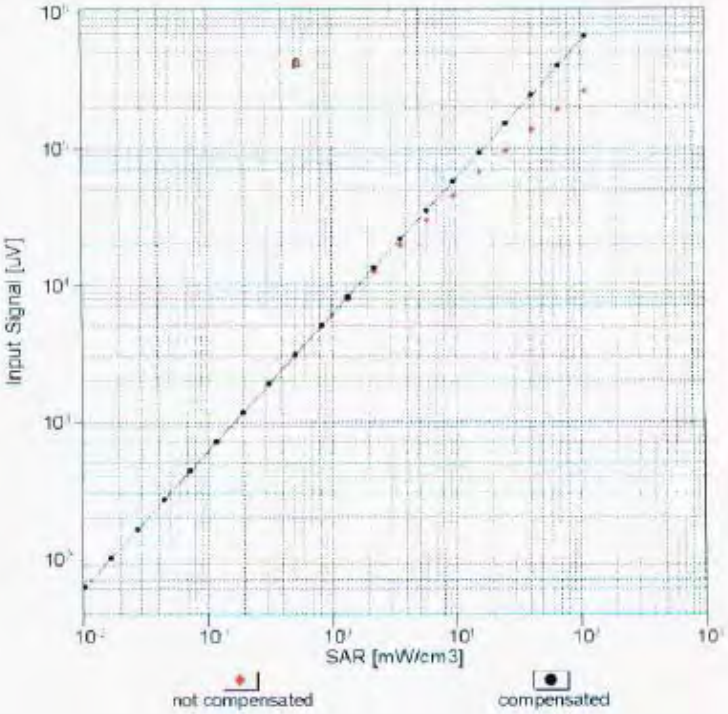


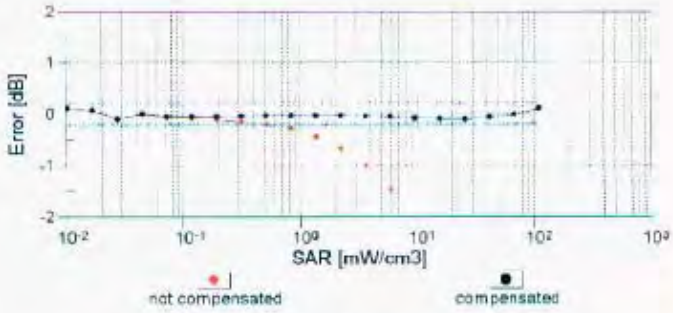
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: EX3-3932_Sep13 Page 8 of 11

EX3DV4– SN:3932 September 16, 2013

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





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

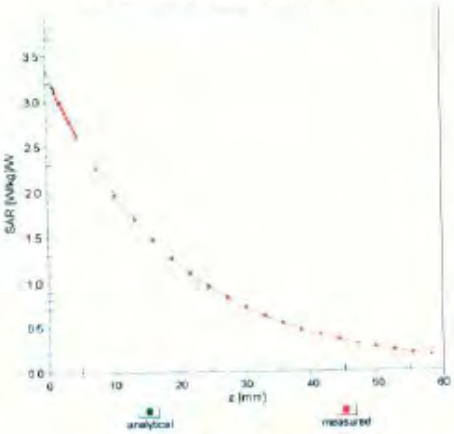
Certificate No: EX3-3932_Sep13 Page 9 of 11

EX3DV4– SN:3932

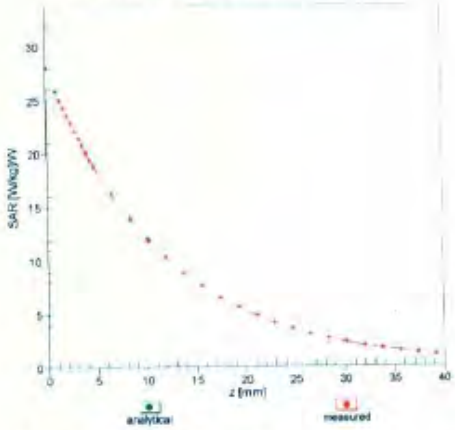
September 16, 2013

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

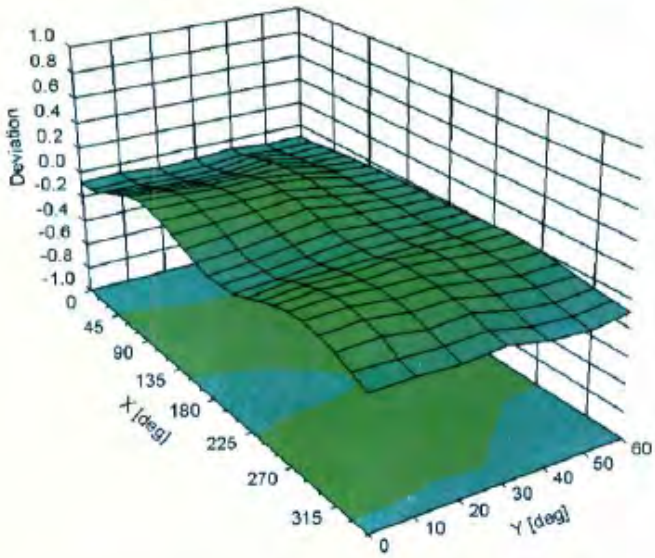


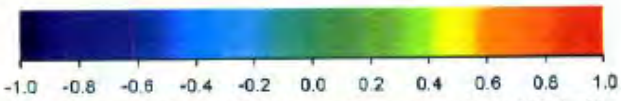
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

Certificate No: EX3-3932_Sep13 Page 10 of 11

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3932

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-109.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

5. (1) D2450V2 Dipole Calibration Certificate

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

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

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

Accreditation No.: SCS 108

Client **Neutron Engieneering (Auden)**

Certificate No: D2450V2-919_Sep13

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 919
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 10, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: September 10, 2013

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

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

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

Accreditation No.: **SCS 108**

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

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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	39.4 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.83 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.6 Ω + 1.2 jΩ
Return Loss	- 25.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.5 Ω + 2.8 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	December 19, 2012

DASY5 Validation Report for Head TSL

Date: 10.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 919

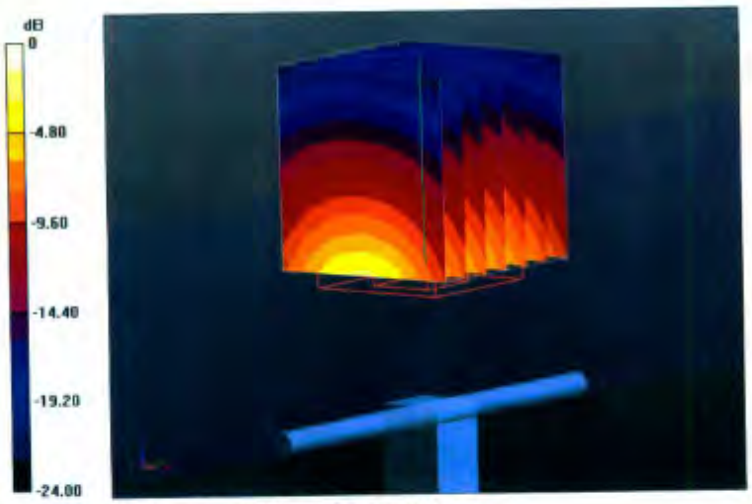
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

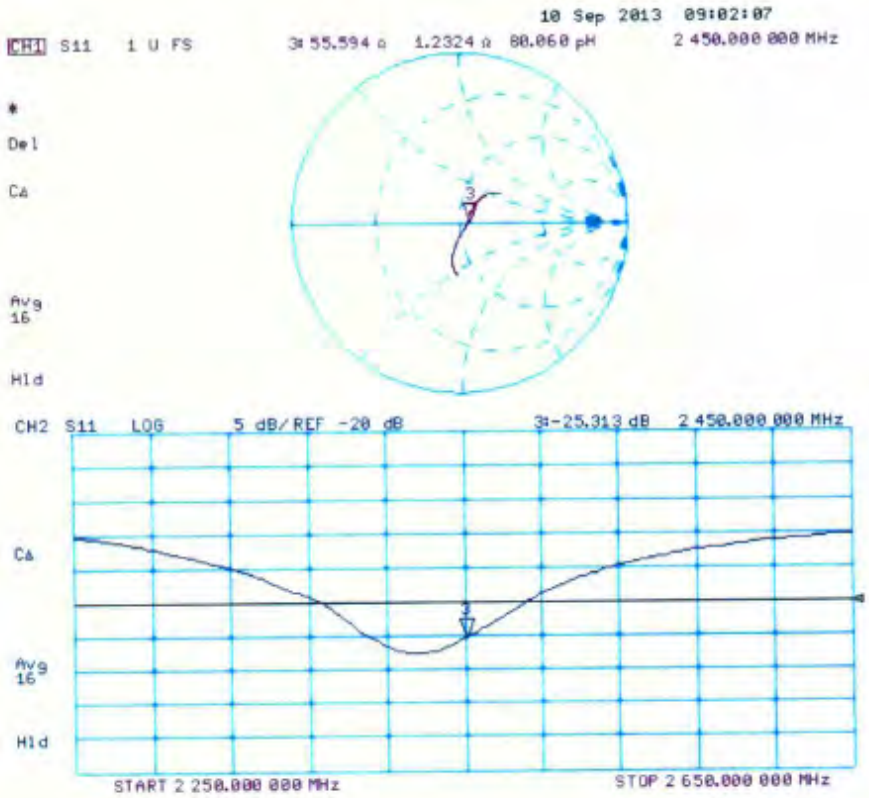
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.422 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.04 W/kg
Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 12.33 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 919

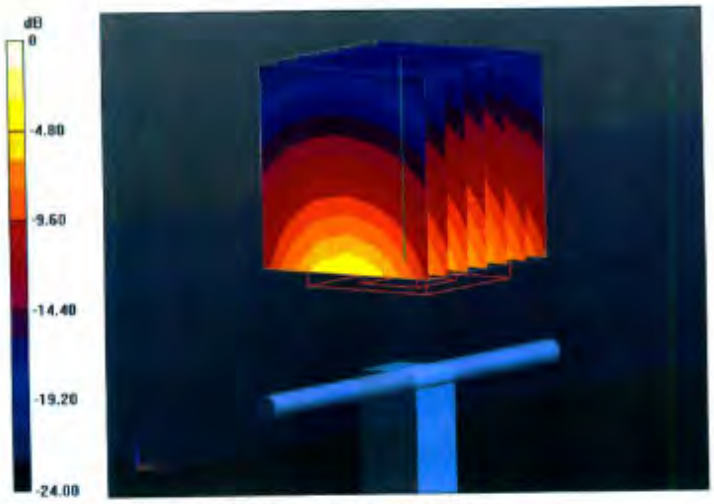
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

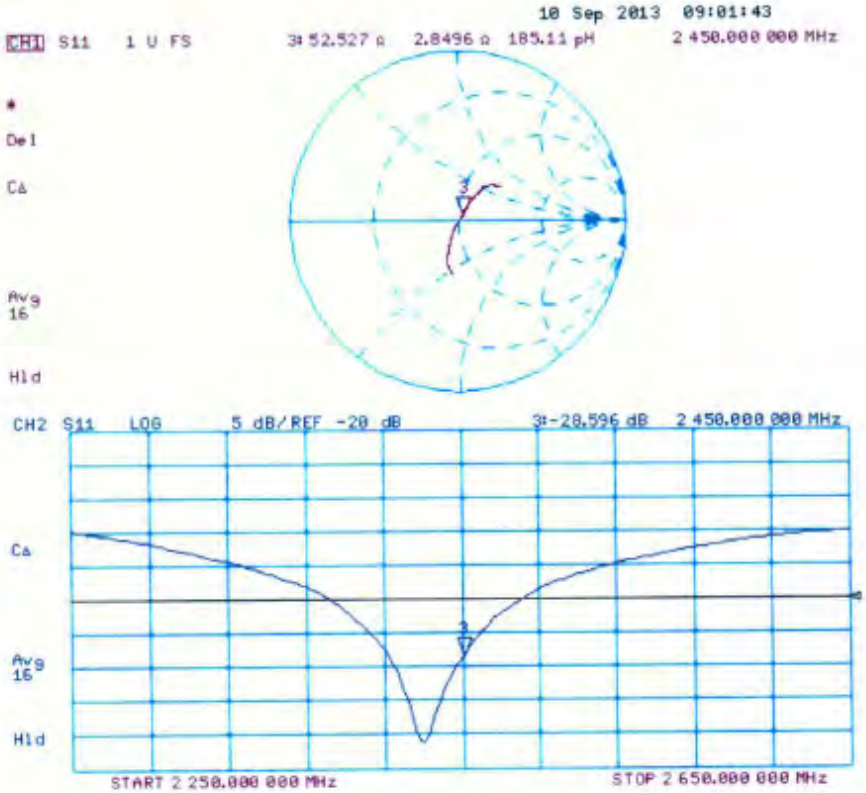
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.422 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.83 W/kg
Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 12.17 dBW/kg

Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-919_Sep13 Page 8 of 8

6. DAE4 Calibration Certificate

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

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

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

Accreditation No.: SCS 108

Client **Neutron Engineering (Auden)**

Certificate No: DAE4-1390_Sep13

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1390
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 10, 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	02-Oct-12 (No:12728)	Oct-13
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: September 10, 2013

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

Certificate No: DAE4-1390_Sep13 Page 1 of 5

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

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

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

Accreditation No.: SCS 108

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	403.648 ± 0.02% (k=2)	403.367 ± 0.02% (k=2)	404.248 ± 0.02% (k=2)
Low Range	3.96280 ± 1.50% (k=2)	3.98266 ± 1.50% (k=2)	3.98218 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	70.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199997.35	0.91	0.00
Channel X	+ Input	20001.49	1.47	0.01
Channel X	- Input	-20001.51	0.14	-0.00
Channel Y	+ Input	199996.87	0.53	0.00
Channel Y	+ Input	19998.65	-1.35	-0.01
Channel Y	- Input	-20003.75	-2.14	0.01
Channel Z	+ Input	199996.57	0.03	0.00
Channel Z	+ Input	19998.48	-1.49	-0.01
Channel Z	- Input	-20002.14	-0.43	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.37	0.14	0.01
Channel X	+ Input	200.69	0.09	0.04
Channel X	- Input	-198.98	0.26	-0.13
Channel Y	+ Input	2000.03	-0.21	-0.01
Channel Y	+ Input	199.35	-1.26	-0.63
Channel Y	- Input	-200.62	-1.31	0.66
Channel Z	+ Input	2000.23	0.08	0.00
Channel Z	+ Input	199.71	-0.80	-0.40
Channel Z	- Input	-200.19	-0.80	0.40

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	-3.16	-5.14
	- 200	6.37	4.63
Channel Y	200	15.87	15.47
	- 200	-18.18	-18.66
Channel Z	200	13.55	13.42
	- 200	-15.48	-15.78

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	-	1.53	-4.47
Channel Y	200	9.07	-	4.25
Channel Z	200	9.52	5.92	-

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	16203	14917
Channel Y	15819	16055
Channel Z	15731	15876

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.77	-1.57	0.21	0.34
Channel Y	-2.08	-2.71	-0.92	0.38
Channel Z	-1.18	-2.78	0.33	0.46

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. EUT Testing Position and antenna location

120mm
5mm
7mm
58mm
130000169
Do not tear off this label

8. Test Configuration

Test Position 1

Test Position 2

Test Position 3

Test Position 4