SAR Evaluation Report
for
FCC OET Bulletin 65 Supplement C

Report No.: 11-08-MAS-294-01

Client:	Qualcomm Atheros, Inc.
Product:	802.11n 1x1 PCIe Minicard transceiver
Model:	AR5B95
FCC ID:	PPD-AR5B95
Manufacturer/supplier:	Qualcomm Atheros, Inc.

Date test item received:	2011/08/24
Date test campaign completed:	2011/08/25
Date of issue:	2011/12/08

Test Result: ■ Compliance ☐ Not Compliance

Statement of Compliance:
The SAR values measured for the test sample are below the maximum recommended level of 1.6 W/kg averaged over any 1g tissue according to FCC OET Bulletin 65 Supplement C (Edition 01-01).

The test result only corresponds to the tested sample. It is not permitted to copy this report, in part or in full, without the permission of the test laboratory.

Total number of pages of this test report: 63 pages

Test Engineer	Checked by	Approved by
Perry Lin	James Cheng	Anson Chou

The testing described in this report has been carried out to the best of our knowledge and ability, and our responsibility is limited to the exercise of reasonable care. This certification is not intended to believe the sellers from their legal and/or contractual obligations.

Applicant Information

Client	:	Qualcomm Atheros, Inc.
Address	:	1700 Technology Drive, San Jose, CA 95110
Manufacturer	:	Qualcomm Atheros, Inc.
Address	:	1700 Technology Drive, San Jose, CA 95110
EUT	:	802.11n 1x1 PCIe Minicard transceiver
Trade name	:	Atheros
Model No.	:	AR5B95
Standard Applied	:	FCC OET 65 Supplement C (Edition 01-01, June 2001) IEEE Standard 1528-2003 KDB: 447498 (12/02/2008)
Laboratory	:	CERPASS TECHNOLOGY CORP. 2F-11, No.3 Yuan Qu St (Nankang Software Park), Taipei 11560 Taiwan, R.O.C.
Test Location	:	No.8, Lane 29, Wenming RD., LeShan Tsuen, GuiShan Shiang, Taoyuan County 33383, Taiwan, R.O.C.
Test Result	:	Maximum SAR Measurement IEEE 802.11b: 0.668 W/kg(1g)

The 802.11n 1x1 PCIe Minicard transceiver is in compliance with the FCC Report and Order 93-326 and Health Canada Safety Code 6, and the tests were performed according to the FCC OET65c for uncontrolled exposure.

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Executive Summary

The EUT is a 802.11n 1x1 PCIe Minicard transceiver operating in the 2.4GHz frequency ranges. This device contains wireless functions that are operational in IEEE 802.11b, IEEE 802.11g, IEEE 802.11n HT20 and IEEE 802.11n HT40 modes. The measurements were conducted by CERPASS and carried out with the dosimetric assessment system – DASY4.

The measurements were conducted according to FCC OET 65 Supplement C [Reference 5] for evaluating compliance with requirements of FCC Report and Order 96-326 [Reference 3].

The frequency range of the device:

IEEE 802.11b/g/n HT20		IEEE 802.11n HT40	
CH	**MHz**	**CH**	**MHz**
01	2412	03	2422
06	2437	06	2437
11	2462	09	2452

The screen display supports both portrait modes (left edge or right edge down) and one portrait mode (bottom edge down). As the display mode with the top edge down is not supported, no tests were performed with the top edge against the phantom.

This device have Bluetooth and WLAN function. These two functions will not operate at the same time.

The maximum output power of Bluetooth is 1mW. No SAR evaluation required since transmitter output power is below FCC threshold.

1 General Information

1.1 Description of Equipment Under Test

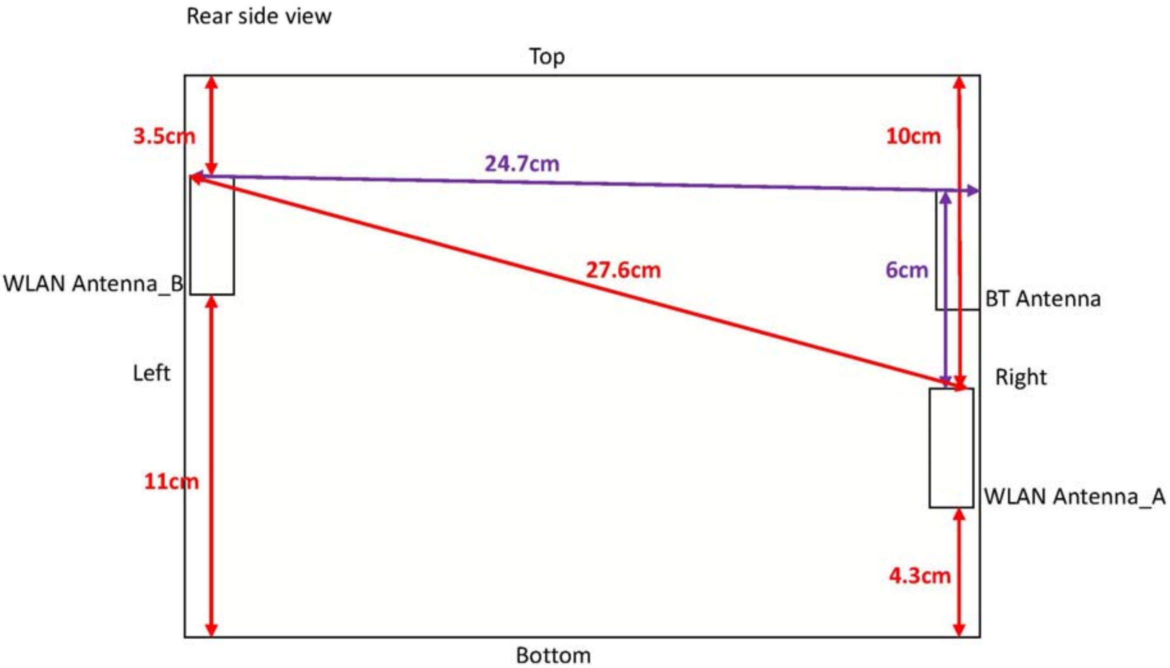
EUT Type	802.11n 1x1 PCIe Minicard transceiver
Trade Name	Atheros
Model Name	AR5B95
Hardware version	N/A
Software version	N/A
Tx Frequency	2412 ~ 2462 MHz
Rx Frequency	2412 ~ 2462 MHz
Antenna Type	Internal Type
Device Category	Portable Part
RF Exposure Environment	General Population / Uncontrolled
Crest Factor	1

The EUT use Antenna as below:

	Antenna	Manufacture	Model	Antenna Gain
Antenna A	TX	SANAV	GEPH-029	0.48
Antenna B	RX	SANAV	GEPH-023	1.84

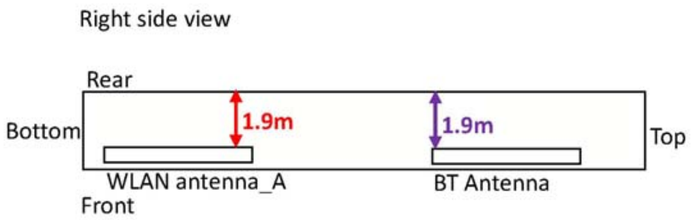
The worse-case for this EUT is based on highest antenna gain.

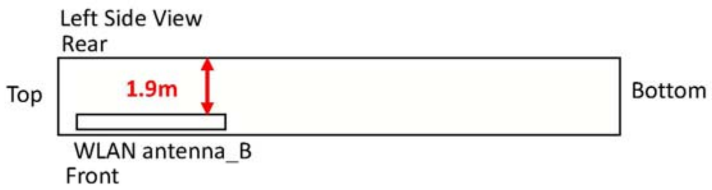
Antenna location:



The distance from WLAN antenna_A to EUT right side is 0.4cm

The distance from WLAN antenna_B to EUT left side is 0.55cm





1.2 Characteristics of Device

The EUT is a 2.4 GHz 802.11n 1x1 PCIe Minicard transceiver. It conforms to the IEEE 802.11b/g/n protocal and operates in the unlicensed ISM Band at 2.4 GHz.

RF chain	1T2R
Frequency Range	IEEE 802.11b/g, 802.11n HT20: 2412MHz~2462MHz IEEE 802.11n HT40: 2422MHz~2452MHz
Channel Spacing	IEEE 802.11b/g/n: 5MHz
Channel Number	IEEE 802.11b/g, 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7 Channels

1.3 Description of support units

No support unit for this device.

1.4 Environment Conditions

Item	Target	Measured
Ambient Temperature (°C)	18 ~ 25	22 ± 1
Temperature of Simulant (°C)	20 ~ 24	22 ± 1
Relative Humidity (% RH)	30 ~ 70	60 ~ 70

1.5 FCC Requirements for SAR Compliance Testing

According to the FCC order "Guidelines for Evaluating the Environmental Effects of RF Radiation", for consumer products, the SAR limit is **1.6 W/kg** for an uncontrolled environment and **8.0 W/kg** for an occupational/controlled environment. Pursuant to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on June 29, 2001 by FCC, the equipment under test should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for intended or normal operation, incorporating normal antenna operating positions, equipment undet test peak performance frequencies and positions for maximum RF power coupling.

1.5.1 RF Exposure Limits

	Whole-Body	Partial-Body	Arms and Legs
Population/Uncontrolled Environments (W/kg)	0.08	1.6	4.0
Occupational/Controlled Environments (W/kg)	0.4	8.0	20.0

Notes:

1. Population/Uncontrolled Environments: Locations where there is the exposure of individuals who have no sense or control of their exposure.
2. Occupational/Controlled Environments: Locations where there is exposure that may be incurred by people who have knowledge of the potential for exposure.
3. Whole-Body: SAR is averaged over the entire body.
4. Partial-Body: SAR is averaged over any 1g of tissue volume as defined in specification.
5. Arms and Legs: SAR is averaged over 10g of tissue volume as defined in specification.

1.6 The SAR Measurement Procudure

1.6.1 General Requirements

The test should be performance in a laboratory without influence on SAR measurements by ambient RF sources and any reflection from the environment inside. The ambient temperature should be kept in the range of 18°C to 25°C with a maximum variation within ± 2°C during the test.

1.6.2 Phantom Requirements

The phantoms used in test are simplified representations of the human head and body as a specific shaped container for the head or body simulating liquids. The physical characteristics of the phantom models should resemble the head and the body of a mobile user sice the shape is a dominant parameter for exposure. The shell of the phantom should be made of low loss and low permittivity material and the thickness tolerance should be less than 0.2 mm. In addition, the phantoms should provide simulations of both right and left hand operations.

1.6.3 Test Positions

Position	Description
A	The EUT contacted to the bottom of ELI4 phantom by the **rear site**. The separation distance is 0mm between the rear site of the EUT and the bottom of the ELI4 phantom.
B	The EUT contacted to the bottom of ELI4 phantom by the **buttom site**. The separation distance is 0mm between the bottom of the EUT and the bottom of the ELI4 phantom.
C	The EUT contacted to the bottom of ELI4 phantom by the **right site**. The separation distance is 0mm between the right site of the EUT and the bottom of the ELI4 phantom.
D	The EUT contacted to the bottom of ELI4 phantom by the **left site**. The separation distance is 0mm between the right site of the EUT and the bottom of the ELI4 phantom.

1.6.4 Test Procedures

The EUT uses the software to control the transmitter channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4 SAR measurement system manufactured and calibrated by SPEAG.

2 Description of the Test Equipment

The measurements were performed using an automated near-field scanning system, DASY4 software, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland. The SAR extrapolation algorithm used in all measurements on the test device was the 'worstcase extrapolation' algorithm.

2.1 Test Equipment List

Equipment	Manufacturer	Type	S/N	Calibration Expiry
Robot	Staubli	RX90B L	F03/5W16A1/A/01	(not necessary)
Robot Controller	Staubli	CS7MB	F03/5W16A1/C/01	(not necessary)
Teach Pendant	Staubli	------------	D221340061	(not necessary)
DAE4	Schmid & Partner Engineering AG	------------	629	2011-09-16
E-field Probe	Schmid & Partner Engineering AG	EX3DV4	3555	2011-09-21
Dipole Validation Kit	Schmid & Partner Engineering AG	D2450V2	764	2012-09-21
Thermo-Hygro.meter	TFA	------------	------------	2012-06-20
Directional Coupler	Amplifier Research	DC7420	310569	2012-09-01
DASY4 Software	Schmid & Partner Engineering AG	------------	Version 4.6B23	To automatically control the robot and perform the SAR measurement
SEMCAD Software	Schmid & Partner Engineering AG	------------	Version 1.8B160	Post-processing and report management
Signal Generator	Agilent	83640B	3844A01143	2011-10-04
Amplifier	Mini-Circuits	ZHL-42W	D111704-01-02	2012-09-05
Power Meter	BOONTON	4532-0102	136601	2012-06-19
Power Sensor	BOONTON	51011-EMC	32861	2012-06-19
S-Parameter Network Analyzer	Agilent	8753ES	MY40001340	2011-12-08
Calibration Kit	Agilent	85033C	2920A03287	(not necessary)
Dielectric Probe Kit	Agilent	85070E	MY44300101	(not necessary)

2.2 DASY4 Measurement System Diagram

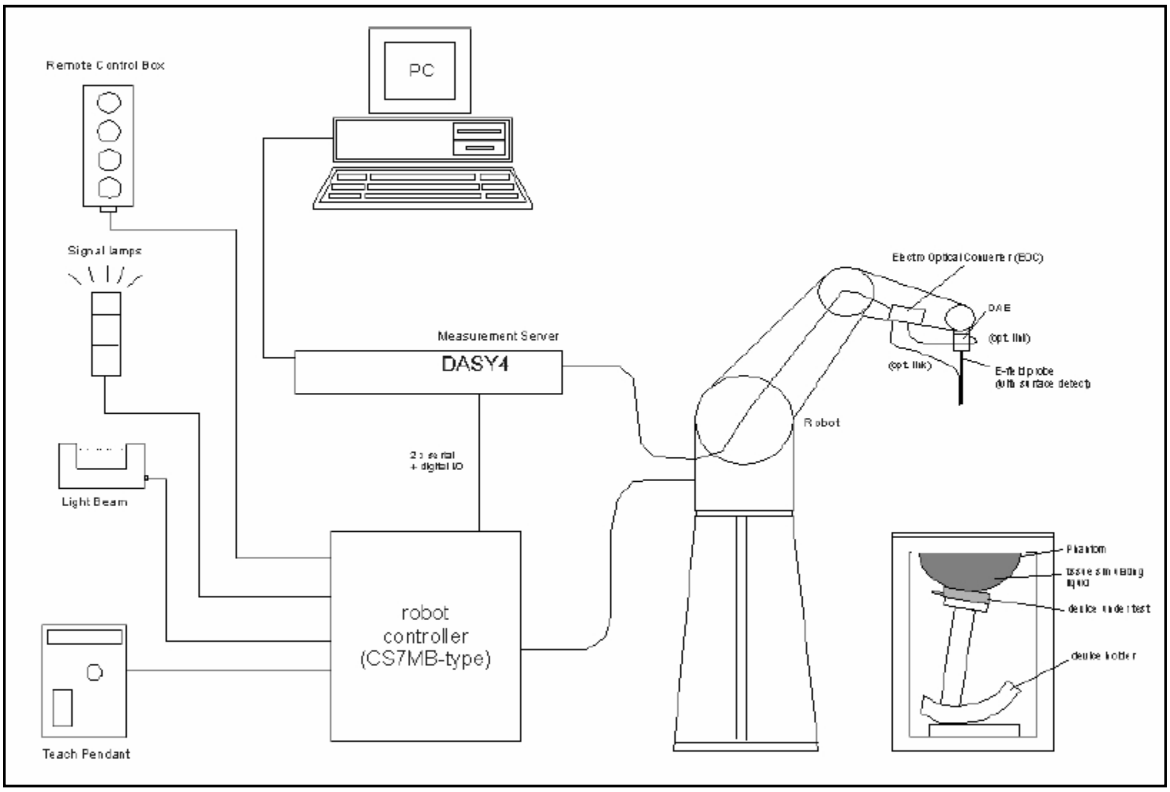


Fig. 1 The DASY4 Measurement System

Fig. 2 The DASY4 System Photo

The DASY4 system consists of the following items:

- A fixed-on-ground high precision 6-axis robot with controller and software and an arm extension for moving the Data Acquisition Electronics (DAE) and Probe.
- A dosimetric probe, an isotropic E-field probe optimized and calibrated for usage in head or body tissue simulating liquids. Some of the probes are equipped with an optical surface detector system.
- A Data Acquisition Electronic (DAE) performing the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. DAE is 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 Electro-Optical Coupler (EOC).
- The EOC performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY4 measurement server.
- The DASY4 measurement server performing all real-time data evaluation for field measurements and surface detection, controling robot movements and handling safety operation. A computer with operating Windows 2000 is used for server.
- DASY4 software and SEMCAD data evaluation software are installed in PC.
- 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 well according to the given recipes.
- System validation dipoles is used to validate the proper functioning of the system

2.3 DASY4 Measurement Server

Fig. 3 DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power pentium, 32MB chipdisk and 64MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server.

2.4 DAE (Data Acquisition Electronics)

Fig. 4 DAE Photo

Some probes are equipped with an optical multifiber line, ending at the front of the probe tip. This line is connected to the EOC box on the robot arm and provides automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. If the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases during the approach, reaches a maximum and then decreases. If the probe perpendicularly touches the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2^{nd} order fitting. The approach is stopped upon reaching the maximum.

The optical surface detection works in transparent liquids and on di_use reflecting surfaces with a repeatability of better than ±0.1mm. The distance of the maximum depends on the fiber and the surrounding media. It is typically 1.0mm to 2.0mm in tissue simulating mixtures. The distance can be measured with the surface check job (described in the reference guide).

2.5 Phantom

SAM Twin Phantom V4.0:

The phantom used for all tests i.e. for both system performance checking and device testing, was the twinheaded "SAM Twin Phantom V4.0", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 - 2003.

SAM Phantom ELI4:

Phantom for compliance testing of handheld and body mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid.

Fig. 5 SAM Twin Phantom and ELI4 Phantom

2.6 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integrated part of the Dasy system.

Fig. 6 Device holder supplied by SPEAG

2.7 Specifications of Probes

The E-Field Probes ET3DV6 or EX3DV4, manufactured and calibrated annually by Schmid & Partner Engineering AG with following specification are used for the dosimetric measurements.

ET3DV6:

- Dynamic range: 5 μ W/g ~ 100 mW/g
- Tip diameter: 6.8 mm
- Probe linearity: ± 0.2 dB (30MHz to 3 GHz)
- Axial isotropy: ± 0.2 dB
- Spherical isotropy: ± 0.4 dB
- Distance from probe tip to dipole centers: 2.7 mm
- Calibration range: 900MHz/1750MHz/1900MHz/ /2450MHz for head and body simulating liquids.

EX3DV4:

- Dynamic range: 10 μ W/g ~ 100 mW/g
- Tip diameter: 2.5 mm
- Probe linearity: ± 0.2 dB (30MHz to 3 GHz)
- Axial isotropy: ± 0.2 dB
- Spherical isotropy: ± 0.4 dB
- Distance from probe tip to dipole centers: 1.0 mm
- Calibration range: 900MHz/1810MHz for head simulating liquid and

2.8 SAR Measurement Procedures in DASY4

Step 1 Setup a Call Connection

Establish a call in handset at the maximum power level with a base station simulator via air interface.

Step 2 Power Reference Measurement

To measure the local E-field value at a fixed location which value will be taken as a reference value for calculating a possible power drift.

Step 3 Area Scan

To measure the SAR distribution with a grid with spacing of 15 mm x 15 mm and kept with a constant distance to the inner surface of the phantom. Additional all peaks within 3 dB of the maximum SAR are searched.

Step 4 Zoom Scan

At these points (maximum number of SAR peaks is two), a cube of 32 mm x 32 mm x 30 mm is applied to and measured with 5 x 5 x 7 points. With these measured data, a peak spatial-average SAR value can be calculated by SEMCAD software.

Step 5 Power Drift Measurement

Repetition of the E-field measurement at the fixed location mentioned in Step 1 to make sure the two results differ by less than ± 0.2 dB.

2.9 Simulating Liquids

Liquid Recipes for this test report are as following:

BSL 2450MHz band (Body)

Ingredient	% by weight
Water	68.12
DGBE	31.72
Salt	0.16

2.10 System Performance Check

2.10.1 Purpose

1. To verify the simulating liquids are valid for testing.
2. To verify the performance of testing system is valid for testing.

2.10.2 System Performance Check Procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and the system performance check. They are read-only document files and destined as fully defined but unmeasured masks, so the finished system performance check must be saved under a different name. The system performance check document requires the SAM Twin Phantom, so this phantom must be properly installed in your system. (User defined measurement procedures can be created by opening a new document or editing an existing document file). Before you start the system performance check, you need only to tell the system with which components (probe, medium, and device) you are performing the system performance check; the system will take care of all parameters.

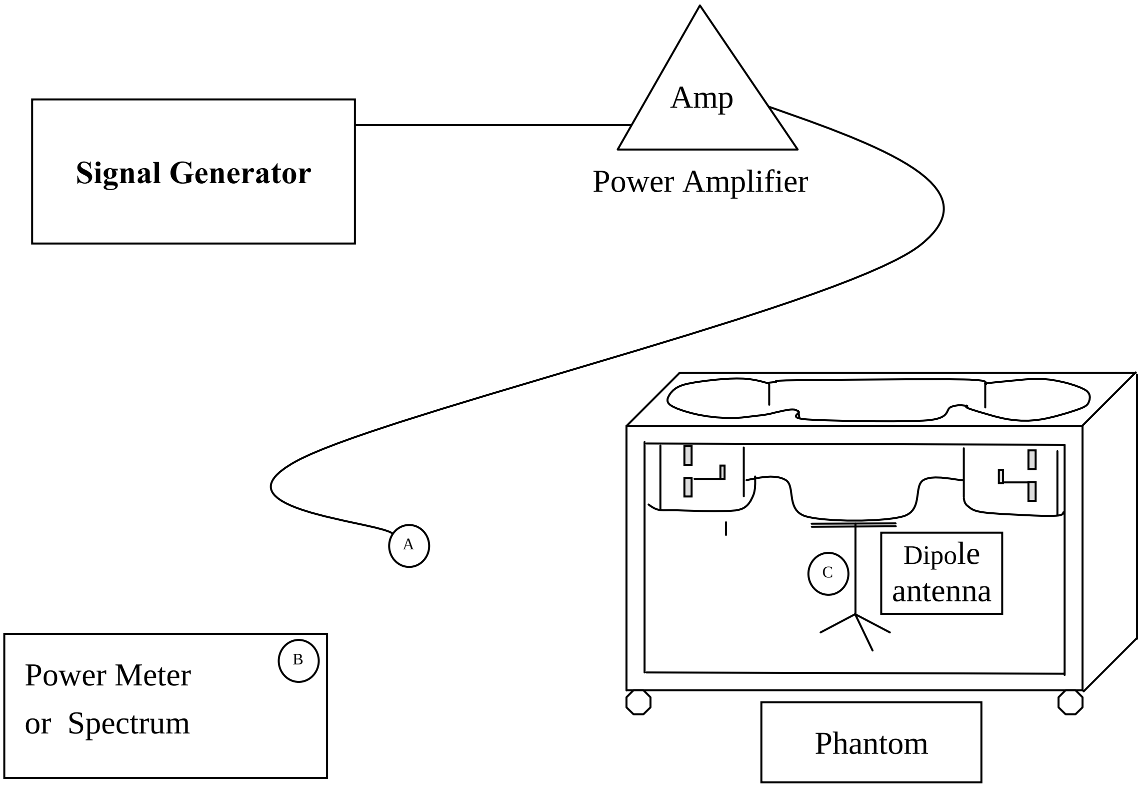
• **The Power Reference Measurement and Power Drift Measurement** jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ±0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ±0.02 dB.

• **The Surface Check** job tests the optical surface detection system of the DASY 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). In that case it is better to abort the system performance check and stir the liquid.

• **The Area Scan** job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. Schmid & Partner Engineering AG, DASY4 Manual, February 2005 16-2 System Performance Check Application Notes If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.

• **The Zoom Scan** job measures the field in a volume around the peak SAR value assessed in the previous Area Scan job (for more information see the application note on SAR evaluation). If the system performance check gives reasonable results, the SAR peak, 1 g and 10 g spatial average SAR values normalized to 1W dipole input power give reference data for comparisons. The next sections analyze the expected uncertainties of these values, as well as additional checks for further information or troubleshooting.

2.10.3 System Performance Check Setup



Note：

1. A connected to B is used to make sure whether the input power is 250mW for target frequency..
2. A connected to C is used to input the measured power to dipole antenna

2.10.4 Result of System Performance Check: Valid Result

2450MHz band - Diepole Antenna: D2450V2 (S/N: 764)

Date of Measurement And Reference Value	SAR@1g [W/kg]	Dielectric Parameters		Temperature [℃]
		ε r	σ [S/m]	
Body 2450MHz Recommended Value	12.9±10% [11.61 ~14.19]	52.5 ±5% [49.875 ~ 55.125]	1.95 ± 5% [1.8525 ~ 2.0475]	22.0 ± 2 [20 ~ 24]
2011-08-25	12.9	50.8	1.98	22.5

3 Results

3.1 Summary of Test Results

No deviations from the technical specification(s) were ascertained in the course of the tests performed.	■
The deviations as specified in this chapter were ascertained in the course of the tests Performed.	□

3.2 Check the conducted output average power of worst mode

Band	Mode	Frequency (MHz)	Channel	Data Rate (Mbps)	Conducted Power (dBm) Peak	Conducted Power (dBm) Avg	Note
2.4GHz	IEEE 802.11b	2437	6	1	19.57	17.34	Worst
		2437	6	2	19.51	17.30	
		2437	6	5.5	19.47	17.31	
		2437	6	11	19.48	17.25	
	IEEE 802.11g	2437	6	6	24.55	16.08	
		2437	6	9	24.50	16.05	
		2437	6	12	24.52	16.06	
		2437	6	18	24.46	16.04	
		2437	6	24	24.45	16.02	
		2437	6	36	24.42	15.98	
		2437	6	48	24.41	15.96	
		2437	6	54	24.41	15.95	
	IEEE 802.11gn20	2437	6	MCS0	23.46	15.46	
		2437	6	MCS1	23.42	15.43	
		2437	6	MCS2	23.44	15.42	
		2437	6	MCS3	23.41	15.39	
		2437	6	MCS4	23.38	15.38	
		2437	6	MCS5	23.36	15.36	
		2437	6	MCS6	23.32	15.31	
		2437	6	MCS7	23.32	15.29	
	IEEE 802.11gn40	2437	6	MCS0	19.70	11.85	
		2437	6	MCS1	19.65	11.81	
		2437	6	MCS2	19.62	11.77	
		2437	6	MCS3	19.57	11.73	
		2437	6	MCS4	19.57	11.72	
		2437	6	MCS5	19.53	11.67	
		2437	6	MCS6	19.51	11.62	
		2437	6	MCS7	19.48	11.58	

NOTE:

1. The lowest data rate is the worse case of all data rates for full testing.

2.The SAR test will utilize KDB-248227:SAR is not required for 802.11g/n20/n40 channels When the maximum average output power is less 1/4 dB higher than that measured on corresponding 802.11b channels

Band	Mode	Frequency (MHz)	Channel	Data Rate (Mbps)	Conducted Power (dBm)		Note
					Peak	Avg	
2.4GHz	IEEE 802.11b	2412	1	1	19.74	17.01	
		2437	6	1	19.57	17.34	Worst
		2462	11	1	19.49	17.30	
	IEEE 802.11g	2412	1	6	24.75	16.28	
		2437	6	6	24.55	16.08	
		2462	11	6	23.59	16.30	
	IEEE 802.11gn20	2412	1	MCS0	23.59	15.50	
		2437	6	MCS0	23.46	15.46	
		2462	11	MCS0	23.21	15.03	
	IEEE 802.11gn40	2422	3	MCS0	19.48	12.05	
		2437	6	MCS0	19.70	11.85	
		2452	9	MCS0	19.68	12.02	

NOTE:

1. The lowest data rate is the worse case of all data rates for full testing.

2.The SAR test will utilize KDB-248227:SAR is not required for 802.11g/n20/n40 channels When the maximum average output power is less 1/4 dB higher than that measured on corresponding 802.11b channels

3.3 Check the position for worst result

Mode	Frequency CH	Frequency MHz	Position	SAR@1g [W/kg]	Power Drift (dB)	Note
IEEE 802.11b	6	2437	A	0.011	0.094	
IEEE 802.11b	6	2437	B	0.029	0.107	
IEEE 802.11b	6	2437	C	0.668	0.154	Worst
IEEE 802.11b	6	2437	D	0.00103	0.152	

The Max Body SAR@2450MHz@1g was 0.668 W/kg, less than limitation of 1.6W/kg

4 The Description of Test Procedure for FCC

4.1 Scan Procedure

First coarse scans were used for determination of the field distribution. Next a cube scan, 5x5x7 points covering a volume of 32x32x30mm was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the coarse scan and again at the end of the cube scan.

4.2 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation. The interpolation, extrapolation and maximum search routines within Dasy4 are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation Of Lagre Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the cube scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics. In the cube scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

4.3 Data Storage

The DASY4 software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the 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 postprocessing 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 erroneous parameter settings.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m] or [W/kg]). Some of these units are not available in certain situations or give 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 Data Evaluation

The DASY4 postprocessing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

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

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY 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	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:

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

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

with V_i = compensated signal of channel i (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
$\mu V/(V/m)^2$ for E-field Probes
$ConvF$ = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

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

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

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

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5 Measurement Uncertainty

Error Description	Unc. value ±%	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	Std. Unc. ±% (1g)	Std. Unc. ±% (10g)	v_i (v_{eff})
Measurement System								
Probe Calibration	±6.6	N	1	1	1	±6.6	±6.6	∞
Axial Isotropy	±0.3	R	$\sqrt{3}$	0.7	0.7	±0.1	±0.1	∞
Hemispherical Isotropy	±1.3	R	$\sqrt{3}$	0.7	0.7	±0.5	±0.5	∞
Boundary Effects	±0.5	R	$\sqrt{3}$	1	1	±0.3	±0.3	∞
Linearity	±0.3	R	$\sqrt{3}$	1	1	±0.2	±0.2	∞
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	±3.0	R	$\sqrt{3}$	1	1	±1.7	±1,7	∞
Probe Positioner	±0.4	R	$\sqrt{3}$	1	1	±0.2	±0.2	∞
Probe Positioning	±2.9	R	$\sqrt{3}$	1	1	±1.7	±1.7	∞
Max. SAR Evaluation	±1.0	R	$\sqrt{3}$	1	1	±0.6	±0.6	∞
Test Sample Related								
Test Sample Positioning	±2.9	N	1	1	1	±2.9	±2.9	145
Device Holder Uncertainty	±3.6	N	1	1	1	±3.6	±3.6	5
SAR Drift Measurement	±5.0	R	$\sqrt{3}$	1	1	±2.9	±2.9	∞
Phantom and Setup								
Phantom Uncertainty	±4.0	R	$\sqrt{3}$	1	1	±2.3	±2.3	∞
Liquid Conductivity(target)	±5.0	R	$\sqrt{3}$	0.64	0.43	±1.8	±1.2	∞
Liquid Conductivity(meas.)	±2.5	N	1	0.64	0.43	±1.6	±1.1	∞
Liquid Permittivity(target)	±5.0	R	$\sqrt{3}$	0.6	0.49	±1.7	±1.4	∞
Liquid Permittivity(meas.)	±2.5	N	1	0.6	0.49	±1.5	±1.2	∞
Combined Std. Uncertainty						±10.0	±9.7	330
Expanded STD Uncertainty (k=2)						±19.9	±19.4	

6 References

1. [ANSI/IEEE C95.1-1992]

Safety Levels with Respect to Human Exposure to Radio Frrequency Electromagnetic Fields, 3 kHz to 300 GHz. The Institute of Electrical and Electronics Engineers, Inc. (IEEE), 1992.

2. [ANSI/IEEE C95.3-1992]

Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave". The Institute of Electrical and Electronics Engineers, Inc. (IEEE), 1992.

3. [FCC Report and Order 96-326]

Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, 1996.

4. [FCC OET Bulletin 65]

Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. OET Bulletin 65 Edition 97-01, August 1997. Federal Communications Commission (FCC), Office of Engineering & Technology. (OET)

5. [FCC OET Bulletin 65 Supplement C]

Additional Information for Evaluating Compliance of Mobile and Portable Device with FCC Limits for Human Exposure to Radiofrequency Emissions. Supplement C (Edition 01-01) to OET Bulletin 65, June 2001. Federal Communications Commission (FCC), Office of Engineering & Technology. (OET)

6. [DASY 4]

Schmid & Partner Engineering AG: DASY 4 Manual, September 2005.

7. [IEEE 1528-2003]

IEEE Std 1528-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wirless Communications Devices: Measurement Techniques. 1528-2003, 19th December, 2003, The Institute of Electrical and Electronics Engineers, Inc. (IEEE).

8. [RSS-102, Issue 2]

Radio Standards Specification 102, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) sets out the requirements and measurement techniques used to evaluate radio frequency (RF) exposure compliance of radiocommunication apparatus designed to be used within the vicinity of the human body. November, 2005. Industry Canada.

9. [Health Canada Safety Code 6]

Canada's Safety Code 6: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz (99-EHD-237)

7 Annex：Test Results of DASY4 (Refer to ANNEX)

ANNEX

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ANNEX A: SAR RESULTS

System Performance Check

Body

Date/Time: 8/25/2011 8:29:32 AM

Test Laboratory: Electronics Testing Center, Taiwan

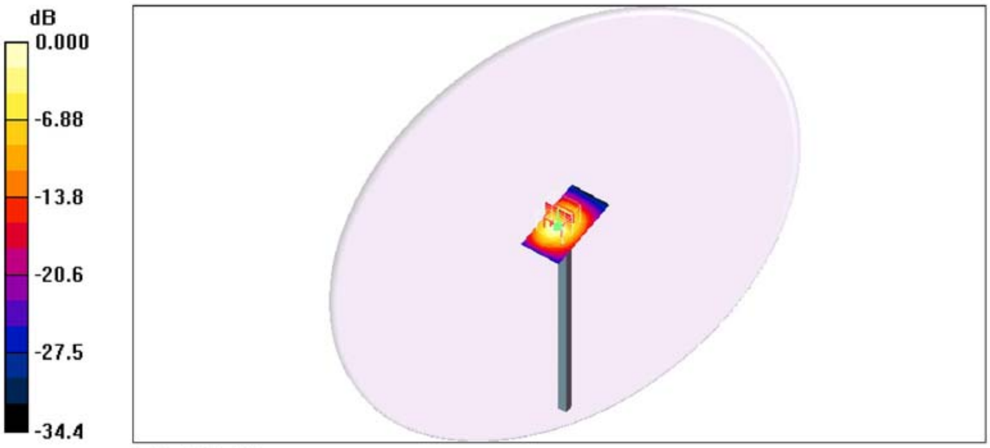
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:764

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Air temperature: 22degC; Liquid temperature: 22.5degC;
Phantom section: Flat Section

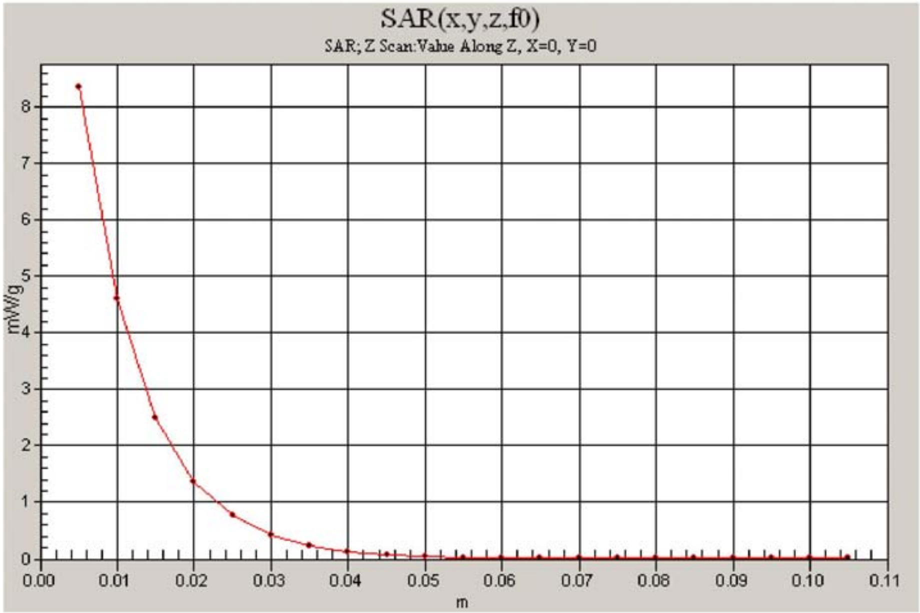
DASY4 Configuration:
- Probe: EX3DV4 - SN3555; ConvF(6.46, 6.46, 6.46); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/21/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1055
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SPC 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 77.8 V/m; Power Drift = 0.025 dB
Peak SAR (extrapolated) = 26.0 W/kg
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6.02 mW/g
Maximum value of SAR (measured) = 14.7 mW/g

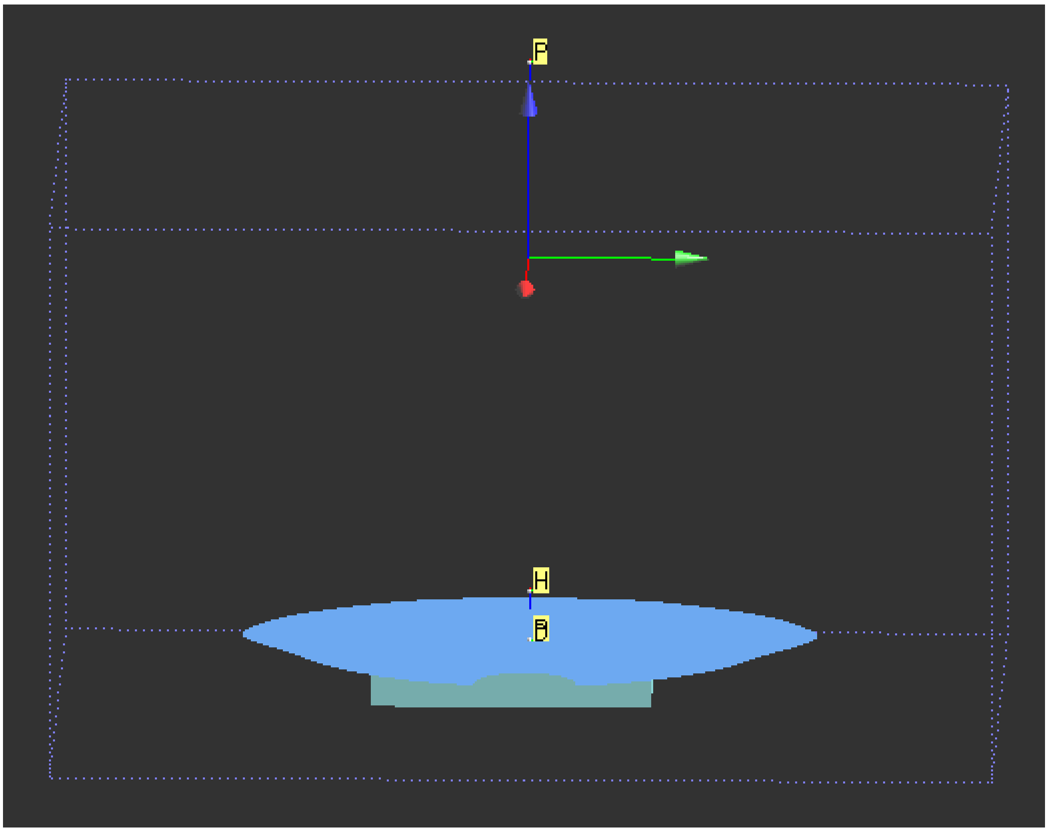
SPC 2/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.7 mW/g



0 dB = 16.7mW/g


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
m
0
1
2
3
4
5
6
7
8
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11

Body



Date/Time: 8/25/2011 10:06:22 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: Tablet; Type: Not Specified; Serial: N/A

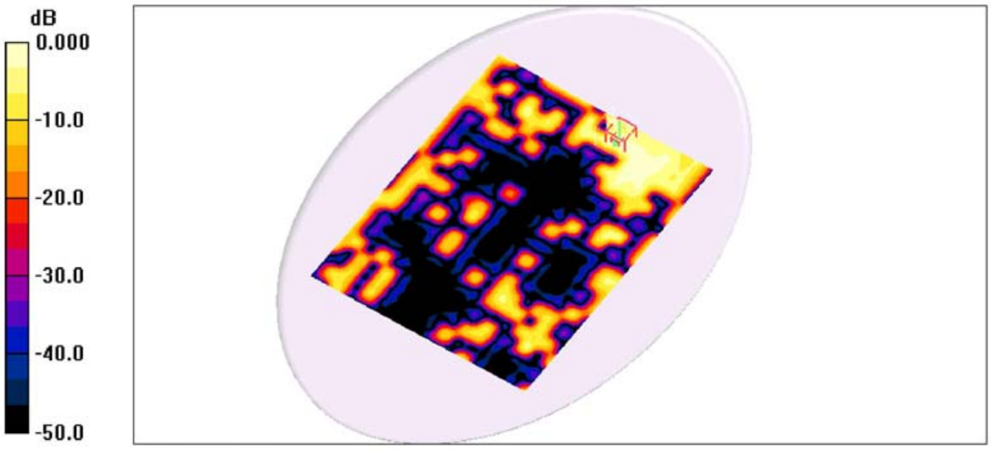
Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.92 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Air temperature: 22degC; Liquid temperature: 22.5degC;
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3555; ConvF(6.34, 6.34, 6.34); Calibrated: 9/22/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/17/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1055
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11B_CH06_A Side/Area Scan (171x221x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.018 mW/g

802.11B_CH06_A Side/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.568 V/m; Power Drift = 0.094 dB
Peak SAR (extrapolated) = 0.028 W/kg
SAR(1 g) = 0.011 mW/g; SAR(10 g) = 0.00626 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.012 mW/g



0 dB = 0.018mW/g

Date/Time: 8/25/2011 9:16:12 AM

Test Laboratory: Electronics Testing Center, Taiwan

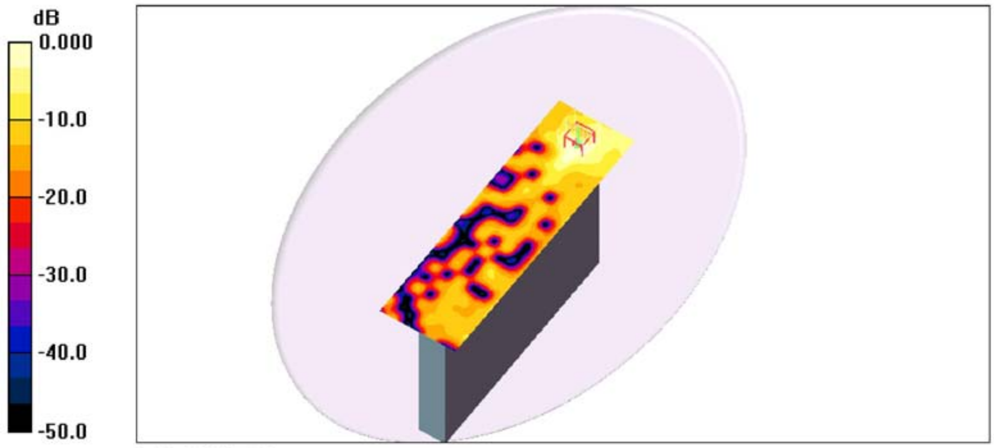
DUT: Tablet; Type: Not Specified; Serial: N/A

Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.92 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Air temperature: 22degC; Liquid temperature: 22.5degC;
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3555; ConvF(6.34, 6.34, 6.34); Calibrated: 9/22/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/17/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1055
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11B_CH06_B Side/Area Scan (61x211x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.029 mW/g

802.11B_CH06_B Side/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.71 V/m; Power Drift = 0.107 dB
Peak SAR (extrapolated) = 0.070 W/kg
SAR(1 g) = 0.029 mW/g; SAR(10 g) = 0.014 mW/g
Maximum value of SAR (measured) = 0.034 mW/g



0 dB = 0.029mW/g

Date/Time: 8/25/2011 9:40:20 AM

Test Laboratory: Electronics Testing Center, Taiwan

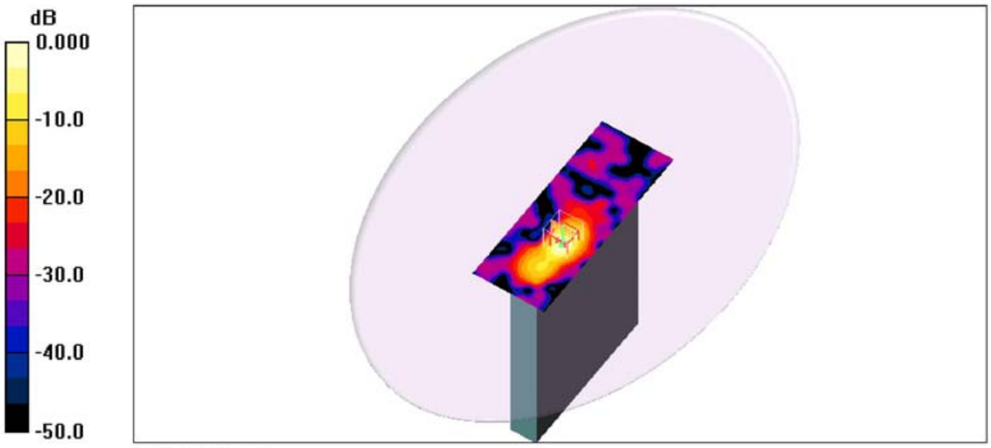
DUT: Tablet; Type: Not Specified; Serial: N/A

Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.92 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Air temperature: 22degC; Liquid temperature: 22.5degC;
Phantom section: Flat Section

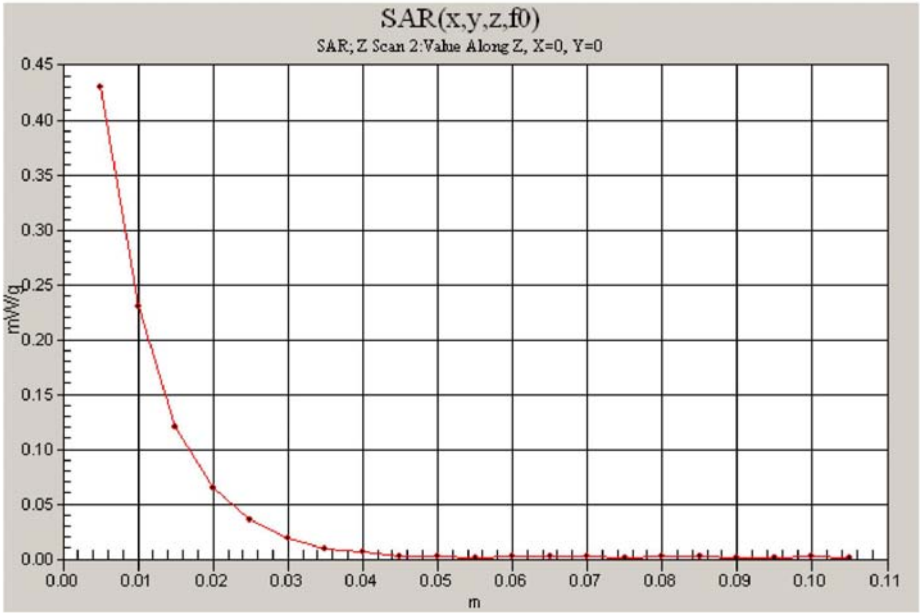
DASY4 Configuration:
- Probe: EX3DV4 - SN3555; ConvF(6.34, 6.34, 6.34); Calibrated: 9/22/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/17/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1055
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11B_CH06_C Side/Area Scan (61x161x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.848 mW/g

802.11B_CH06_C Side/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.83 V/m; Power Drift = 0.154 dB
Peak SAR (extrapolated) = 1.48 W/kg
SAR(1 g) = 0.667 mW/g; SAR(10 g) = 0.273 mW/g
Maximum value of SAR (measured) = 0.799 mW/g



0 dB = 0.848mW/g


SAR(x,y,z,f0)
SAR; Z Scan 2:Value Along Z, X=0, Y=0
mW/g
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
m

Date/Time: 8/25/2011 1:16:09 PM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: Tablet PC; Type: Not Specified; Serial: N/A

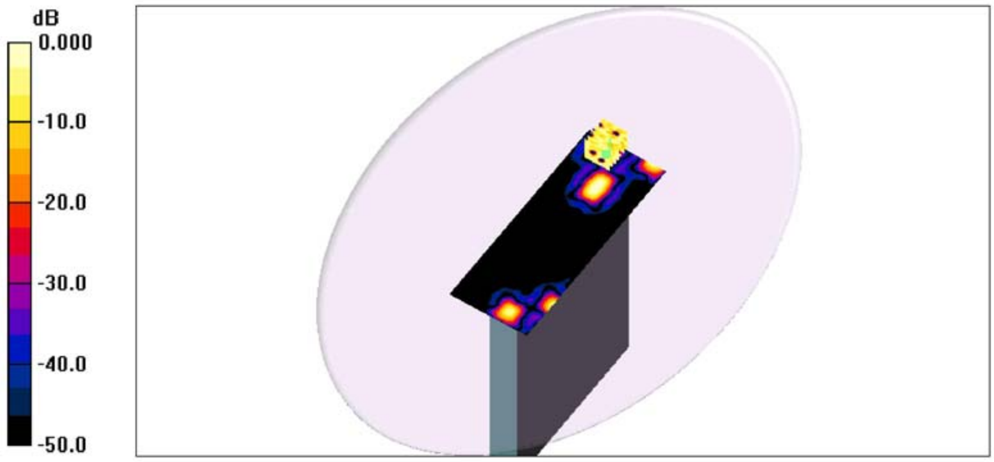
Communication System: IEEE 802.11b/g/n; Frequency: 2442 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2442 MHz; σ = 1.97 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Air temperature:22 degC; Liquid temperature:22.5 degC;
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3555; ConvF(6.34, 6.34, 6.34); Calibrated: 9/22/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/17/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1055
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11B_CH06_D Side/Area Scan (61x161x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.005 mW/g

802.11B_CH06_D Side/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.16 V/m; Power Drift = 0.152 dB
Peak SAR (extrapolated) = 0.006 W/kg
SAR(1 g) = 0.00103 mW/g; SAR(10 g) = 0.000377 mW/g

Maximum value of SAR (measured) = 0.004 mW/g



0 dB = 0.005mW/g

ANNEX B: DIPOLE 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 **ETC (Auden)**

Certificate No: **D2450V2-764_Sep10**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 764
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	September 21, 2010

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	06-Oct-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 22, 2010

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

Certificate No: D2450V2-764_Sep10 Page 1 of 9

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
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	39.0 ± 6 %	1.74 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR normalized	normalized to 1W	52.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**52.8 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.09 mW / g
SAR normalized	normalized to 1W	24.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 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	52.5 ± 6 %	1.95 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 mW / g
SAR normalized	normalized to 1W	51.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.5 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.00 mW / g
SAR normalized	normalized to 1W	24.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 1.5 jΩ
Return Loss	- 31.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8 Ω + 3.3 jΩ
Return Loss	- 28.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 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.
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	August 10, 2004

DASY5 Validation Report for Head TSL

Date/Time: 20.09.2010 14:17:25

Test Laboratory: SPEAG, Zurich, Switzerland

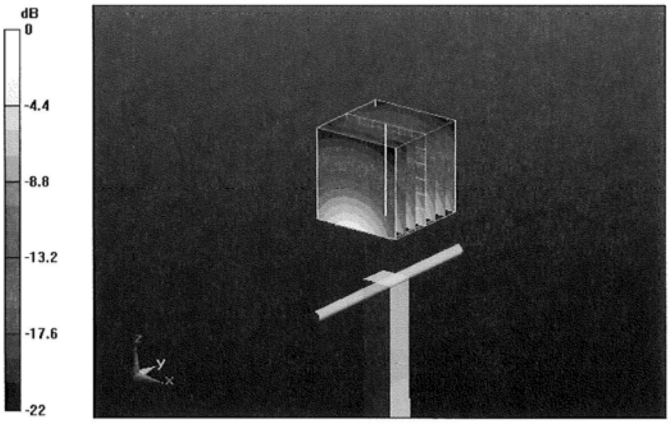
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:764

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 2450 MHz; $\sigma = 1.74$ mho/m; $\varepsilon_r = 39$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.4 V/m; Power Drift = 0.044 dB
Peak SAR (extrapolated) = 26.5 W/kg
SAR(1 g) = 13 mW/g; SAR(10 g) = 6.09 mW/g
Maximum value of SAR (measured) = 16.6 mW/g



0 dB = 16.6mW/g

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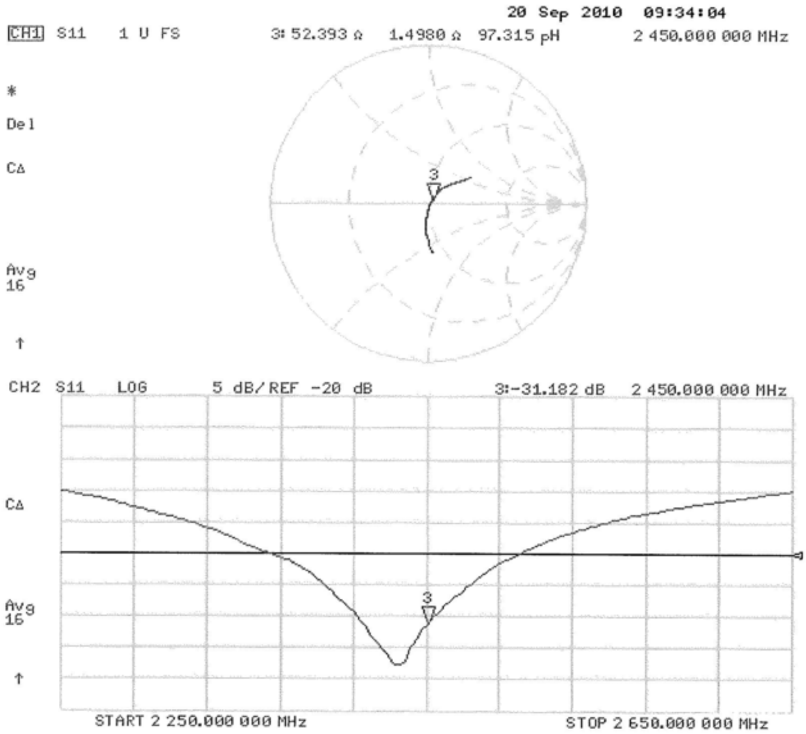
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date/Time: 21.09.2010 14:15:54

Test Laboratory: SPEAG, Zurich, Switzerland

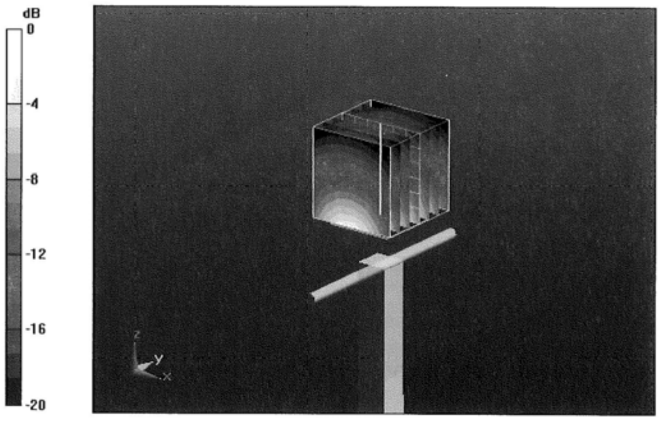
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:764

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.95 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.2 V/m; Power Drift = 0.012 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6 mW/g
Maximum value of SAR (measured) = 17 mW/g



0 dB = 17mW/g

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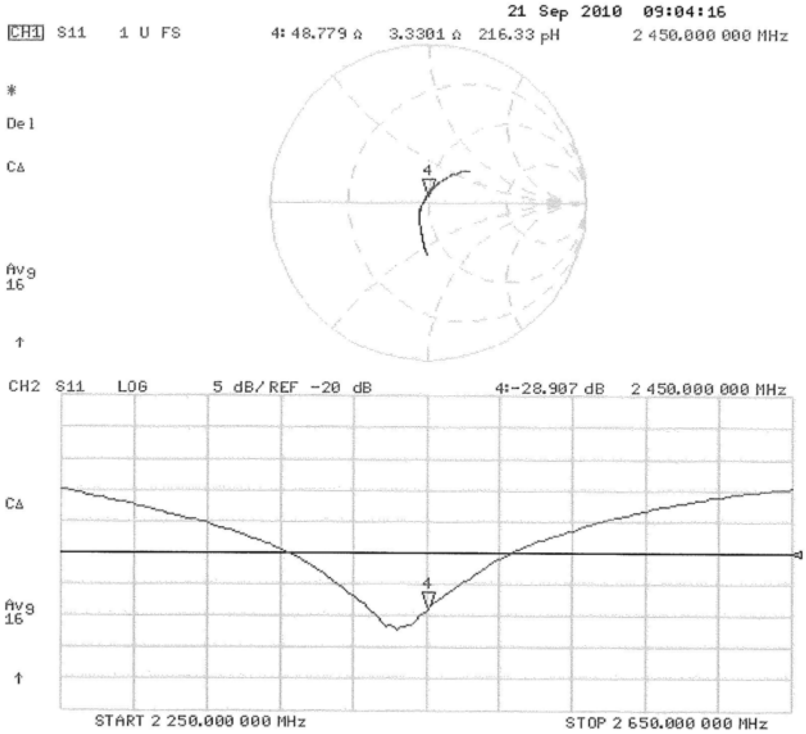
Impedance Measurement Plot for Body TSL



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