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SAR Test Report

Report Number: M050753_CERT_WM3B2915ABG_SAR_2.4

Test Sample:	Portable Notebook Computer Wireless LAN
Model:	WM3B2915ABG
Tested For:	Fujitsu Australia Pty Ltd
FCC ID:	EJE-WB0035
IC:	337J-WB0035
Date of Issue:	2nd September 2005

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SAR EVALUATION

Portable Notebook Computer Wireless LAN
Model: WM3B2915ABG

Report Number: M050753_CERT_WM3B2915ABG_SAR_2.4
FCC ID: EJE-WB0035
IC: 337J-WB0035

1.0 GENERAL INFORMATION

Test Sample:	Portable Notebook Computer Wireless LAN and Bluetooth Module
Model Name:	Calexico2
Interface Type:	Mini-PCI Module
Device Category:	Portable Transmitter
Test Device:	Production Unit
FCC ID:	EJE-WB0035
IC:	337J-WB0035
RF exposure Category:	General Population/Uncontrolled
Manufacturer:	Fujitsu Limited

Test Standard/s:

1. Evaluating Compliance with FCC Requirements For Human Exposure to Radiofrequency Electromagnetic Fields Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)
2. Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields. RSS-102 Issue 1 (Provisional) September 25, 1999

Statement Of Compliance: The Fujitsu Portable Notebook Computer Wireless LAN model WM3B2915ABG complied***** with the FCC General public/uncontrolled RF exposure limits of 1.6mW/g per requirements of 47CFR2.1093(d). It also complied with IC RSS-102 requirements.
***.** Refer to compliance statement section 9**.**

Test Date: 24th – 26th August 2005

Tested for:	Fujitsu Australia Pty Ltd
Address:	5 Lakeside Drive, Burwood East, Vic. 3151
Contact:	Praveen Rao
Phone:	+61 3 9845 4300

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Authorised Signature: Aaron Sargent

Aaron Sargent B.Eng
EMR Engineer

SAR EVALUATION
Portable Notebook Computer Wireless LAN
Model: WM3B2915ABG
Report Number: M050753_CERT_WM3B2915ABG_SAR_2.4

2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The EUT is a Fujitsu LifeBook incorporating a Mini-PCI wireless LAN (WLAN) module Calexico2 (WM3B2915ABG). The Calexico2 module is an OEM product. The Mini-PCI wireless LAN (WLAN) module was tested in the dedicated host, a LifeBook P Series “TIGA”. The measurement test results mentioned hereon only apply to the 2450MHz frequency band; an additional report titled “M050751_CERT_WM3B2915ABG_SAR_5.2” applies to the 5200/5800MHz range.

2.1.1 Summary of EUT Details

Operating Mode during Testing		: Crest Factor – DSSS/OFDM = 1.0
Modulation Schemes	802.11b	: Direct Sequence Spread Spectrum (DSSS)
	802.11a	: Orthogonal Frequency Division Multiplexing (OFDM)
	802.11g	: Orthogonal Frequency Division Multiplexing (OFDM)
Bluetooth (BT)	FHSS	: Frequency Hopping Spread Spectrum
Data Rates:		
802.11b	DBPSK	: Data Rate – 1Mbps
	DQPSK	: Date Rate – 2Mbps
	CCK	: Data Rate – 5.5Mbps, 11Mbps
802.11a & 802.11g	BPSK	: Data Rate - 6Mbps, 9Mbps
	QPSK	: Data Rate - 12Mbps, 18Mbps
	16QAM	: Data Rate - 24Mbps, 36Mbps
	64QAM	: Data Rate - 48Mbps, 54Mbps
Device Power Rating for test sample and identical production unit (Max. Output Power)		: 802.11b = 15 dBm : 802.11g = 14 dBm : 802.11a = 10-14 dBm : FHSS = 12 dBm
Antenna type		: Nissei Electric Inverted-F
Applicable Head Configurations		: None
Applicable Body Configurations		1. Notebook Position
Battery Options		: Standard Battery

2.1.2 EUT Host Details

Test Sample:	LIFEBOOK P Series
Model:	P7120D
Codename:	TIGA
CPU Speed:	Pentium-M 1.2 GHz ULV Celeron-M 1.0 GHz ULV
Manufacturer:	Fujitsu Ltd.
LAN:	Realtech RTL8100C : 10 Base-T/100 Base-TX
Modem:	Agere MDC 1.5, Model: AM2
LCD Screen:	10.6” WXGA

2.2 Test sample Accessories

2.2.1 Battery Types

One type of Fujitsu Lithium Ion Batteries is used to power the Portable Notebook Computer Wireless LAN Model: WM3B2915ABG. SAR measurements were performed with the battery as shown below.

Standard Battery

Model	
V/mAh	10.8V/4400mAh
Cell No.	6

2.3 Test Signal, Frequency and Output Power

The Portable Notebook Computer Wireless LAN uses a total of 11 channels (USA model) within the 2412 to 2462 MHz frequency band and 12 channels within the frequency range 5180 – 5825 MHz. The frequency range is 2412 MHz to 2462 MHz and the device operates in 2 modes, OFDM and DSSS. Within the 5180 – 5825 MHz frequency range the device operates in OFDM mode only. For the SAR measurements the device was operating in continuous transmit mode using programming codes supplied by Fujitsu. The fixed frequency channels used in the testing are shown in Table 1.

The Bluetooth module operates over 79 channels within the frequency range 2402 to 2480 MHz. It is possible for the Bluetooth module to operate simultaneously with the WLAN module (co-transmission). For the SAR measurements the device was operating in continuous transmit mode using programming codes supplied by Fujitsu. The tests were conducted with only the WLAN operating and also with the WLAN and Bluetooth module operating in co-transmission. The fixed frequency channels used in the testing are shown in Table 1. The Bluetooth interface utilizes dedicated antenna, for the purpose of this report labelled antenna “D”.

The test results mentioned in this report only apply to the 2450MHz frequency range. An additional report titled *“M050751_CERT_WM3B2915ABG_SAR_5.2”* is specific to the 5200/5800MHz range.

The WLAN modules can be configured in a number of different data rates. It was found that the highest source based time averaged power was measured when using the lowest data rates available in each mode. This lowest data rate corresponds to 6Mbps in OFDM mode and 1Mbps in DSSS mode. Table 1 shows the data rates used in the SAR tests.

The frequency span of the 2450 MHz Band was more than 10MHz consequently; the SAR levels of the test sample were measured for lowest, centre and highest channels in DSSS mode. There were no wires or other connections to the Portable Notebook Computer during the SAR measurements.

At the beginning and completion of the SAR tests, conducted power of the device was measured after temporary modification of antenna connector inside the device’s TX RX compartment. Measurements were performed with a calibrated Power Meter. The results of these measurements are listed in table 1.

Table 1: Frequency and Output Power

Modulation Mode	Channel	Channel Frequency MHz	Antenna	*Data Rate (Mbps)	Maximum Conducted Average Output Power Measured
802.11b - DSSS	01	2412	Aux	1	12.8
802.11b - DSSS	06	2437	Aux	1	12.6
802.11b - DSSS	11	2462	Aux	1	13.1
802.11g - OFDM	01	2412	Aux	6	10.9
802.11g - OFDM	06	2437	Aux	6	10.5
802.11g - OFDM	11	2462	Aux	6	10.7
Bluetooth					
Channel 1	2402	FHSS	D	N/A	11.9
Channel 40	2441	FHSS	D	N/A	11.7
Channel 79	2480	FHSS	D	N/A	11.9

*NOTE: The highest conducted power was measured in these data rates for each respective mode. i.e. DSSS & OFDM.

2.4 Battery Status

The device battery was fully charged prior to commencement of measurement. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the RF field at a defined position inside the phantom before the commencement of each test and again after the completion of the test. It was not possible to perform conducted power measurements at the output of the device, at the beginning and end of each scan due to lack of a suitable antenna port. The uncertainty associated with the power drift was less than 9.5% and was included in the uncertainty budget.

2.5 Details of Test Laboratory

2.5.1 Location

EMC Technologies Pty Ltd - ACN/ABN: 82 057105 549
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website: www.emctech.com.au

2.5.2 Accreditations

EMC Technologies Pty. Ltd. is accredited by the National Association of Testing Authorities, Australia (NATA).
NATA Accredited Laboratory Number: 5292

EMC Technologies Pty Ltd is NATA accredited for the following standards:

AS/NZS 2772.1:	RF and microwave radiation hazard measurement
ACA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003
FCC:	Guidelines for Human Exposure to RF Electromagnetic Field OET 65C 01/01
CENELEC:	ES59005: 1998
EN 50360: 2001	Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)
EN 50361: 2001	Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz)
IEEE 1528: 2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.

Refer to NATA website www.nata.asn.au for the full scope of accreditation.

2.5.3 Environmental Factors

The measurements were performed in a shielded room with no background network signals. The temperature in the laboratory was controlled to within 21±1.0 °C, the humidity was in the range 42% to 44%. The liquid parameters are measured daily prior to the commencement of each test. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY4 SAR measurement system using the SN1380 probe is less than 5μV in both air and liquid mediums.

3.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

3.1 Probe Positioning System

The measurements were performed with the state of the art automated near-field scanning system **DASY4 V4.5 Build 19** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater that 1.1m), which positions the SAR measurement probes with a positional repeatability of better than ±0.02 mm. The DASY4 fully complies with the OET65 C (01-01), IEEE 1528 and EN50361 SAR measurement requirements.

3.2 E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 Serial: 1377 (manufactured by SPEAG) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than ±0.25 dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom. The sensors of the probe are directly loaded with Schottky diodes and connected via highly resistive lines (length = 300 mm) to the data acquisition unit.

3.3 Data Acquisition Electronics

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. The input impedance of the DAE3 box is 200 MΩ; the inputs are symmetrical and floating. Common mode rejection is above 80dB.Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

3.4 Calibration and Validation Procedures and Data

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation was performed at 2450 MHz with the SPEAG 2450V2 calibrated dipole.

The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole.

System validation is performed by feeding a known power level into a reference dipole, set at a know distance from the phantom. The measured SAR is compared to the theoretically derived level.

3.4.1 Validation Results @ 2450MHz

The following table lists the dielectric properties of the tissue simulating liquid measured prior to SAR validation. The results of the validation are listed in columns 4 and 5. The forward power into the reference dipole for SAR validation was adjusted to 250 mW.

Table 2: Validation Results (Dipole: SPEAG D2450V2 SN: 724)

1. Validation Date	2. $\in r$ (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
26th August 2005	39.6	1.87	13.4	6.41

3.4.2 Deviation from reference validation values

The reference SAR values are derived using a reference dipole and flat section of the SAM phantom suitable for a centre frequency of 2450MHz. These reference SAR values are obtained from the IEEE Std 1528-2003 and are normalized to 1W.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole (D2450V2) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table 3 below.

Table 3: Deviation from reference validation values

Frequency and Date	Measured SAR 1g (mW/g)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration reference SAR Value 1g (mW/g)	Deviation From SPEAG Reference (1g)	IEEE Std 1528 reference SAR value 1g (mW/g)	Deviation From IEEE (1g)
2450MHz	13.4	53.6	55.6	-3.6	52.4	2.3

NOTE: All reference validation values are referenced to 1W input power.

3.4.3 Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of a least 15cm with a tolerance of 0.5cm.

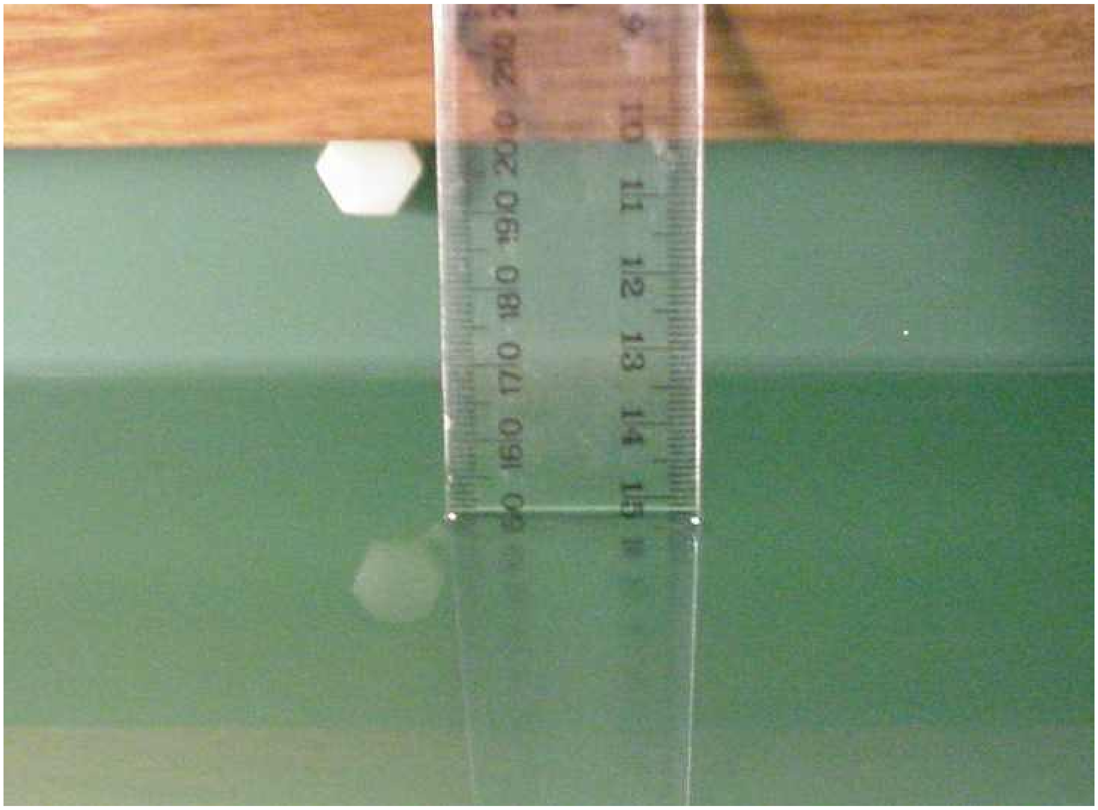


Photo of liquid Depth in Flat Phantom

3.5 Phantom Properties (Size, Shape, Shell Thickness)

The phantom used during the validations was the SAM Phantom model: TP - 1060 from SPEAG. It has a single thickness of 2 mm and was filled with the required tissue simulating liquid. The SAM phantom support structures were all non-metallic and spaced more than one device width away in transverse directions.

For SAR testing in the body worn positions a Flat phantom AndreT P 10.1 was used. The phantom thickness is 2.0mm+/-0.2 mm and the phantom was filled with the required tissue simulating liquid. Table 4 provides a summary of the measured phantom properties.

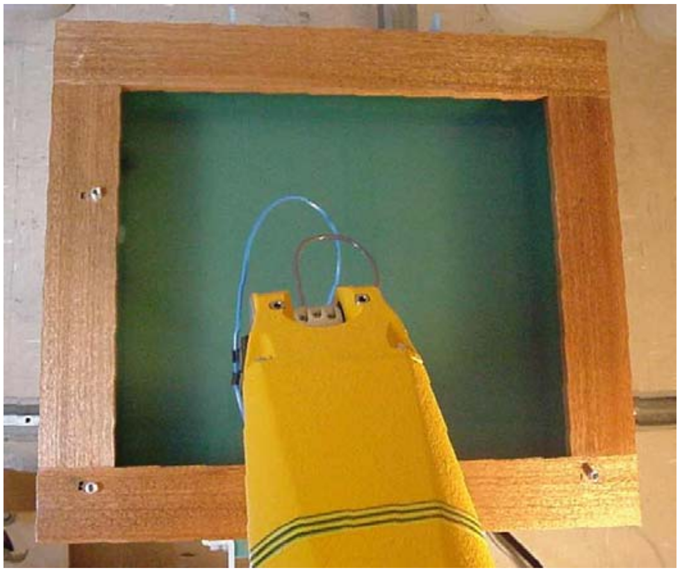
Table 4: Phantom Properties (300MHz-2500MHz)

Phantom Properties	Required	Measured
Thickness of flat section	2.0mm ± 0.2mm (bottom section)	2.12-2.20mm
Dielectric Constant	<5.0	4.603 @ 300MHz (worst-case frequency)
Loss Tangent	<0.05	0.0379 @ 2500MHz (worst-case frequency)

Depth of Phantom	200mm
Length of Flat Section	620mm
Width of Flat Section	540mm

P 10.1 Flat Phantom

P 10.1 Flat Phantom



3.6 Tissue Material Properties

The dielectric parameters of the tissue simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8753ES Network Analyser. The actual dielectric parameters are shown in the following table.

Table 5: Measured Brain Simulating Liquid Dielectric Values - Validation

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
2450 MHz Brain	39.6	39.2 ±5% (37.2 to 41.2)	1.87	1.80 ±5% (1.71 to 1.89)	1000

Table 6: Measured Body Simulating Liquid Dielectric Values

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
2437 MHz Muscle	50.32	52.7 ±5% (50.1 to 55.3)	2.00	1.95 ±5% (1.85 to 2.05)	1000

NOTE: The brain and muscle liquid parameters were within the required tolerances of ±5%.

3.6.1 Liquid Temperature and Humidity

The humidity and dielectric/ambient temperatures were recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

Table 7: Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
26th August 2005	20.7	20.2	44.0

3.7 Simulated Tissue Composition Used for SAR Test

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

Table 8: Tissue Type: Brain @ 2450MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	62.7
Salt	0.5
Triton X-100	36.8

Table 9: Tissue Type: Muscle @ 2450MHz
Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	73.2
Salt	0.04
DGBE	26.7

*Refer "OET Bulletin 65 97/01 P38"

3.8 Device Holder for Laptops and P 10.1 Phantom

A low loss clamp was used to position the Laptop underneath the phantom surface. Small pieces of foam were then used to press the laptop flush against the phantom surface.

Refer to Appendix A for photographs of device positioning

4.0 SAR MEASUREMENT PROCEDURE USING DASY4

The SAR evaluation was performed with the SPEAG DASY4 system. A summary of the procedure follows:

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.

b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 3.0 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm. The actual Area Scan has dimensions of 101 mm x 141 mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first "pre-scans" covered an area of 131 mm x 161 mm to ensure that the hotspot was correctly identified.

c) Around this point, a volume of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

   (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

   (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

   (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

   (iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.

5.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both Handset SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table 10: Uncertainty Budget for DASY4 Version V4.5 Build 19 – EUT SAR test @ 2450MHz

a	b	c	D	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i (%)	10g u_i (%)	v_i
Measurement System									
Probe Calibration (k=1) (numerical calibration)	7.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	7.2.1	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	7.2.1	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	7.2.1	1	R	1.73	1	1	0.6	0.6	∞
Linearity	7.2.1	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	7.2.1	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	7.2.1	1	N	1	1	1	1.0	1.0	∞
Response Time	7.2.1	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	7.2.1	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions	7.2.3	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	7.2.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	7.2.2	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	7.2.4	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	7.2.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty									7
Output Power Variation – SAR Drift Measurement	7.2.3	5	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	7.2.2	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	7.2.3	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	7.2.3	4.3	N	1	0.64	0.43	2.8	1.8	5
Liquid Permittivity – Deviation from target values	7.2.3	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	7.2.3	4.3	N	1	0.6	0.49	2.6	2.1	5
Combined standard Uncertainty			RSS				9.7	9.2	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				19.4	18.38	

Estimated total measurement uncertainty for the DASY4 measurement system was ± 9.7 %. The extended uncertainty (K = 2) was assessed to be ±19.4% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table 11: Uncertainty Budget for DASY4 Version V4.5 Build 19 – Validation 2450MHz

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (6%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i (6%)	10g u_i (6%)	v_i
Measurement System									
Probe Calibration (k=1) (standard calibration)	E.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	R	1.73	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	1	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related				□					
Dipole Axis to Liquid Surface		2	R	1.73	1	1	1.2	1.2	∞
Power Drift		4.7	R	1.73	1	1	2.7	2.7	∞
				□					□
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.43	1.7	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.43	0.9	0.6	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.49	0.9	0.7	5
Combined standard Uncertainty			RSS				8.0	7.8	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				16.0	15.63	

Estimated total measurement uncertainty for the DASY4 measurement system was ±8.0%. The extended uncertainty (K = 2) was assessed to be ±16.0% based on 95% confidence level. The uncertainty is not added to the Validation measurement result.

6.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table 12: SPEAG DASY4 V4.5 Build 19

EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	Yes
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1260	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1060	Not applicable	No
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	Yes
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	No
Flat Phantom	SPEAG	PO1A 6mm	1003	Not Applicable	No
Data Acquisition Electronics	SPEAG	DAE3 V1	359	07-July-2006	No
Data Acquisition Electronics	SPEAG	DAE3 V1	442	06-Dec-2005	Yes
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	No
Probe E-Field	SPEAG	ET3DV6	1380	14-Dec-2005	No
Probe E-Field	SPEAG	ET3DV6	1377	14-July-2006	Yes
Probe E-Field	SPEAG	ES3DV6	3029	1-Nov-2005	No
Antenna Dipole 300 MHz	SPEAG	EX3DV4	3563	1-July-2006	No
Antenna Dipole 450 MHz	SPEAG	D300V2	1005	27- Nov-2005	No
Antenna Dipole 900 MHz	SPEAG	D450V2	1009	15-Dec-2006	No
Antenna Dipole 1640 MHz	SPEAG	D900V2	047	12-July-2006	No
Antenna Dipole 1800 MHz	SPEAG	D1640V2	314	25-May-2006	No
Antenna Dipole 2450 MHz	SPEAG	D1800V2	242	13-July-2006	Yes
Antenna Dipole 5600 MHz	SPEAG	D2450V2	724	2-Nov-2006	No
RF Amplifier	SPEAG	D3500V2	1002	1-July-2007	No
RF Amplifier	SPEAG	D5GHzV2	1008	05-Oct-2005	No
RF Amplifier	EIN	603L	N/A	In test	No
Synthesized signal generator	Mini-Circuits	ZHL-42	N/A	In test	Yes
RF Power Meter Dual	Mini-Circuits	ZVE-8G	N/A	In test	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	ESG-D3000A	GB37420238	*Not Required	Yes
RF Power Meter Dual	Hewlett Packard	437B	3125012786	28-May-2006	Yes
RF Power Sensor	Hewlett Packard	8481H	1545A01634	30-May-2006	Yes
RF Power Meter Dual	Gigatronics	8542B	1830125	13-April-2006	No
RF Power Sensor	Gigatronics	80301A	1828805	13-April-2006	No
Network Analyser	Hewlett Packard	435A	1733A05847	*Not Required	Yes
Network Analyser	Hewlett Packard	8482A	2349A10114	*Not Required	No
Dual Directional Coupler	Hewlett Packard	8714B	GB3510035	10-Sept-2005	No
Dual Directional Coupler	Hewlett Packard	8753ES	JP39240130	11-Aug-2006	Yes

7.0 OET BULLETIN 65 – SUPPLEMENT C TEST METHOD

7.1 Description of the Test Positions (Lap Top)

Notebooks should be evaluated in normal use positions, typical for lap-held bottom-face only. However the number of positions will depend on the number of configurations the laptop can be operated in. The P Series laptop “TIGA” can be used in a conventional laptop position (see Appendix A1). The antenna location in the “TIGA” is closest to the top of the screen when used in a conventional laptop configuration and due to the separation distances involved between the phantom and the laptop antenna, testing is technically required in this position.

Therefore SAR measurements were performed with the bottom face of the laptop facing the flat section of the AndreT Flat phantom (P 10.1). See Appendix A for photos of test positions.

7.1.1 “Notebook” Position Definition (0mm spacing)

The device was tested in the 2.00 mm flat section of the AndreT Flat phantom P 10.1 for the “Notebook” position. The Transceiver was placed at the bottom of the phantom and suspended in such way that the bottom of the device was touching the phantom. This device orientation simulates the laptops normal use – being held on the lap of the user. A spacing of 0mm ensures that the SAR results are conservative and represent a worst-case assessment.

7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

The device has a fixed antenna. Depending on the measured SAR level up to three test channels with the test sample operating at maximum power, as specified in section 2.3 were recorded. The following table represents the matrix used to determine what testing was required.

Table 13: Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			Channel (Low)	Channel (Middle)	Channel (High)
Notebook	OFDM	A			
(No Bluetooth)		B			
	DSSS	A			
		B			
Notebook	DSSS	A			
(With Bluetooth)		B		X	

Legend

X	Testing Required in this configuration
	Testing not required in this configuration because SAR of middle channel is more than 3dB below the SAR limit.

7.3 FCC RF Exposure Limits for Occupational/ Controlled Exposure

Spatial Peak SAR Limits For:	
Partial-Body:	8.0 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	20.0 mW/g (averaged over 10g cube of tissue)

7.4 FCC RF Exposure Limits for Un-controlled/Non–occupational

Spatial Peak SAR Limits For:	
Partial-Body:	1.6 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	4.0 mW/g (averaged over 10g cube of tissue)

8.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 1g tissue masses were determined for the sample device for all test configurations listed in section 7.2.

1. Test Position	2. Plot No.	3. Antenna	4. Test Channel	5. Test Freq (MHz)	6. Measured 1g SAR Results (mW/g)	7. Measured Drift (dB)
Notebook	1	Aux	6	2437	0.00621	*-

*SAR results are within the noise floor of the DASY4 system drift not evaluated.
NOTE: The measurement uncertainty of 19.4% for 2.45GHz was not added to the result.

The highest SAR level recorded in the 2450MHz band was 0.00621 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in “Notebook” position in DSSS mode, utilizing channel 6 (2437 MHz), at the antenna Aux. The Bluetooth was ON at the Frequency of 2441 MHz.

9.0 COMPLIANCE STATEMENT

The model WM3B2915ABG, FCC ID: EJE-WB0035, IC: 337J-WB0035 Portable Notebook Computer Wireless LAN was found to comply with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded was 0.00621 mW/g for a 1g cube. This value was measured at 2437 MHz (channel 6) in the “Notebook” position in DSSS modulation mode with antenna Aux. The Bluetooth was ON at Frequency 2441 MHz. This was below the limit of 1.6 mW/g for uncontrolled exposure, even taking into account the measurement uncertainty of 19.4 %.

APPENDIX A1 TEST SAMPLE PHOTOGRAPHS

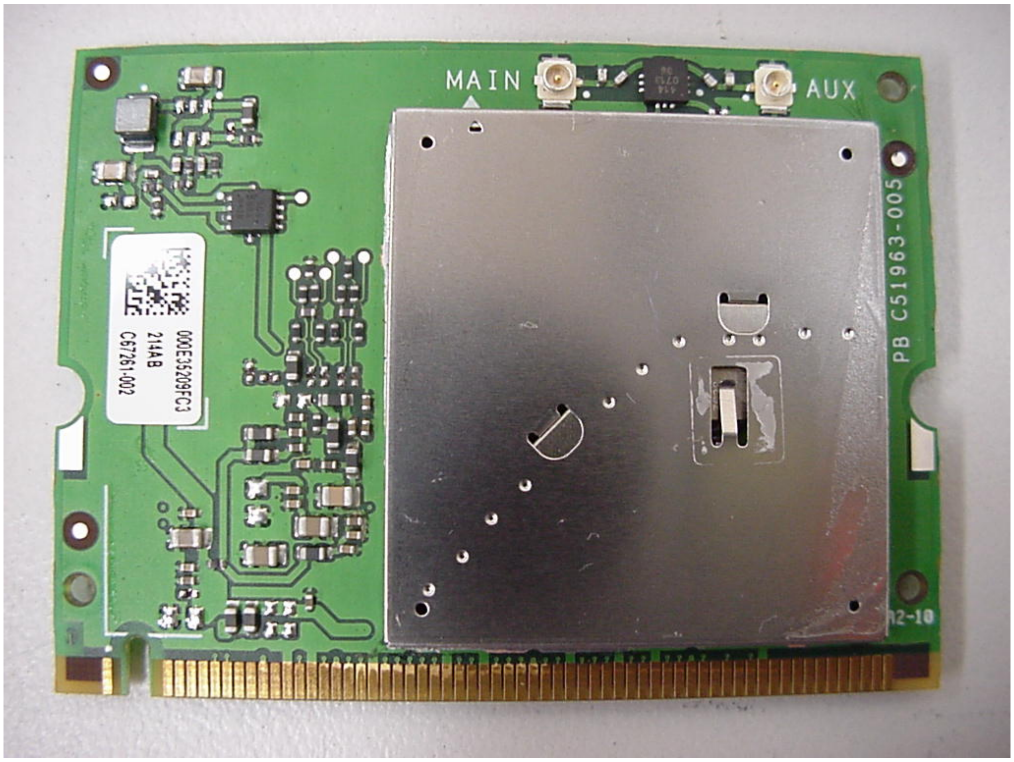
TIGA Host – Antenna Locations

TIGA Host - Notebook Configuration

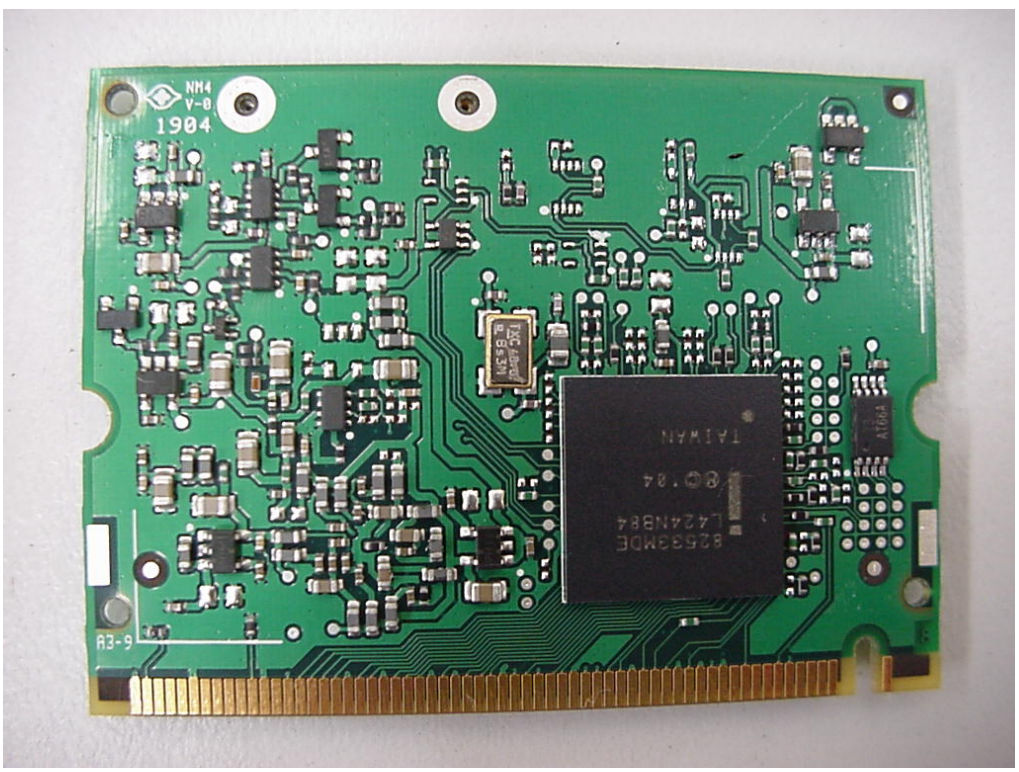
APPENDIX A2 TEST SAMPLE PHOTOGRAPHS

WLAN module Model: WM3B2915ABG

Front



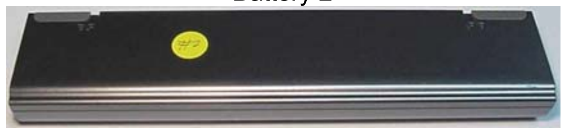
Back



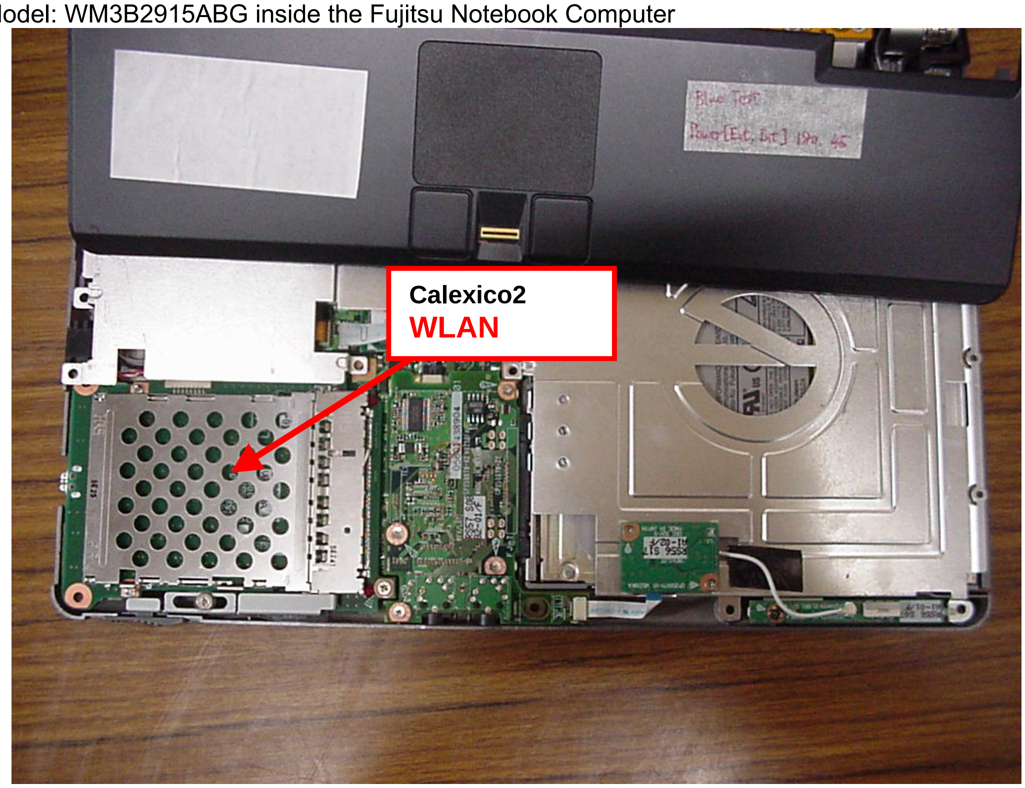
APPENDIX A3 TEST SAMPLE PHOTOGRAPHS

Battery 1

Battery 2



WLAN Model: WM3B2915ABG inside the Fujitsu Notebook Computer



APPENDIX A4 TEST SETUP PHOTOGRAPHS

Notebook Position

APPENDIX B PLOTS OF THE SAR MEASUREMENTS

Plots of the measured SAR distributions inside the phantom are given in this Appendix for the "Notebook" configurations. The spatial peak SAR values were assessed with the procedure described in this report.

Table 15: 2500MHz Validation Plots

Plot 1	Notebook Position – Ant Aux – Pre-scan	CH#06
Z-Axis Graphs	Z-Axis graph for Plots 1	

Table 16: 2500MHz Validation Plot

Plot 2	Validation 2500MHz 26th August 2005
Z-Axis Graphs	Z-Axis graphs for Plot 1

Test Date: 26 August 2005

File Name: Notebook DSSS 2.45 GHz Antenna Aux Bluetooth On Prescan 26-08-05.da4

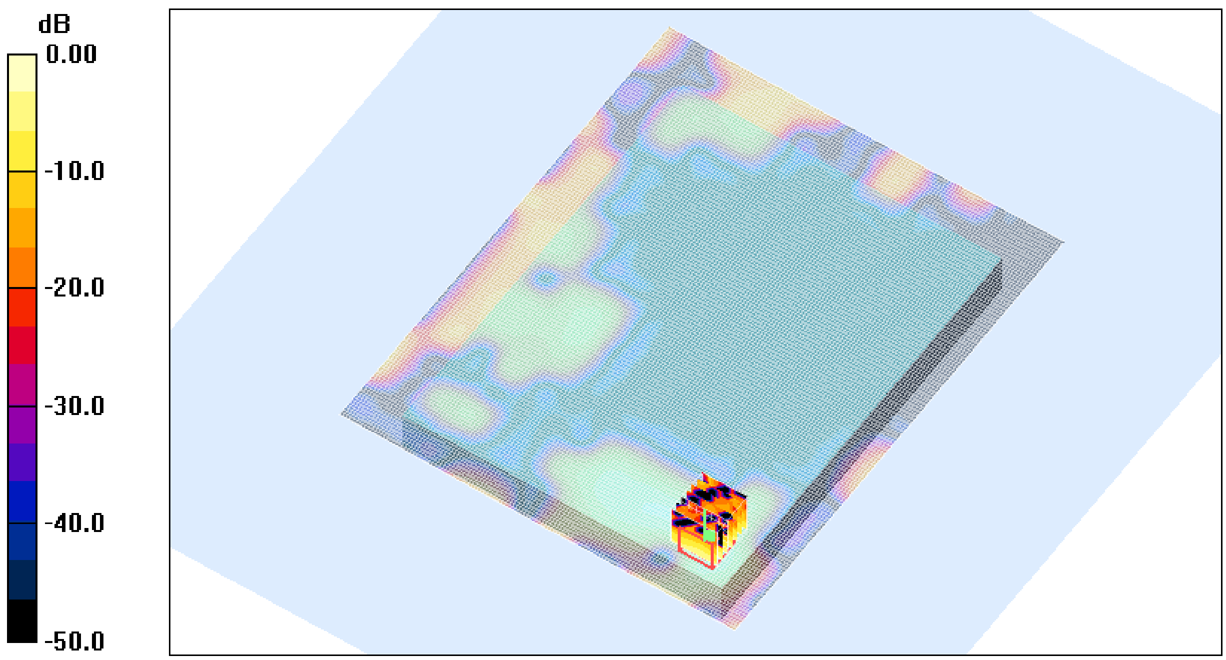
DUT: Fujitsu Notebook Tiga with Calexico 11abg and Bluetooth; Type: CP254581-01; Serial: Not Specified

* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
* Medium parameters used: σ = 1.99999 mho/m, ε_r = 50.3177; ρ = 1000 kg/m^3

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.99, 3.99, 3.99)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (131x161x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.01 mW/g

Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.034 V/m; Power Drift
Peak SAR (extrapolated) = 0.011 W/kg
SAR(1 g) = 0.00621 mW/g; SAR(10 g) = 0.00266 mW/g
Maximum value of SAR (measured) = 0.01 mW/g

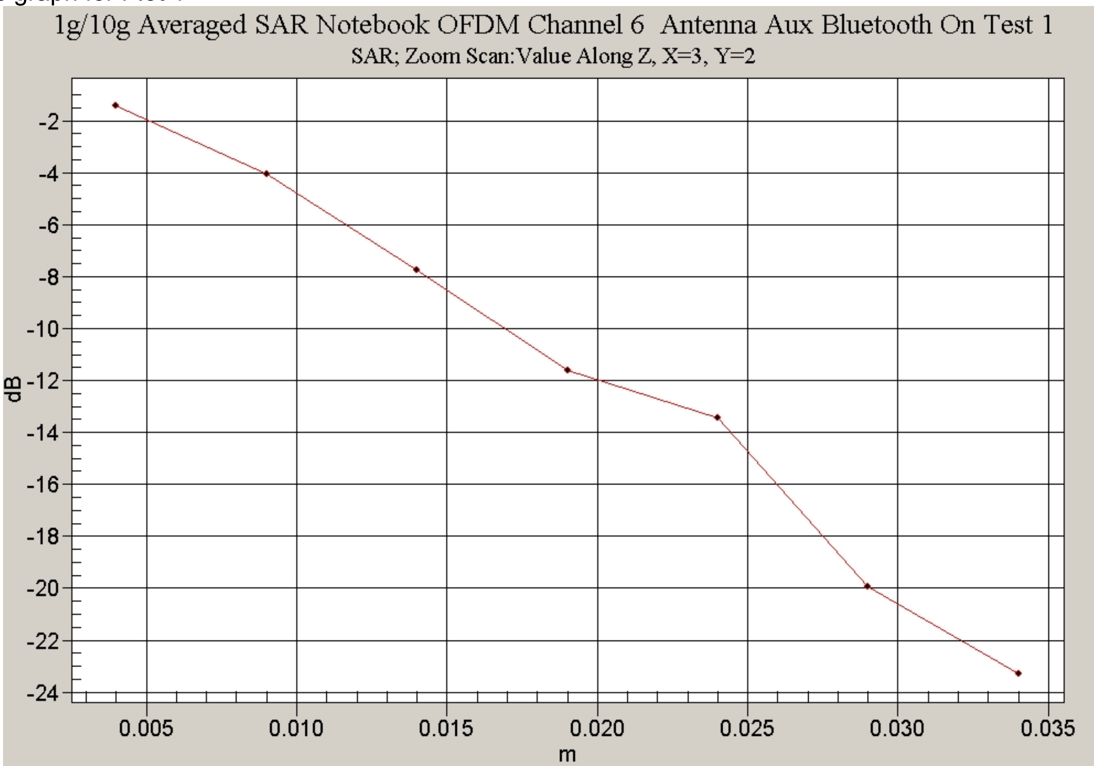


0 dB = 0.010mW/g

SAR MEASUREMENT PLOT 1

Ambient Temperature	**20.7 Degrees Celsius**
Liquid Temperature	**20.2 Degrees Celsius**
Humidity	**44.0 %**

Z-Axis graph for Plot 1



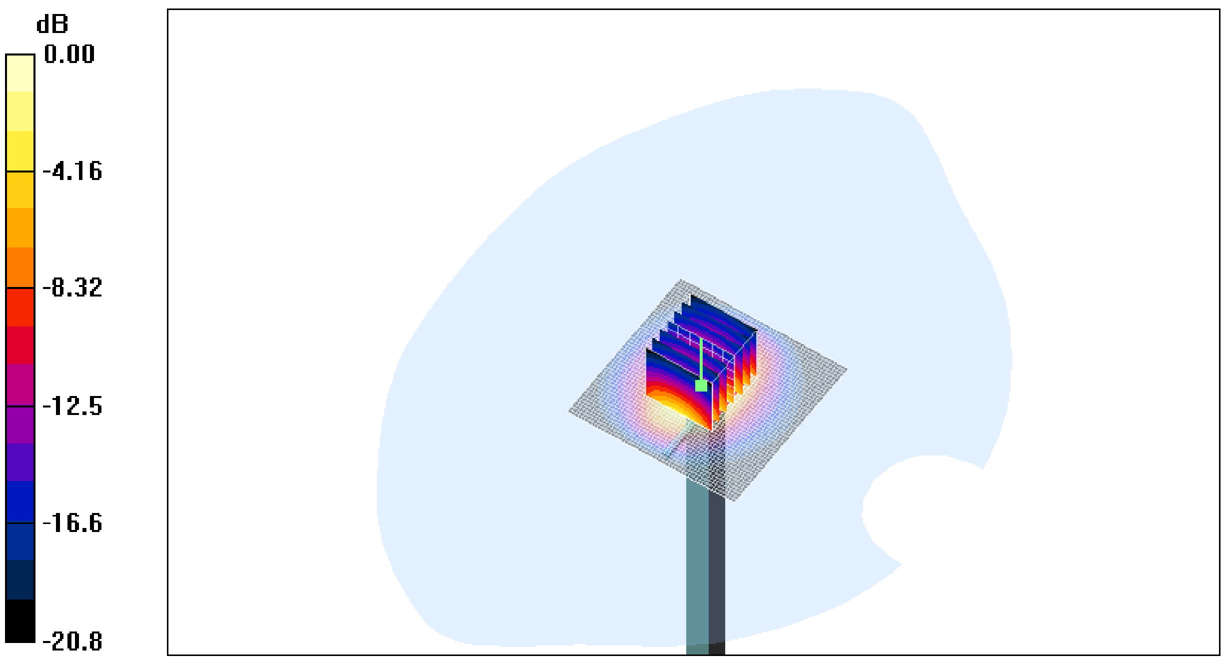
Test Date: 26 August 2005

File Name: Validation 2450 MHz (DAE442 Probe1377) 26-08-05.da4
DUT: Dipole 2450 MHz; Type: DV2450V2; Serial: 724

* Communication System: CW 2450 MHz; Frequency: 2450 MHz; Duty Cycle: 1:1
* Medium parameters used: σ = 1.87093 mho/m, ε_r = 39.6421; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(4.57, 4.57, 4.57)
- Phantom: SAM 22; Serial: 1260; Phantom section: Flat Section

Channel 1 Test/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 18.6 mW/g

Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.1 V/m; Power Drift = 0.067 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.41 mW/g
Maximum value of SAR (measured) = 15.1 mW/g

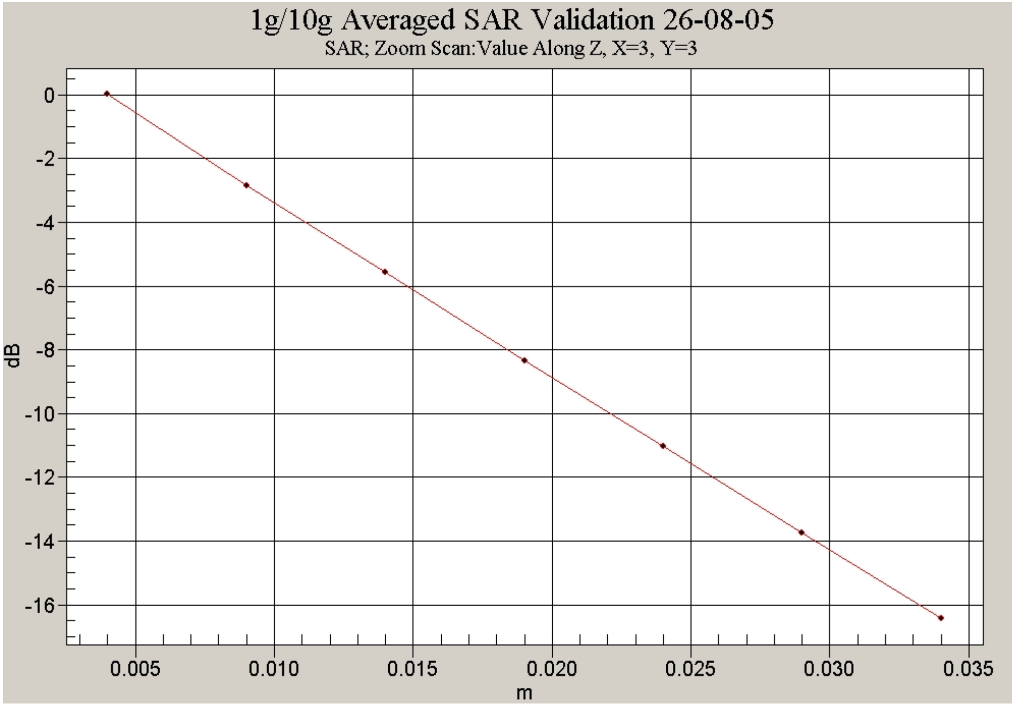


0 dB = 15.1mW/g

SAR MEASUREMENT PLOT 2

Ambient Temperature	**20.7 Degrees Celsius**
Liquid Temperature	**20.2 Degrees Celsius**
Humidity	**44.0 %**

Z-Axis Scan for Plot 2



APPENDIX C
SAR TESTING EQUIPMENT CALIBRATION CERTIFICATE ATTACHMENTS

Calibration Certificate Attachments

1. 2.4GHz E-Field Probe Calibration Sheet	10 Pages
2. 2400MHz Dipole Calibration Sheet	5 pages