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TEST REPORT

REFERENCE STANDARDS:

FCC 47CFR Part 2.1093

FCC OET Bulletin 65, Supplement C (Edition 01-01)

NIE ..... :	30478RET.002
Approved by (name / position & signature) ..... :	A. Llamas / RF Lab. Manager
Elaboration date ..... :	2009-10-22

Alejandro Llamas Rodríguez
Firmado digitalmente por Alejandro Llamas Rodríguez
Fecha: 2009.10.22 15:50:50 +02'00'

Identification of item tested ..... :	Intel® Centrino® Ultimate-N 6300 inside a host laptop
Trademark ..... :	Intel
Model and/or type reference ..... :	633ANHMW
Serial number ..... :	MAC Address: 0015005AA4D4
Other identification of the product ..... :	FCC ID: E2K633ANH / IC: 1514B-633ANH
Features ..... :	802.11 a/b/g/n
Description ..... :	Wireles Module: Intel® Centrino® Ultimate-N 6300 Antenna Type: Smart Approach PE-11000C / PE-08000C Host platform: PP39L

Applicant ..... :	Intel Corporation
Address ..... :	2111 Ne 25th Avenue JF3-3-G14, Hillsboro, OR 97124, USA
CIF/NIF/Passport ..... :	---
Contact person:	Steven C. Hackett (Wireless Regulatory Engineer)
Telephone / Fax ..... :	803-216-2344
e-mail: ..... :	steven.c.hackett@intel.com

Test samples supplier ..... :	Same as applicant

Manufacturer ..... :	Same as applicant

Test method requested .....:	See Standard
Standard .....:	1. FCC 47 CFR Part 2.1093. Radiofrequency radiation exposure evaluation: portable devices. 2. FCC OET Bulletin 65, Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields". 3. FCC OET KDB 248227 – SAR Measurements Procedures 802.11a/b/g Transmitters (May 2007 – Revised) 4. FCC OET KDB 616217 – SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens (December 2007) 5. FCC OET KDB 865664 – SAR Measurements Requirements for 3-6 GHz (October 2006) 6. FCC OET KDB 450824 – SAR Probe Calibration and System Verification Considerations for measurements at 150 MHz – 3 GHz (January 2007)
Test procedure .....:	Same as standards.
Non-standardized test method .....:	N/A
Used instrumentation .....:	1. Dosimetric E-field probe SPEAG ES3DV3 2. Dosimetric E-field probe SPEAG EX3DV4 3. Data acquisition device SPEAG DAE4 4. Electro-optical converter SPEAG EOC3 5. 2450 MHz dipole validation kit SPEAG D2450V2 6. 5GHz dipole validation kit SPEAG D5GHzV2 7. Robot STÄUBLI RX60BL 8. Robot controller STÄUBLI CM7MB 9. Oval flat phantom SPEAG ELI 4 10. SAR measurement software SPEAG DASY4 V4.7 Build 80 11. Measurement server SPEAG DASY4 SE UMS 001 DC 12. Body Tissue Equivalent Liquids for 2450MHz and 5GHz bands 13. Vector network analyzer Agilent E5071C 14. Dielectric probe kit Agilent 85070C 15. Power meter R&S NRVD 16. Power Sensor R&S NRV-Z51 17. Power Sensor R&S NRV-Z1 18. RF Generator Agilent ESG E4438C 19. Dual directional coupler NARDA FSCM 99899 20. Power amplifier MITEQ AMF-4D-00400600-50-30P 21. Laptop positioning extension SPEAG Laptop Holder
Report template No. .....:	FDT08_11

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Competences and guarantees

AT4 wireless is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the following documents:

1. FCC OET Bulletin 65, Supplement C (Edition 01-01), “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields”.
2. FCC OET KDB 865664 – SAR Measurements Requirements for 3-6 GHz (October 2006).

Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample M/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
30478/01	WiFi module inside a Laptop PC	Intel® Centrino® Ultimate-N 6300 / Laptop PP39L / Smart Approach Antennas	MAC Address: 0015005AA4D4	2009-10-10

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested".

Testing period

The performed test started on 2009-10-13 and finished on 2009-10-20.

The tests have been performed at AT4 wireless.

Environmental conditions

In the laboratory for measurements, the following limits were not exceeded during the test:

Temperature	Min. = 22.66 ºC Max. = 24.65 ºC
Relative humidity	Min. = 35.78 % Max. = 58.30 %
Air pressure	Min. = 1003 mbar Max. = 1020 mbar

Summary

Considering the results of the performed test according to FCC 47CFR Part 2.1093, the item under test is **IN COMPLIANCE** with the requested specifications specified in the standard.

The maximum 1g volume averaged SAR found during this test has been 0.273 W/kg, for the 5600 MHz band and 802.11a with 20MHz BW mode.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

Remarks and comments

1: 802.11n = 20MHz BW / 802.11n* = 40MHz BW.
2: Testing of 802.11g and 802.11n with 20MHz BW are not required due to the testing reductions mentioned in FCC OET KDB 248227 – SAR Measurements Procedures 802.11a/b/g Transmitters (May 2007 – Revised), paragraph "Frequency Channel Configurations".
3: Testing of other channels in each band is optional when the maximum output channel SAR fulfills the testing reductions mentioned in FCC OET KDB 248227 – SAR Measurements Procedures 802.11a/b/g Transmitters (May 2007 – Revised), paragraph "Frequency Channel Configurations".

Testing verdicts

Not applicable .....: NA

Pass.....: P

Fail .....: F

Not measured.....: NM

2450 MHz band

FCC 47CFR Part 2.1093 Paragraph	VERDICT			
	NA	P	F	NM
(d)(2) 802.11b		P		
(d)(2) 802.11g				NM[2]
(d)(2) 802.11n[1]		P		
(d)(2) 802.11n*[1]		P		

1 and 2: See Remarks and Comments.

5.2 – 5.8 GHz band

FCC 47CFR Part 2.1093 Paragraph	VERDICT			
	NA	P	F	NM
Lower Band (5.18 – 5.32 GHz)				
(d)(2) 802.11a		P		
(d)(2) 802.11n[1]				NM[2]
(d)(2) 802.11n*[1]		P		
Middle Band (5.5 – 5.7 GHz)				
(d)(2) 802.11a		P		
(d)(2) 802.11n[1]				NM[2]
(d)(2) 802.11n*[1]		P		
Higher Band (5.745 – 5.825 GHz)				
(d)(2) 802.11a		P		
(d)(2) 802.11n[1]				NM[2]
(d)(2) 802.11n*[1]		P		

1 and 2: See Remarks and Comments.

APPENDIX A: Test Configuration

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1. GENERAL INTRODUCTION

1.1. Application Standard

The Federal Communications Commission (FCC) sets the limits for General Population / Uncontrolled exposure to radio frequency electromagnetic fields for transmitting devices designed to be used within 20 centimetres of the user body under FCC 47 CFR Part 2.1093 - "Radiofrequency radiation exposure evaluation: portable devices", paragraph (d)(2).

Specific requirements and procedure for SAR assessment are describe under FCC OET Bulletin 65, Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields", and all the FCC OET Knowledge Database documents referred at the beginning of this document.

1.2. General requirements

The SAR measurement has been performed continuing the following considerations and environment conditions:

- The ambient temperature shall be in the range of 18ºC to 25ºC and the variation shall not exceed +/-2ºC during the test.
- The ambient humidity shall be in the range of and 30% - 70%.
- The device battery shall be fully charged before each measurement.

1.3. Measurement system and phantom requirements

The measurement system used for SAR tests fulfils the procedural and technical requirements described at the reference standards used.

The phantom is a simplified representation of the human anatomy and comprised of material with electrical properties similar to the corresponding tissues in human body.

1.4. Measurement Liquids requirements.

The liquids used to simulate the human tissues, must fulfils the requirements of the dielectric properties required. These target dielectric properties per FCC OET KDB 450824 instructions come from the dipole and probe calibration data which are included in Appendix B, Section 2, of this document (the values for 5200 and 5600 MHz are linearly interpolated between the specified values for 3000 and 5800 MHz indicated in FCC OET Bulletin 65 – Supplement C, Appendix C, 'Tissue Dielectric Parameters').

As indicated in FCC OET KDB 450824, it is allowed a 5% variation of the above mentioned level at the 2450 MHz band. As indicated in FCC OET KDB 865664 – 'Measurements Requirements for 3-6 GHz', it is allowed a 10% and a 5% variation of permittivity and conductivity respectively at the 5200-5800 GHz band.

2. MEASUREMENT SYSTEM

2.1. Measurement System

Manufacturer	Device	Type
Schmid & Partner Engineering AG	Dosimetric E-Fiel Probe	ES3DV3
Schmid & Partner Engineering AG	Dosimetric E-Fiel Probe	EX3DV4
Schmid & Partner Engineering AG	Data Acquisition Electronics	DAE4
Schmid & Partner Engineering AG	Electro-Optical Converter	EOC5
Schmid & Partner Engineering AG	2450 MHz System Validation Dipole	D2450V2
Schmid & Partner Engineering AG	5GHz System Validation Dipole	D5GHzV2
Stäubli	Robot	RX60BL
Stäubli	Robot controller	CM7MB
Schmid & Partner Engineering AG	Oval flat phantom	ELI 4
Schmid & Partner Engineering AG	Measurement Software	DASY V4.7 Build 80
Schmid & Partner Engineering AG	Measurement Server	DASY4 SE UMS 001 DC
Agilent	Vector Network Analyser	E5071C
Agilent	Dielectric Probe Kit	85070C
Rohde & Schwarz	Power Meter	NRVD
Rohde & Schwarz	Power Sensor	NRV-Z51
Rohde & Schwarz	Power Sensor	NRV-Z1
Agilent	RF Generator	ESG E4438C
NARDA	Dual directional coupler	FSCM 99899
MITEQ	Power amplifier	AMF-4D-00400600-50-30P
Schmid & Partner Engineering AG	Laptop Holder	SM LH1 001 AC

Table 1: Measurement Equipment

2.2. Test Positions of device relative to body

The laptop device was tested in one position for all tests, with the bottom face placed directly against the phantom so the position of the laptop would be used (normal use condition). Further analysis was performed to determine the antenna and location which showed the highest SAR.

The antennas on the laptop are located within the edge screen. According to FCC OET Bulletin 65 – Supplement C, the antennas which would applied in the test are antennas or radiating structures in direct contact with the user's body within 20 centimetres of the body of a user under normal operating conditions.

2.3. Test to be performed

In all operating modes and bands the measurements have to be performed on the "default test channels" defined at FCC OET KDB 248227 – SAR Measurements Procedures 802.11a/b/g Transmitters (May 2007 – Revised), except those channels defined as "required test channels" at the same document.

2.4. Description of interpolation/extrapolation scheme

The local SAR inside the Phantom is measured using small dipole sensing elements inside a probe element. The probe tip must not be in contact with the Phantom's surface in order to minimise measurement errors, but the highest local SAR is obtained from measurements at a certain distances from the shell trough extrapolation. The accurate assessment of the maximum SAR averaged over 1 gr. requires a very fine resolution in the three dimensional scanned data array. Since the measurements have to be performed over a limited time, the measured data have to be interpolated to provide an array of sufficient resolution.

The interpolation of 2D area scan is used after the initial area scan, at a fixed distance from the Phantom shell wall. The initial scan data is collected with a proper spatial resolution and this interpolation is used to find the location of the local maximum for positioning the subsequent 3D scanning to within a 1mm resolution.

For the 3D scan, data is collected on a spatially regular 3D grid having 5mm steps in both lateral directions, and 5mm in depth direction for the 2450MHz band. Over the 5GHz band, a 4mm lateral resolution is required, and 2.5mm in depth direction. After the data collection by the SAR probe, the data are extrapolated in the depth direction to assign values to points in the 3D array closer to the shell wall. A notional extrapolation value is also assigned to the first point outside the shell wall so that subsequent interpolation schemes will de applicable right up to the shell wall boundary.

2.5. Determination of the largest peak spatial-average SAR

To determine the maximum value of the peak spatial-average SAR of a EUT, all device positions, configurations and operational modes should be tested for each frequency band.

According to FCC 47 CFR Part 2.1093, the averaging volume shall be chosen as 1 g of contiguous tissue. The cubic volumes, over which the SAR measurements are averaged after extrapolation and interpolation, are chosen in order to include the highest values of local SAR.

The maximum SAR level for the EUT will be the maximum level obtained of the performed measurements, and indicated in the previous points.

2.6. System Validation

Prior to the SAR measurements, system verification is done daily to verify the system accuracy. As FCC OET Bulletin 65 – Supplement C, Appendix D "SAR measurement procedures" Paragraph "System Verification" specifies, a complete SAR evaluation is done using a half-wavelength dipole as source with the frequency of the mid-band channel of the operating band, or within 100MHz of this channel.

The measured one-gram SAR should be within 10% of the expected target values specified in the calibration certificate of the dipole, for the specific tissue and frequency used.

3. UNCERTAINTY

Uncertainty for 300 MHz – 3 GHz

ERROR SOURCES	Uncertainty value (%)	Probability distribution	Divisor	(c_i) 1g	(c_i) 10g	Standard uncertainty (1g)	Standard uncertainty (10g)	v_i v_{eff}
Measurement Equipment								
Probe Calibration	±5.9%	Normal	1	1	1	±5.90 %	±5.90%	∞
Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.92%	±1.92%	∞
Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.92%	±3.92%	∞
Boundary effect	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.71%	±2.71%	∞
System detection limits	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Readout electronics	±1.0%	Normal	1	1	1	±1.00%	±1.00%	∞
Response time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.46%	±0.46%	∞
Integration time	±2.6%	Rectangular	$\sqrt{3}$	1	1	±1.50%	±1.50%	∞
RF Ambien conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.73%	±1.73%	∞
Probe positioner	±0.4%	Rectangular	$\sqrt{3}$	1	1	±0.23%	±0.23%	∞
Probe positioning	±2.9%	Rectangular	$\sqrt{3}$	1	1	±1.67%	±1.67%	∞
Maximum SAR evaluation	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Test Sample Related								
Device positioning	±2.9%	Normal	1	1	1	±2.90%	±2.90%	145
Device Holder	±3.6%	Normal	1	1	1	±3.60%	±3.60%	5
Power Drift	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.89%	±2.89%	∞
Phantom and Setup								
Phantom uncertainty	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.31%	±2.31%	∞
Liquid conductivity (deviation from target)	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.85%	±1.24%	∞
Liquid conductivity (measurement error)	±2.5%	Normal	1	0.64	0.43	±1.60%	±1.08%	∞
Liquid permittivity (deviation from target)	±5.0%	Rectangular	$\sqrt{3}$	0.60	0.49	±1.73%	±1.41%	∞
Liquid permittivity (measurement error)	±2.5%	Normal	1	0.60	0.49	±1.50%	±1.23%	∞
Combined standard uncertainty	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					±10.85%	±10.62%	330
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**±21.71%**	**±21.24%**	

Table 2: Uncertainty Assessment for 300 MHz - 3 GHz

Uncertainty for 5-6 GHz

ERROR SOURCES	Uncertainty value (%)	Probability distribution	Divisor	(c_i) 1g	(c_i) 10g	Standard uncertainty (1g)	Standard uncertainty (10g)	v_i v_{eff}
Measurement Equipment								
Probe Calibration	±6.55%	Normal	1	1	1	±6.55 %	±6.55%	∞
Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.92%	±1.92%	∞
Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.92%	±3.92%	∞
Boundary effect	±2.0%	Rectangular	$\sqrt{3}$	1	1	±1.15%	±1.15%	∞
Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.71%	±2.71%	∞
System detection limits	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Readout electronics	±1.0%	Normal	1	1	1	±1.00%	±1.00%	∞
Response time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.46%	±0.46%	∞
Integration time	±2.6%	Rectangular	$\sqrt{3}$	1	1	±1.50%	±1.50%	∞
RF Ambien conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.73%	±1.73%	∞
Probe positioner	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.46%	±0.46%	∞
Probe positioning	±5.7%	Normal	1	1	1	±5.70%	±5.70%	∞
Maximum SAR evaluation	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.31%	±2.31%	∞
Test Sample Related								
Device positioning	±2.9%	Normal	1	1	1	±2.90%	±2.90%	145
Device Holder	±3.6%	Normal	1	1	1	±3.60%	±3.60%	5
Power Drift	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.89%	±2.89%	∞
Phantom and Setup								
Phantom uncertainty	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.31%	±2.31%	∞
Liquid conductivity (deviation from target)	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.85%	±1.24%	∞
Liquid conductivity (measurement error)	±2.5%	Normal	1	0.64	0.43	±1.60%	±1.08%	∞
Liquid permittivity (deviation from target)	±5.0%	Rectangular	$\sqrt{3}$	0.60	0.49	±1.73%	±1.41%	∞
Liquid permittivity (measurement error)	±2.5%	Normal	1	0.60	0.49	±1.50%	±1.23%	∞
Combined standard uncertainty	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					±12.72%	±12.52%	330
Expanded uncertainty (confidence interval of 95%)	*ue = 2.00 uc*					**±25.43%**	**±25.04%**	

Table 3: Uncertainty Assessment for 5-6 GHz

4. SAR LIMIT

Having a worst case measurement, the SAR limit is valid for general population/uncontrolled exposure.

The SAR values have to be averaged over a mass of 1 gr. ($SAR_{1\ gr.}$) with the shape of a cube. This level couldn't exceed the values indicated in the application Standard:

Standard	SAR	SAR Limit (W/Kg)
FCC 47 CFR Part 2.1093 Paragraph (d)(2)	$SAR_{1\ gr.}$	1.6

Table 4: SAR limit

APPENDIX B: Test results

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1. TEST CONDITIONS

1.1. Power supply (V):

V_n = 11.1 Vdc battery

Type of power supply = DC Voltage from rechargeable Li-Ion 11.1 V battery.

1.2. Temperature (ºC):

T_n = +22.66 to +24.65

The subscript n indicates normal test conditions.

1.3. Test signal, Output Power and Frequencies

The device was put into operation by using an own control software to program the test mode required for select the continuous transmission with 100% duty cycle.

In all operating bands the measurements were performed on the "default test channels" defined at FCC OET KDB 248227 – SAR Measurements Procedures 802.11a/b/g Transmitters (May 2007 – Revised), except those that fulfil the frequency channel selection criteria mentioned on paragraph "Frequency Channel Configuration" at the same document.

The output power of the device was set to maximum power level for all tests; a fully charged battery was used for every test sequence.

The maximum average conducted power of the device was measured with a Power meter R&S NRVD and a thermocoupled Power sensor NRV-Z51.

1.4. DUT information

The device under test was the Intel® Centrino® Ultimate-N 6300 card located inside a host laptop (PP39L) computer which utilises a set of SmartAproach antennas (PE-11000C / PE-08000C). The card was operated utilizing proprietary software (CRTU Version 5.15.36.0) and each channel was measured using a broadband power meter to determine the maximum average power. The device was tested in a single chain configuration which is representative of the maximum exposure condition of this wireless transceiver.

2. TISSUE PARAMETERS MEASUREMENTS

Frequency (MHz)	Target Body Tissue: Parameters used in Probe Calibration		Target Body Tissue: Parameters used in Dipole Calibration		Measured Body Tissue		Measured Date
	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	
2450	52.7 ± 5%	1.95 ± 5%	53.2 ± 6%	2.00 ± 6%	50.80	1.95	2009-10-13
5200	49.0 ± 5%	5.30 ± 5%	47.7 ± 6%	5.30 ± 6%	48.52	5.07	2009-10-15
5500	48.5 ± 5%	5.77 ± 5%	46.8 ± 6%	5.74 ± 6%	47.82	5.52	2009-10-15
5800	48.2 ± 5%	6.00 ± 5%	46.3 ± 6%	6.05 ± 6%	47.04	5.98	2009-10-15

Note: The dielectric properties have been measured by the contact probe method at 23.0° C.

3. SYSTEM VALIDATION MEASUREMENTS

3.1. Validation results in 2450 MHz Band for Body TSL

SAR	Target SAR (W/kg)	Measured SAR (W/kg)	Drift (%)	Limit (%)
1 gr.	53.0	50.76	-4.23	± 10
10 gr.	25.0	23.38	-6.47	± 10

3.2. Validation results in 5200 MHz Band for Body TSL

SAR	Target SAR	Measured SAR	Drift (%)	Limit (%)
1 gr.	75.7	72.17	-4.66	± 10
10 gr.	21.1	20.62	-2.27	± 10

3.3. Validation results in 5500 MHz Band for Body TSL

SAR	Target SAR	Measured SAR	Drift (%)	Limit (%)
1 gr.	81.1	75.43	-7.00	± 10
10 gr.	22.4	21.45	-4.24	± 10

3.4. Validation results in 5800 MHz Band for Body TSL

SAR	Target SAR	Measured SAR	Drift (%)	Limit (%)
1 gr.	71.9	68.89	-4.19	± 10
10 gr.	19.7	19.63	-0.38	± 10

4. MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)

4.1. Summary maximum results

2450 MHz band:

Band	Mode	Channel	Frequency (MHz)	Measured SAR, value (1g avg) (W/Kg)	SAR limit (1g avg) (W/Kg)
2450 MHz band	802.11b	11	2462	0.039	1.6
	802.11g	-	-	NM[2]	1.6
	802.11n[1]	6	2437	0.037	1.6
	802.11n*[1]	6	2437	0.038	1.6

1 and 2: See Remarks and Comments.

5.2 – 5.8 GHz band:

Band	Mode	Channel	Frequency (MHz)	Measured SAR, value (1g avg) (W/Kg)	SAR limit (1g avg) (W/Kg))
Lower Band (5.18 – 5.32 GHz)	802.11a	52	5260	0.199	1.6
	802.11n[1]	-	-	NM[2]	1.6
	802.11n*[1]	38	5190	0.192	1.6
Middle Band (5.5 – 5.7 GHz)	802.11a	120	5600	0.273	1.6
	802.11n[1]	-	-	NM[2]	1.6
	802.11n*[1]	102	5510	0.211	1.6
Higher Band (5.745 – 5.825 GHz)	802.11a	165	5825	0.156	1.6
	802.11n[1]	-	-	NM[2]	1.6
	802.11n*[1]	159	5795	0.177	1.6

1 and 2: See Remarks and Comments.

4.2. Results for 2450 MHz Band

Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	SAR averaged over 1g (W/Kg)	Power Drift (%)	Limit (%)
802.11b	1	2412	16.37	NM[3]	-	±5
	6	2437	16.28	NM[3]	-	±5
	11	2462	16.55	0.039	-2.56	±5
802.11g	1	2412	NM[2]	NM[2]	-	±5
	6	2437	NM[2]	NM[2]	-	±5
	11	2462	NM[2]	NM[2]	-	±5
802.11n[1]	1	2417	15.62	NM[3]	-	±5
	6	2437	16.32	0.037	-1.19	±5
	11	2457	15.42	NM[3]	-	±5
802.11n*[1]	3	2422	11.92	NM[3]	-	±5
	6	2437	16.38	0.038	0.08	±5
	9	2452	12.17	NM[3]	-	±5

1, 2 and 3: See Remarks and Comments.

4.3. Results for 5200 MHz Band

Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	SAR averaged over 1g (W/Kg)	Power Drift (%)	Limit (%)
802.11a	36	5180	16.51	NM[3]	-	±5
	48	5240	16.64	NM[3]	-	±5
	52	5260	16.72	0.199	-2.20	±5
	64	5320	16.38	NM[3]	-	±5
802.11n[1]	36	5180	NM[2]	NM[2]	-	±5
	48	5240	NM[2]	NM[2]	-	±5
	52	5260	NM[2]	NM[2]	-	±5
	64	5320	NM[2]	NM[2]	-	±5
802.11n*[1]	38	5190	16.59	0.192	0.24	±5
	46	5230	16.56	NM[3]	-	±5
	54	5270	16.47	NM[3]	-	±5
	62	5310	16.51	NM[3]	-	±5

1, 2 and 3: See Remarks and Comments.

4.4. Results for 5600 MHz Band

Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	SAR averaged over 1g (W/Kg)	Power Drift (%)	Limit (%)
802.11a	100	5500	16.40	NM[3]	-	±5
	120	5600	16.53	0.273	0.131	±5
	140	5700	16.45	NM[3]	-	±5
802.11n[1]	100	5500	NM[2]	NM[2]	-	±5
	120	5600	NM[2]	NM[2]	-	±5
	140	5700	NM[2]	NM[2]	-	±5
802.11n*[1]	102	5510	16.93	0.211	2.18	±5
	118	5590	16.53	NM[3]	-	±5
	134	5670	16.65	NM[3]	-	±5

1, 2 and 3: See Remarks and Comments.

4.5. Results for 5800 MHz Band

Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	SAR averaged over 1g (W/Kg)	Power Drift (%)	Limit (%)
802.11a	149	5745	16.40	NM[3]	-	±5
	157	5785	16.33	NM[3]	-	±5
	165	5825	16.64	0.156	-2.79	±5
802.11n[1]	149	5745	NM[2]	NM[2]	-	±5
	157	5785	NM[2]	NM[2]	-	±5
	165	5825	NM[2]	NM[2]	-	±5
802.11n*[1]	151	5755	16.44	NM[3]	-	±5
	159	5795	16.62	0.177	1.23	±5

1, 2 and 3: See Remarks and Comments.

APPENDIX C: Measurements Reports

2450 MHz Band – 802.11b Channel 11

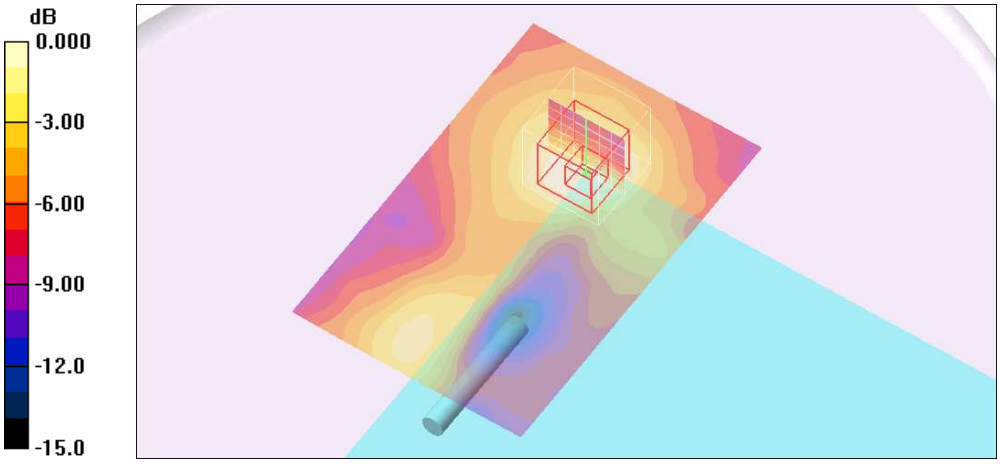
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11b at 2450MHz

Communication System: 802.11; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.94 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

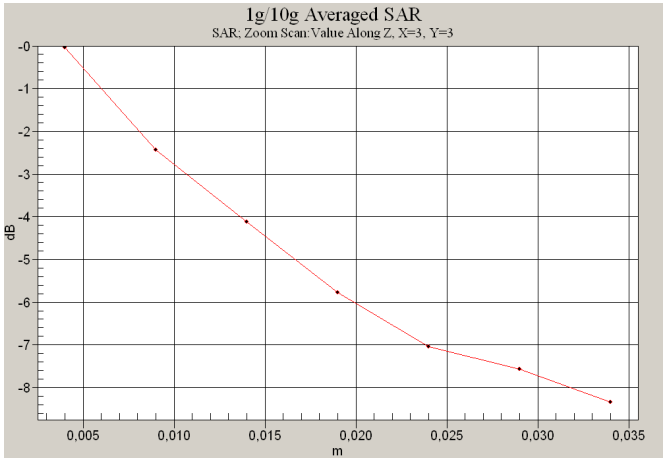
DASY4 Configuration:
- Probe: ES3DV3 - SN3173; ConvF(4.25, 4.25, 4.25); Calibrated: 24/06/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11b, Channel 11/Area Scan (91x141x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.044 mW/g

802.11b, Channel 11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.52 V/m; Power Drift = -0.225 dB
Peak SAR (extrapolated) = 0.073 W/kg
SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.023 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.042 mW/g



0 dB = 0.042mW/g



2450 MHz Band – 802.11n Channel 6

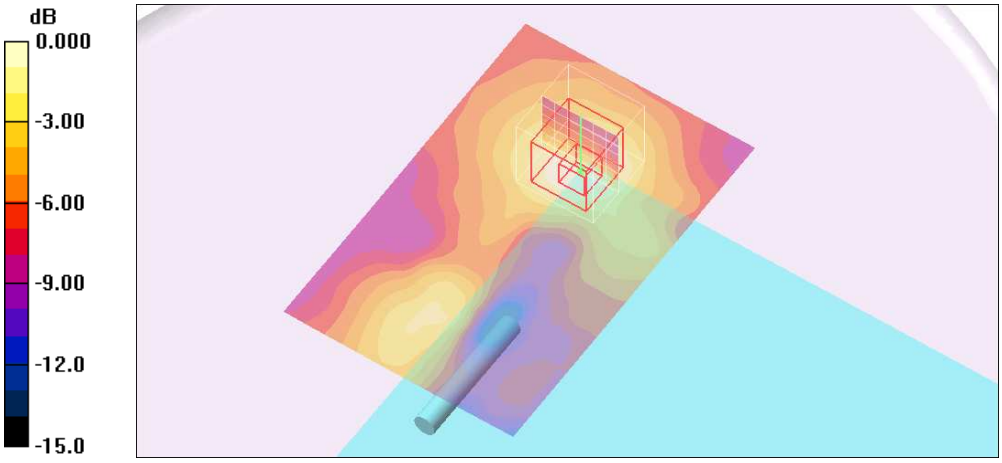
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11n at 2450MHz

Communication System: 802.11; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

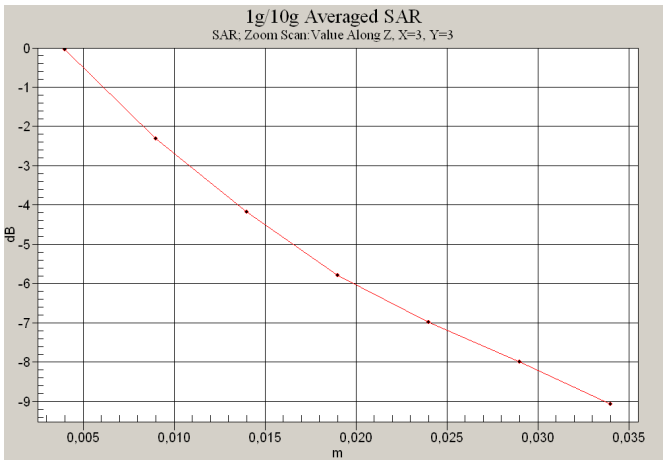
DASY4 Configuration:
- Probe: ES3DV3 - SN3173; ConvF(4.25, 4.25, 4.25); Calibrated: 24/06/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11n, Channel 6/Area Scan (91x141x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.041 mW/g

802.11n, Channel 6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.69 V/m; Power Drift = -0.104 dB
Peak SAR (extrapolated) = 0.067 W/kg
SAR(1 g) = 0.037 mW/g; SAR(10 g) = 0.022 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.041 mW/g



0 dB = 0.041mW/g



2450 MHz Band – 802.11n* Channel 6

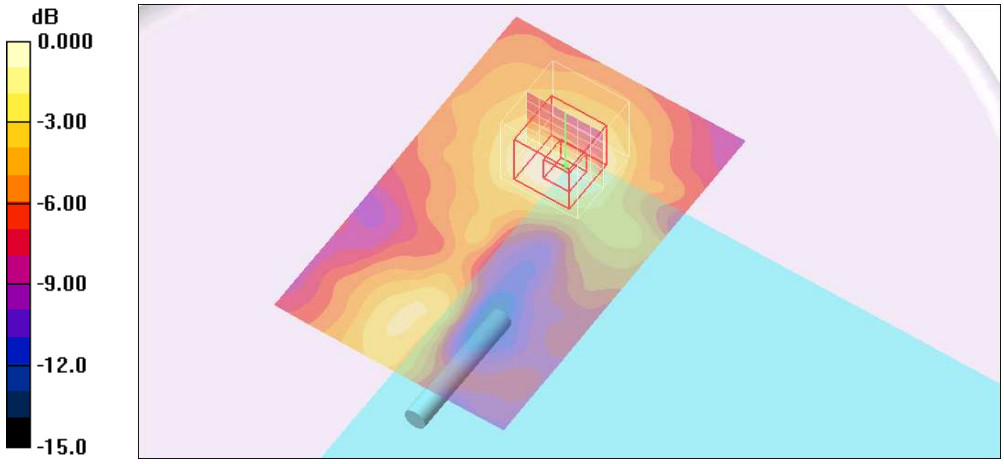
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11n* at 2450MHz

Communication System: 802.11; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.94 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

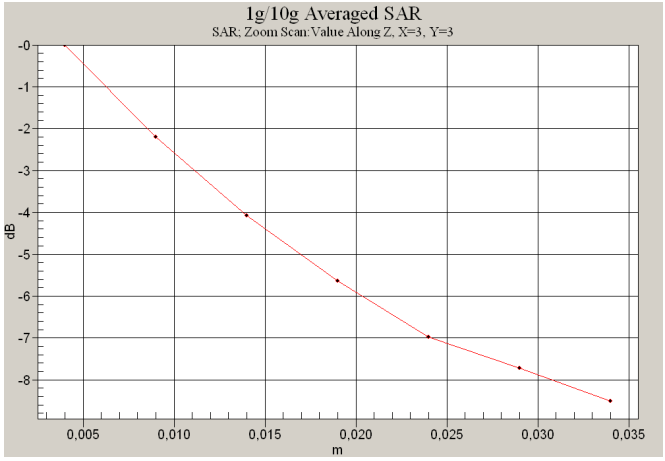
DASY4 Configuration:
- Probe: ES3DV3 - SN3173; ConvF(4.25, 4.25, 4.25); Calibrated: 24/06/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11n*, Channel 6/Area Scan (91x141x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.041 mW/g

802.11n*, Channel 6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.64 V/m; Power Drift = 0.007 dB
Peak SAR (extrapolated) = 0.069 W/kg
SAR(1 g) = 0.038 mW/g; SAR(10 g) = 0.023 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.041 mW/g



0 dB = 0.041mW/g



5200 MHz Band – 802.11a Channel 52

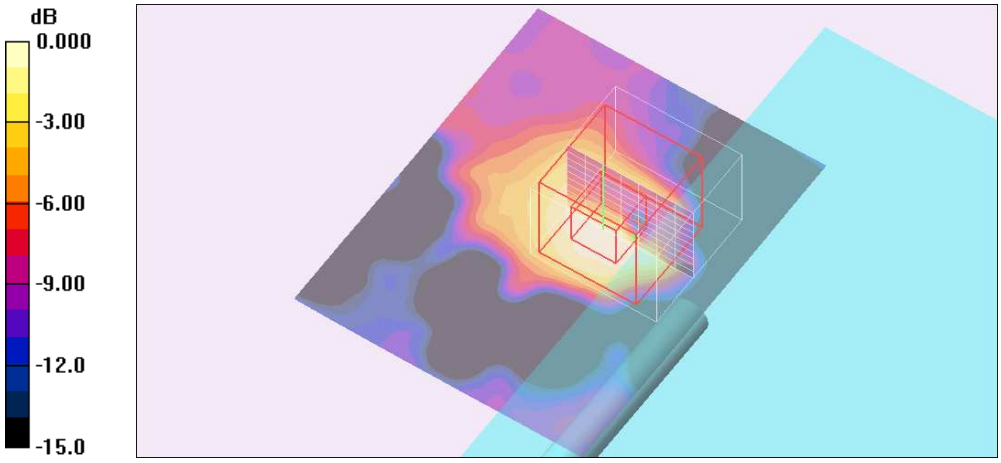
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11a at 5200MHz

Communication System: 802.11; Frequency: 5260 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5260 MHz; σ = 5.16 mho/m; ε_r = 48.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

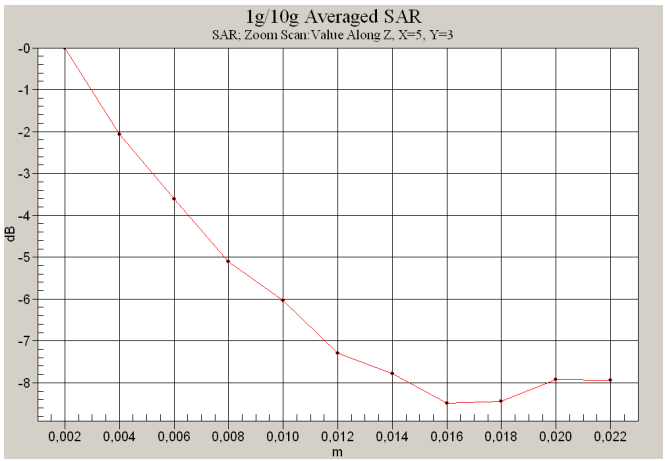
DASY4 Configuration:
- Probe: EX3DV4 - SN3687; ConvF(4.08, 4.08, 4.08); Calibrated: 16/03/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a, Channel 52/Area Scan (81x101x1): Measurement grid: dx=8mm, dy=8mm
Maximum value of SAR (interpolated) = 0.385 mW/g

802.11a, Channel 52/Zoom Scan (8x8x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 9.09 V/m; Power Drift = -0.193 dB
Peak SAR (extrapolated) = 0.563 W/kg
SAR(1 g) = 0.199 mW/g; SAR(10 g) = 0.090 mW/g
Maximum value of SAR (measured) = 0.331 mW/g



0 dB = 0.331mW/g



5200 MHz Band – 802.11n* Channel 38

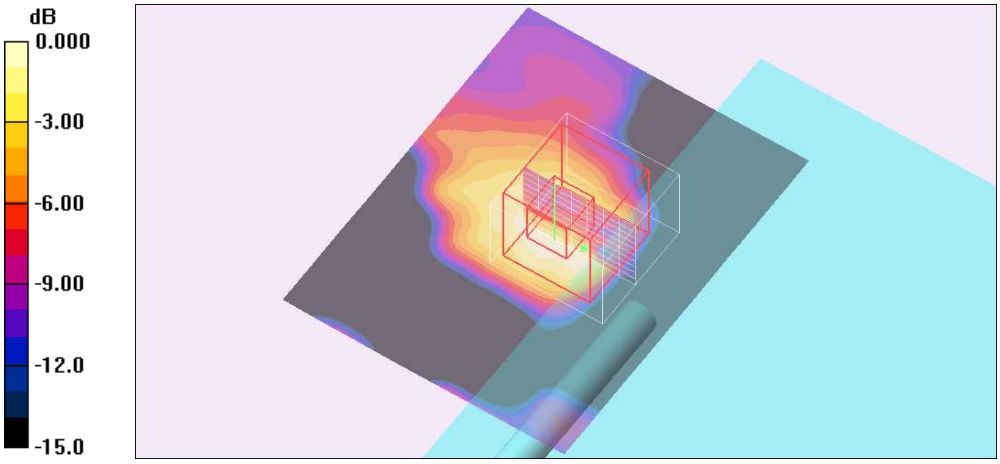
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11a at 5200MHz

Communication System: 802.11; Frequency: 5190 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5190 MHz; σ = 5.05 mho/m; ε_r = 48.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

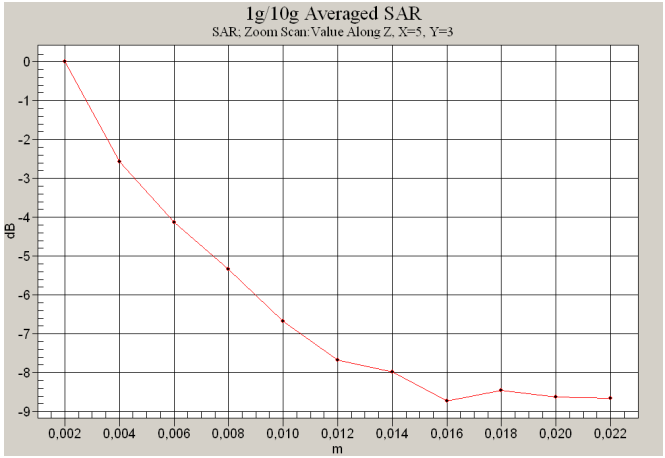
DASY4 Configuration:
- Probe: EX3DV4 - SN3687; ConvF(4.08, 4.08, 4.08); Calibrated: 16/03/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11n*, Channel 38/Area Scan (71x91x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.402 mW/g

802.11n*, Channel 38/Zoom Scan (8x8x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.52 V/m; Power Drift = 0.021 dB
Peak SAR (extrapolated) = 0.599 W/kg
SAR(1 g) = 0.195 mW/g; SAR(10 g) = 0.090 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.323 mW/g



0 dB = 0.323mW/g



5600 MHz Band – 802.11a Channel 120

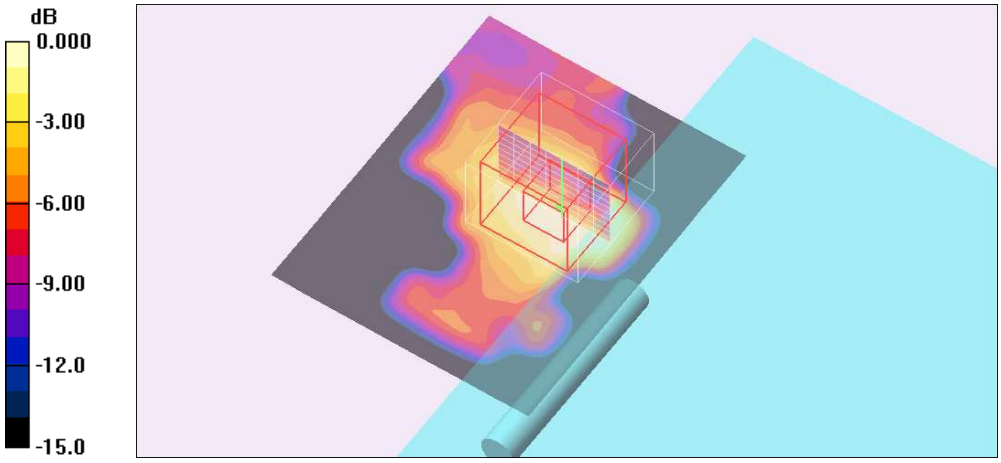
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11a at 5600MHz

Communication System: 802.11; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.67 mho/m; ε_r = 47.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

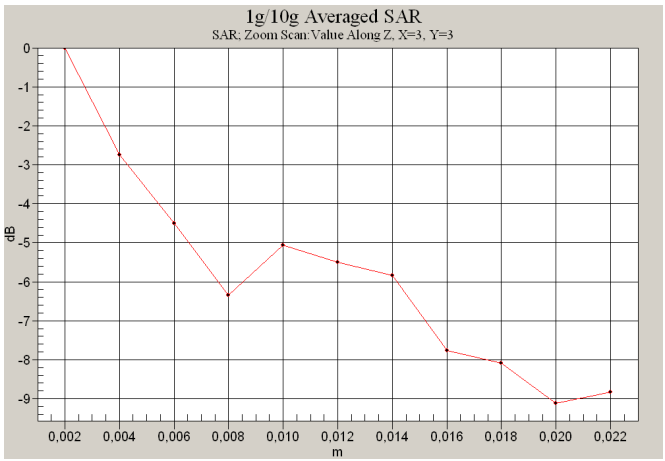
DASY4 Configuration:
- Probe: EX3DV4 - SN3687; ConvF(3.43, 3.43, 3.43); Calibrated: 16/03/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a, Channel 120 bis2/Area Scan (81x101x1): Measurement grid: dx=8mm, dy=8mm
Maximum value of SAR (interpolated) = 0.485 mW/g

802.11a, Channel 120 bis2/Zoom Scan (8x8x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 10.2 V/m; Power Drift = -0.274 dB
Peak SAR (extrapolated) = 0.953 W/kg
SAR(1 g) = 0.273 mW/g; SAR(10 g) = 0.131 mW/g
Maximum value of SAR (measured) = 0.451 mW/g



0 dB = 0.451mW/g



5600 MHz Band – 802.11n* Channel 102

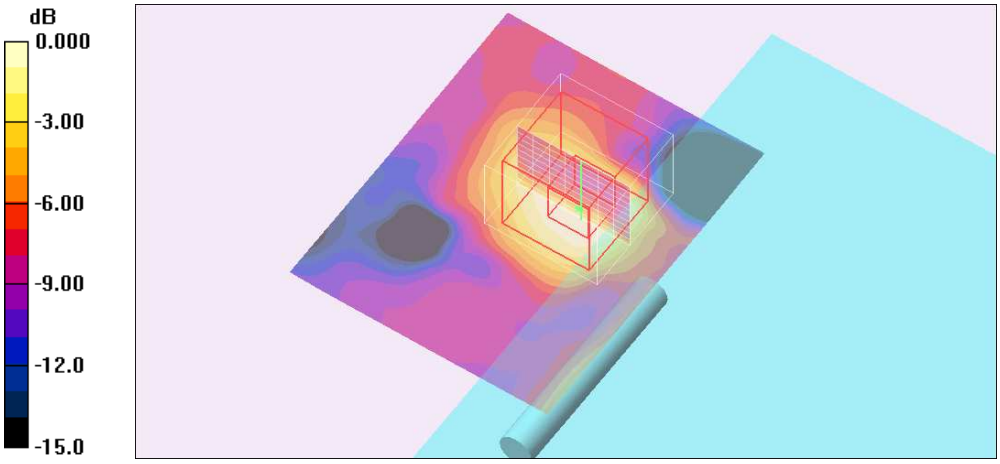
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11n* at 5600MHz

Communication System: 802.11; Frequency: 5510 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5510 MHz; σ = 5.53 mho/m; ε_r = 47.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

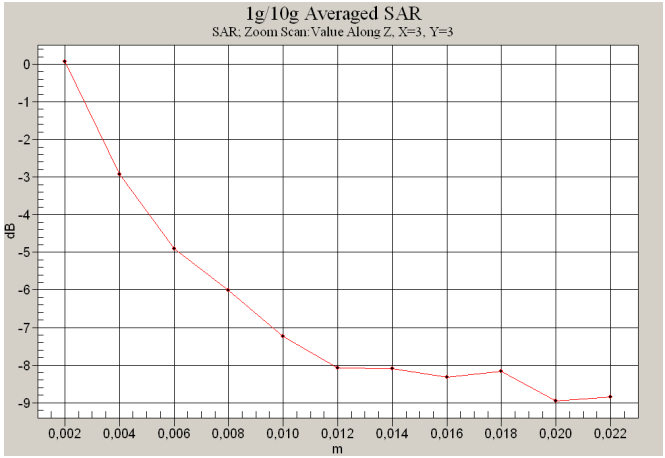
DASY4 Configuration:
- Probe: EX3DV4 - SN3687; ConvF(3.43, 3.43, 3.43); Calibrated: 16/03/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11n*, Channel 102/Area Scan (81x101x1): Measurement grid: dx=8mm, dy=8mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.409 mW/g

802.11n*, Channel 102/Zoom Scan (8x8x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.80 V/m; Power Drift = 0.187 dB
Peak SAR (extrapolated) = 0.681 W/kg
SAR(1 g) = 0.211 mW/g; SAR(10 g) = 0.100 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.351 mW/g



0 dB = 0.351mW/g



5800 MHz Band – 802.11a Channel 165

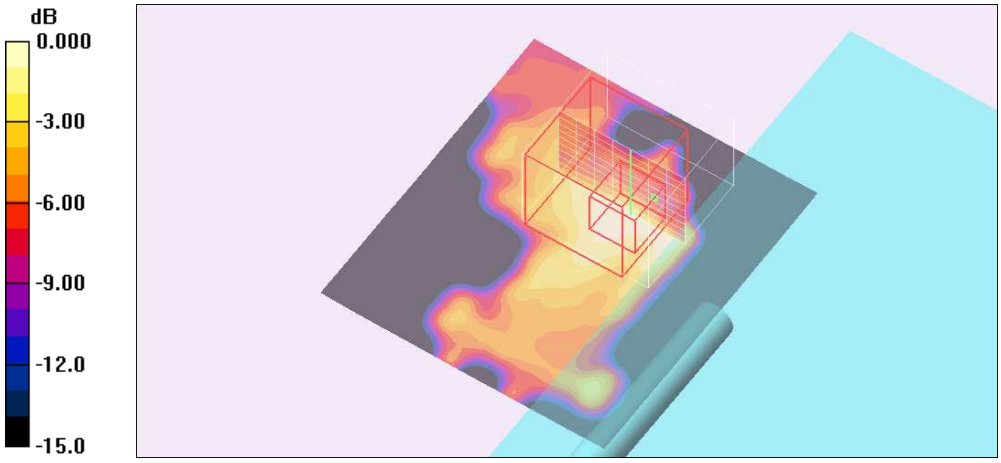
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11a at 5800MHz

Communication System: 802.11; Frequency: 5825 MHz;Duty Cycle: 1:1
Medium parameters used (extrapolated): f = 5825 MHz; σ = 6.03 mho/m; ε_r = 47; ρ = 1000 kg/m^3
Phantom section: Flat Section

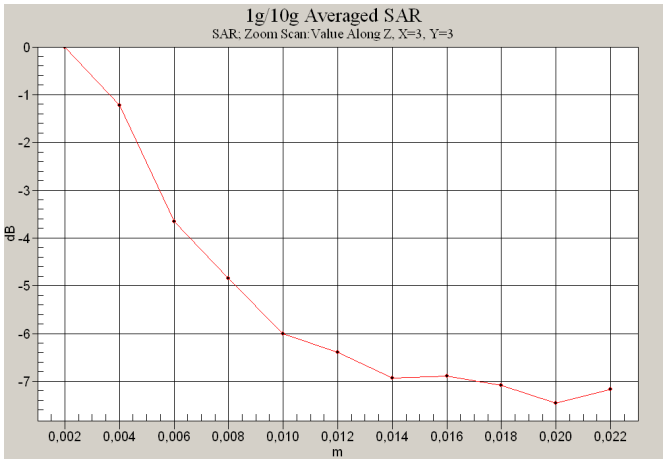
DASY4 Configuration:
- Probe: EX3DV4 - SN3687; ConvF(3.74, 3.74, 3.74); Calibrated: 16/03/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a, Channel 165 3/Area Scan (91x101x1): Measurement grid: dx=7mm, dy=7mm
Info: Extrapolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.362 mW/g

802.11a, Channel 165 3/Zoom Scan (8x8x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.62 V/m; Power Drift = -0.246 dB
Peak SAR (extrapolated) = 0.734 W/kg
SAR(1 g) = 0.156 mW/g; SAR(10 g) = 0.070 mW/g
Info: Extrapolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.274 mW/g



0 dB = 0.274mW/g



5800 MHz Band – 802.11n* Channel 159

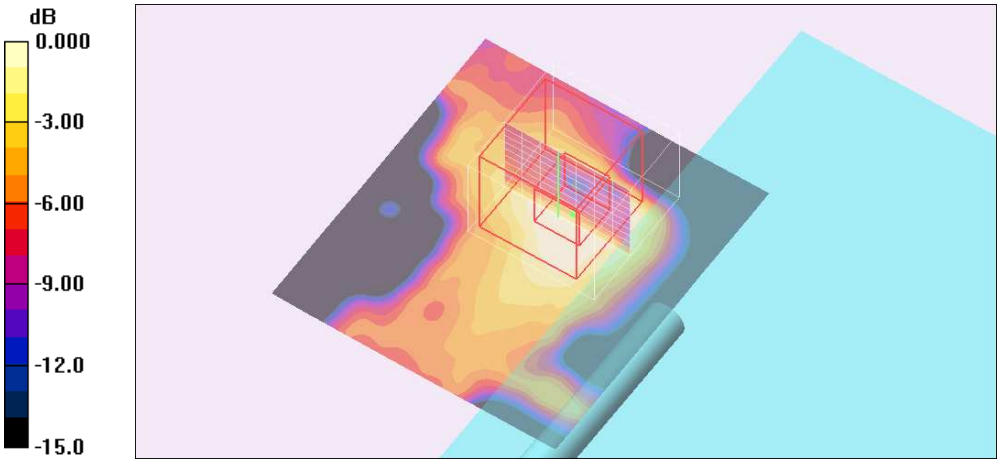
DUT: PP39L + Intel 633AN_HMW + Smart Approach Antenna; Type: Laptop; Serial: ---
Program Name: 802.11n* at 5800MHz

Communication System: 802.11; Frequency: 5795 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5795 MHz; σ = 5.97 mho/m; ε_r = 47.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

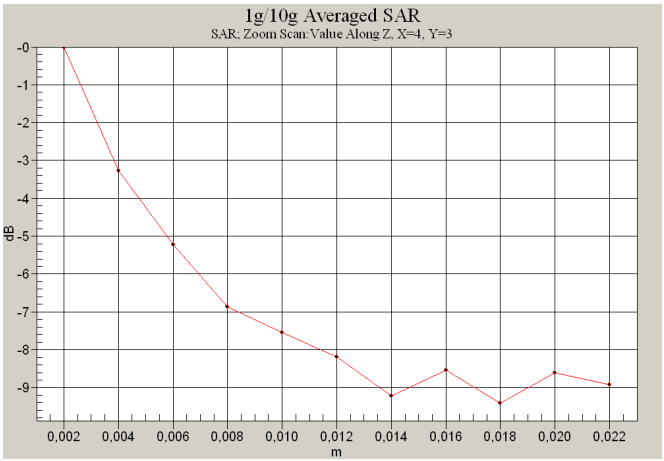
DASY4 Configuration:
- Probe: EX3DV4 - SN3687; ConvF(3.74, 3.74, 3.74); Calibrated: 16/03/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 28/05/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11n*, Channel 159 2/Area Scan (91x101x1): Measurement grid: dx=7mm, dy=7mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.406 mW/g

802.11n*, Channel 159 2/Zoom Scan (8x8x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 9.11 V/m; Power Drift = 0.106 dB
Peak SAR (extrapolated) = 1.33 W/kg
SAR(1 g) = 0.177 mW/g; SAR(10 g) = 0.088 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.377 mW/g



0 dB = 0.377mW/g



APPENDIX D: Photographs

EUT Front view:

EUT Back view:

General test set:

APPENDIX E: Calibration Data

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

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

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

Accreditation No.: SCS 108

Client SPEAG Replacement

Certificate No: ES3-3173_Jun09

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3173
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date	June 24, 2009
Condition of the calibrated item	In Tolerance

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)

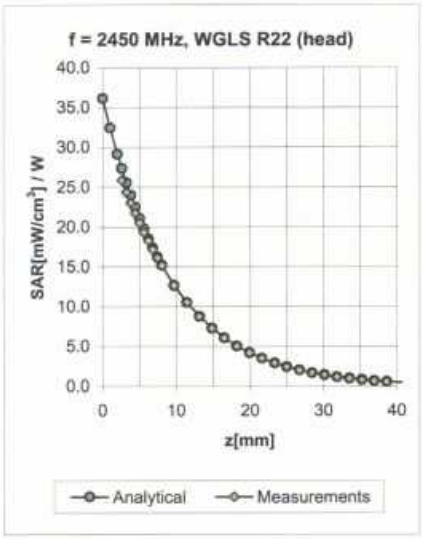
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

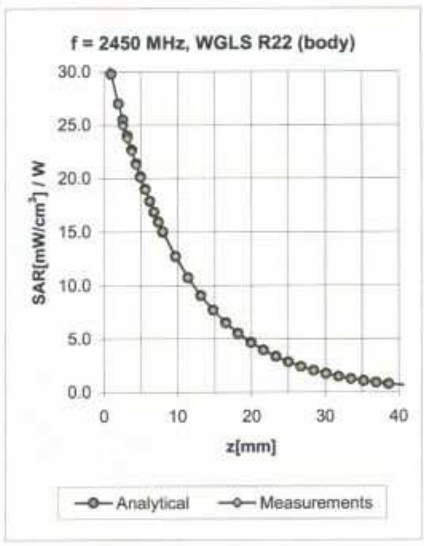
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: June 24, 2009

Conversion Factor Assessment





f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.36	2.00	4.39 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.78	1.17	4.25 ± 11.0% (k=2)

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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Accreditation No.: SCS 108

Client AT4wireless

Certificate No: EX3-3687_Mar09/2

CALIBRATION CERTIFICATE (Replacement of No: EX3-3687_Mar09)

Object	EX3DV4 - SN:3687
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date	March 16, 2009
Condition of the calibrated item	In Tolerance

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)

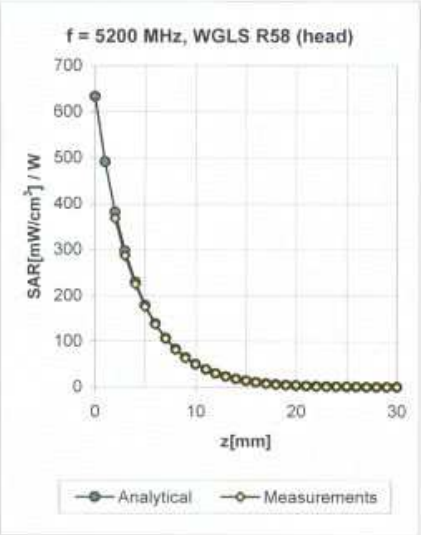
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

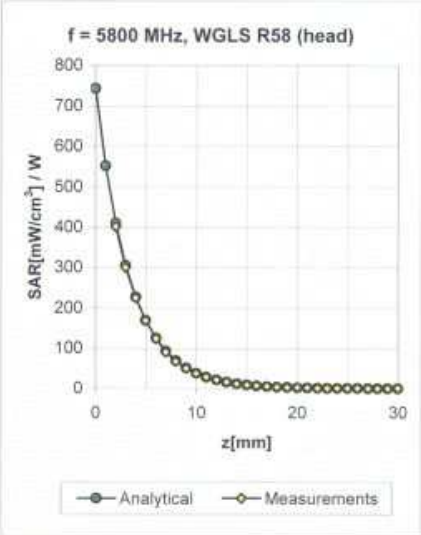
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: April 29, 2009

Conversion Factor Assessment





f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
5200	± 50 / ± 100	Head	36.0 ± 5%	4.66 ± 5%	0.50	1.80	4.48 ± 13.1% (k=2)
5600	± 50 / ± 100	Head	35.5 ± 5%	5.07 ± 5%	0.50	1.80	3.64 ± 13.1% (k=2)
5800	± 50 / ± 100	Head	35.3 ± 5%	5.27 ± 5%	0.50	1.80	4.03 ± 13.1% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.50	1.85	4.08 ± 13.1% (k=2)
5600	± 50 / ± 100	Body	48.5 ± 5%	5.77 ± 5%	0.50	1.85	3.43 ± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.50	1.85	3.74 ± 13.1% (k=2)

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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Accreditation No.: SCS 108

Client AT4wireless

Certificate No: D2450V2-756_Jun09

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 756
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	June 19, 2009
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
Reference Probe ES3DV2	SN: 3025	30-Apr-09 (No. ES3-3025_Apr09)	Apr-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 19, 2009

Measurement Conditions

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

DASY Version	DASY5	V5.0
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	40.4 ± 6 %	1.78 mho/m ± 6 %
Head TSL temperature during test	(22.4 ± 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	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**53.9 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.29 mW / g
SAR normalized	normalized to 1W	25.2 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**25.3 mW /g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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	53.2 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 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	13.4 mW / g
SAR normalized	normalized to 1W	53.6 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**53.0 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.27 mW / g
SAR normalized	normalized to 1W	25.1 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**25.0 mW /g ± 16.5 % (k=2)**

[2] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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Accreditation No.: SCS 108

Client AT4 Wireless

Certificate No: D5GHzV2-1071_Mar09

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1071
Calibration procedure(s)	QA CAL-22.v1 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	March 13, 2009
Condition of the calibrated item	In Tolerance

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	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe EX3DV4	SN: 3503	11-Mar-09 (No. EX3-3503_Mar09)	Mar-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: March 17, 2009

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

Certificate No: D5GHzV2-1071_Mar09 Page 1 of 13

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.5 mm	
Frequency	5200 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	100 mW input power	7.69 mW / g
SAR normalized	normalized to 1W	76.9 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**76.6 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.16 mW / g
SAR normalized	normalized to 1W	21.6 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**21.5 mW / g ± 19.5 % (k=2)**

[1] Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	100 mW input power	7.66 mW / g
SAR normalized	normalized to 1W	76.6 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**76.1 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.14 mW / g
SAR normalized	normalized to 1W	21.4 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**21.2 mW / g ± 19.5 % (k=2)**

[1] Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities"

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	5.30 mho/m ± 6 %
Body TSL temperature during test	(21.2 ± 0.2) °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.61 mW / g
SAR normalized	normalized to 1W	76.1 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**75.7 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 mW / g
SAR normalized	normalized to 1W	21.2 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**21.1 mW / g ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	6.05 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.25 mW / g
SAR normalized	normalized to 1W	72.5 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**71.9 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	1.99 mW / g
SAR normalized	normalized to 1W	19.9 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**19.7 mW / g ± 19.5 % (k=2)**

[2] Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities"

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Accreditation No.: SCS 108

Client **AT4 Wireless**

Certificate No: **D5GHzV2-1071_Apr09**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1071
Calibration procedure(s)	QA CAL-22.v1 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	April 28, 2009
Condition of the calibrated item	In Tolerance

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	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe EX3DV4	SN: 3503	11-Mar-09 (No. EX3-3503_Mar09)	Mar-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 30, 2009

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.5 mm	
Frequency	5500 MHz ± 1 MHz	

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.17 mW / g
SAR normalized	normalized to 1W	81.7 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**81.4 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 mW / g
SAR normalized	normalized to 1W	22.9 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**22.8 mW / g ± 19.5 % (k=2)**

[1] Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.74 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	100 mW input power	8.17 mW / g
SAR normalized	normalized to 1W	81.7 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**81.1 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 mW / g
SAR normalized	normalized to 1W	22.6 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**22.4 mW / g ± 19.5 % (k=2)**

[2] Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities