



EMC Technologies Pty Ltd

A.C.N. 057 105 549

57 Assembly Drive

Tullamarine Victoria Australia 3043

Ph: + 613 9335 3333

Fax: + 613 9338 9260

email: melb@emctech.com.au

SAR Test Report

Report Number: M061026_CERT_AR5BXB6_SAR_5.6G

Test Sample: LifeBook P Series
Model Number: P7230
Radio Modules AR5BXB6
Tested For: Fujitsu Australia Pty Ltd
FCC ID: EJE-WB0045
IC: 337J- WB0045
Date of Issue: 30th October 2006

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

www. emctech.com.au

CONTENTS

1.0	GENERAL INFORMATION.....	3
2.0	DESCRIPTION OF DEVICE.....	4
2.1	Description of Test Sample	4
2.1.1	Summary of EUT Details	4
2.1.2	EUT Host Details	5
2.2	Test sample Accessories	5
2.2.1	Battery Types	5
2.3	Test Signal, Frequency and Output Power	6
2.4	Battery Status.....	7
2.5	Details of Test Laboratory	7
2.5.1	Location.....	7
2.5.2	Accreditations.....	7
2.5.3	Environmental Factors.....	8
3.0	DESCRIPTION OF SAR MEASUREMENT SYSTEM	8
3.1	Probe Positioning System	8
3.2	E-Field Probe Type and Performance	8
3.3	Data Acquisition Electronics.....	8
3.4	Calibration and Validation Procedures and Data	8
3.4.1	Validation Results @ 5GHz	9
3.4.2	Deviation from reference validation values	9
3.4.3	Liquid Depth 15cm.....	10
3.5	Phantom Properties (Size, Shape, Shell Thickness)	11
3.6	Tissue Material Properties.....	12
3.6.1	Liquid Temperature and Humidity.....	13
3.7	Simulated Tissue Composition Used for SAR Test	13
3.8	Device Holder for Laptops and P 10.1 Phantom	13
4.0	SAR MEASUREMENT PROCEDURE USING DASY4.....	14
5.0	MEASUREMENT UNCERTAINTY	15
6.0	EQUIPMENT LIST AND CALIBRATION DETAILS.....	17
7.0	OET BULLETIN 65 – SUPPLEMENT C TEST METHOD	18
7.1.1	“Notebook” Position Definition (0mm spacing).....	18
7.2	List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes).....	19
7.3	FCC RF Exposure Limits for Occupational/ Controlled Exposure.....	19
7.4	FCC RF Exposure Limits for Un-controlled/Non-occupational	19
8.0	SAR MEASUREMENT RESULTS	20
8.1	5.6 GHz Band SAR Results	20
9.0	COMPLIANCE STATEMENT	21
APPENDIX A1	TEST SAMPLE PHOTOGRAPHS	22
APPENDIX A2	TEST SAMPLE PHOTOGRAPHS	23
APPENDIX A3	TEST SAMPLE PHOTOGRAPHS	24
APPENDIX A4	TEST SETUP PHOTOGRAPHS	25
APPENDIX B	PLOTS OF THE SAR MEASUREMENTS	26
APPENDIX C	SAR TESTING EQUIPMENT CALIBRATION CERTIFICATE ATTACHMENTS ...	29

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

SAR TEST REPORT
LifeBook P Series
Model: P7230 Radio Module AR5BxB6
Report Number: M061026_CERT_AR5BxB6_SAR_5.6G
FCC ID: EJE-WB0045 IC: 337J- WB0045

1.0 GENERAL INFORMATION

Test Sample: LifeBook P Series
Model Name: P7230
Radio Modules: XB62 Mini-PCI WLAN Module, Model AR5BxB6 (Atheros)
Bluetooth Module Model:EYTF3CSFT (TAIYO YUDEN)
Interface Type: Mini-PCI Module
Device Category: Portable Transmitter
Test Device: Production Unit
Model Number: AR5BxB6
FCC ID: EJE-WB0045
IC: 337J- WB0045
RF exposure Category: General Population/Uncontrolled

Manufacturer: Fujitsu Limited

Test Standard/s:

1. Evaluating Compliance with FCC Guidelines 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 LifeBook P Series Model P7230 with Wireless LAN model AR5BxB6 complied* with the FCC General public/uncontrolled RF exposure limits of 1.6mW/g per requirements of 47CFR 2.1093(d). It also complied with IC RSS-102 requirements.
*. Refer to compliance statement section 9.

Test Date: 19th October 2006

Tested for: Fujitsu Australia Pty Ltd
Address: 1230 Nepean Highway, Cheltenham VIC 3192
Contact: Praveen Rao
Phone: +61 3 9265 0210
Fax: +61 3 9265 0656

Test Officer:



Peter Jakubiec
Assoc Dip Elect Eng

Authorised Signature:



Aaron Sargent B.Eng
EMR Engineer

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

SAR TEST REPORT
LifeBook P Series
Model: P7230 Radio Module AR5BxB6
Report Number: M061026_CERT_AR5BxB6_SAR_5.6G
FCC ID: EJE-WB0045 IC: 337J- WB0045

2.0 DESCRIPTION OF DEVICE

(Information supplied by the client)

2.1 Description of Test Sample

The EUT is a Fujitsu LifeBook P series incorporating a Mini-PCI wireless LAN (WLAN) module XB62 (AR5BxB6). The XB62 module is an OEM product. The Mini-PCI wireless LAN (WLAN) module was tested in the dedicated host, a LifeBook P series "MISTLETOE".

The measurement test results mentioned herein only apply to the 5GHz frequency band; an additional report titled "M061026_CERT_AR5BxB6_SAR_2.4G" applies to the 2450MHz frequency range.

2.1.1 Summary of EUT Details

Table: EUT Details

WLAN Module	: XB62 11abg, Model: AR5BxB6
Antenna type	: Monopole Ceramic chip CP313544 (Main: Right), CP313545 (Aux: Left)
Applicable Head Configurations	: None
Applicable Body Configurations	: Notebook Position
Battery Options	: Standard

Table: Modulation Schemes and Frequency Ranges

Frequency Range	Modulation	Rated Power Output (dBm)
2.402-2.480	Bluetooth (BT) Frequency Hopping Spread Spectrum (FHSS)	12
2.412-2.462 GHz	802.11b - DSSS	17
	802.11g - OFDM	
5.180-5.320 GHz	802.11a – OFDM	16
5.500-5.700 GHz		16
5.745-5.825 GHz		16

NOTE: For 2.4GHz SAR results refer to report titled "M061026_CERT_AR5BxB6_SAR_2.4G".

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

www.emctech.com.au

Table: 802.11a

Modulation Scheme	Date Rate
BPSK	6Mbps , 9Mbps
QPSK	12Mbps, 18Mbps
16QAM	24Mbps, 36Mbps
64QAM	48Mbps, 54Mbps

NOTE: For 2.4GHz SAR results refer to report titled "M061026_CERT_AR5BxB6_SAR_2.4G".

Table: 802.11b

Modulation Scheme	Date Rate
DBPSK	1Mbps
DQPSK	2Mbps
CCK	5.5Mbps, 11Mbps

Table: 802.11g

Modulation Scheme	Date Rate
BPSK	6Mbps , 9Mbps
QPSK	12Mbps, 18Mbps
16QAM	24Mbps, 36Mbps
64QAM	48Mbps, 54Mbps

2.1.2 EUT Host Details

Table: Host Details

Test Sample:	LifeBook P series
Model:	P7230
Codename:	MISTLETOE
CPU Speed:	Core Duo U2500 1.2GHz
Manufacturer:	Fujitsu Ltd.
LAN:	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: D40
LCD Screen:	10.6" WXGA

2.2 Test sample Accessories

2.2.1 Battery Types

One type of Fujitsu Lithium Ion Battery is used to power the EUT. SAR measurements were performed with the battery as shown below.

Standard Battery

Model	W01A-K36AT
V	10.8V
Cell No.	6

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

2.3 Test Signal, Frequency and Output Power

The Portable Tablet Computer Wireless LAN had a total of 11 channels (USA model) within the 2412 to 2462 MHz frequency band and 28 channels within the frequency range 5180 – 5825 MHz. In The frequency range 2412 MHz to 2462 MHz 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 the table below.

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 the table below. 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 5200/5800MHz frequency range. An additional report titled "M061026_CERT_AR5BxB6_SAR_2.4G" is specific to the 2450MHz 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. The table below shows the data rates used in the SAR tests.

The frequency span of the 2450 MHz band and 5600MHz bands was more than 10MHz consequently; the SAR levels of the test sample were measured for lowest, centre and highest channels in the applicable modes. There were no wires or other connections to the Portable NOTEBOOK Computer during the SAR measurements.

At the beginning and at the completion of the SAR tests, the 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 this measurement are listed in the following table.

Table: Frequency and Conducted Power Results WLAN

Channel	Channel Frequency MHz	Modulation	Maximum Conducted Output Power - Peak Measured (dBm)
Channel 36	5180	OFDM	16.9
Channel 52	5260	OFDM	16.6
Channel 64	5320	OFDM	17.0
Channel 100	5500	OFDM	16.8
Channel 120	5600	OFDM	16.3
Channel 140	5700	OFDM	16.6
Channel 149	5745	OFDM	16.9
Channel 157	5785	OFDM	16.6
Channel 165	5825	OFDM	17.0

Table: Frequency and Conducted Power Results Bluetooth

Channel	Channel Frequency MHz	Modulation	Antenna Port	*Data Rate (Mbps)	Maximum Conducted Output Power Measured (dBm)
Channel 1	2402	FHSS	D	N/A	3.5
Channel 40	2441	FHSS	D	N/A	3.7
Channel 79	2480	FHSS	D	N/A	3.9

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 12% and was assessed in the uncertainty budget.

2.5 Details of Test Laboratory

2.5.1 Location

EMC Technologies Pty Ltd - ABN: 82057105549
57 Assembly Drive
Tullamarine, (Melbourne) Victoria
Australia 3043

Telephone: +61 3 9335 3333
Facsimile: +61 3 9338 9260
email: melb@emctech.com.au
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 2772.2: RF and microwave radiation hazard measurement
ACA: Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003
FCC: Guidelines for Human Exposure to RF Electromagnetic Field OET65C 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.

The 5.2 to 5.8 GHz SAR measurement range is not within the current scope of NATA accreditation. Refer to NATA website www.nata.asn.au for the full scope of accreditation.

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director, EMC Technologies Pty. Ltd.

www.emctech.com.au

2.5.3 Environmental Factors

The measurements were performed in a shielded room with no background RF signals. The temperature in the laboratory was controlled to within $21 \pm 1^\circ\text{C}$, the humidity was 43%. 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 EX3DV4 probe SN3563 was less than $5\mu\text{V}$ 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 V4.6 Build 23.7** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater than 1.1m), which positions the SAR measurement probes with a positional repeatability of better than $\pm 0.02\text{ mm}$. 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 SPEAG dosimetric probe EX3DV4 Serial: 3563 (5.6 GHz) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than $\pm 0.25\text{ dB}$. 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 $200\text{ M}\Omega$; 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 validations were performed in the 5.6 GHz band with the SPEAG calibrated dipole D5GHzV2.

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 known distance from the phantom. The measured SAR is compared to the theoretically derived level.

3.4.1 Validation Results @ 5GHz

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: Validation Results (Dipole: SPEAG D5GHzV2 SN: 1008)

1. Validation Date	2. ϵ_r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
19 th Oct 06	34.6	5.13	23.1	6.61

3.4.2 Deviation from reference validation values

Currently no IEEE Std 1528-2003 SAR reference values are available in 5.6 GHz band, as a consequence all validation results were compared against the SPEAG calibration reference SAR values.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole (D5GHzV2) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in below.

Table: Deviation from reference validation values in 5.6 GHz band.

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)
5500MHz	23.1	92.4	86.8	6.45

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

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

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.

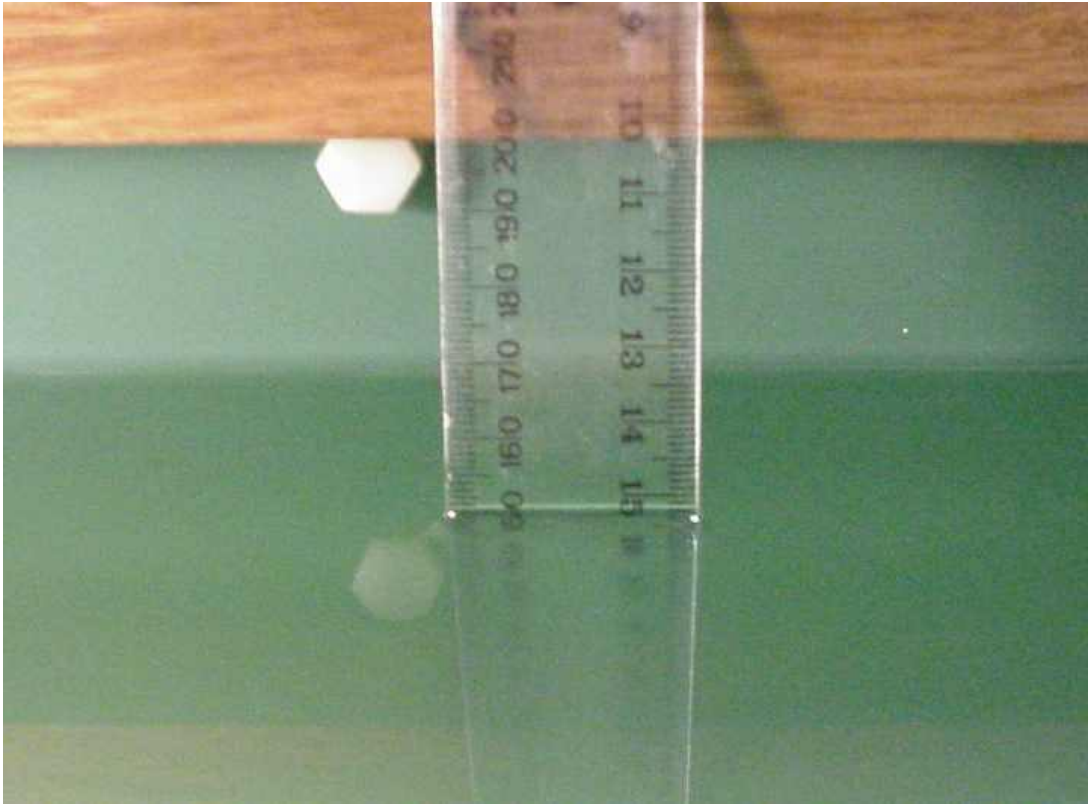


Photo of liquid Depth in Flat Phantom

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

www.emctech.com.au

3.5 Phantom Properties (Size, Shape, Shell Thickness)

The phantom used during the validations was the SAM Phantom model: TP - 1060 from SPEAG. It is a phantom with 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 an AndreT Flat phantom P 10.1 was used. The phantom thickness is 2.0mm $\pm$ 0.2 mm and was filled with the required tissue simulating liquid. Table below provides a summary of the measured phantom properties.

Table: Phantom Properties (300MHz-2500MHz)

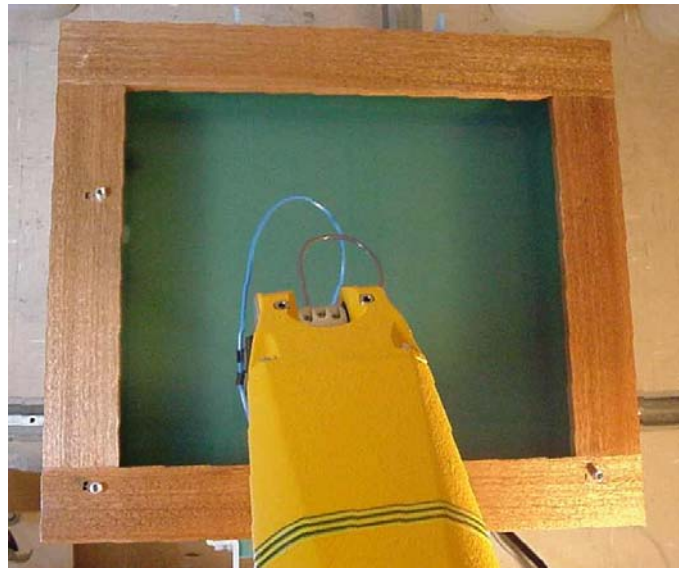
Phantom Properties	Required	Measured
Thickness of flat section	2.0mm $\pm$ 0.2mm (bottom section)	2.12-2.20mm
Dielectric Constant	<5.0	4.603 @ 300MHz (worst-case frequency)
Loss Tangent	<0.05	0.0379 @ 2500MHz (worst-case frequency)

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

P 10.1 Flat Phantom



P 10.1 Flat Phantom



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

3.6 Tissue Material Properties

The dielectric parameters of the brain 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: Measured Brain Simulating Liquid Dielectric Values for Validations

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m ³
5500 MHz Brain	34.6	35.6 $\pm$ 5% (33.8 to 37.4)	5.13	4.96 $\pm$ 5% (4.71 to 5.21)	1000

NOTE: The brain liquid parameters were within the required tolerances of $\pm$ 5%.

Table: Measured Body Simulating Liquid Dielectric Values for 5600MHz range

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m ³
5600 MHz Muscle	47.8	48.5 $\pm$ 10% (43.8 to 53.5)	5.93	5.77 $\pm$ 10% (5.20 to 6.34)	1000

NOTE: The muscle liquid parameters were within the required tolerances of $\pm$ 10%.

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 $|2|^\circ\text{C}$.

Table: Temperature and Humidity recorded for each day

Date	Ambient Temperature ($^\circ\text{C}$)	Liquid Temperature ($^\circ\text{C}$)	Humidity (%)
19 th October 2006	21.5	21.0	43.0

3.7 Simulated Tissue Composition Used for SAR Test

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

Table: Tissue Type: Muscle @ 5600MHz

Volume of Liquid: 60 Litres

EMCT Liquid

Composition
Distilled Water
Salt
Triton X-100

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 2.0 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 101mm x 81mm 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 171 mm x 181 mm to ensure that the hotspot was correctly identified.
- c) Around this point, a volume of 30 mm x 30 mm x 24 mm is assessed by measuring 7 x 7 x 8 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 1.0 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 2.0 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.

Table: Uncertainty Budget for DASY4 Version V4.6 Build 23.7 – EUT SAR test 5GHz

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)	E.2.1	6.8	N	1	1	1	6.8	6.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	2	R	1.73	1	1	1.2	1.2	∞
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	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions	E.6.1	0.075	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.73	1	1	0.5	0.5	∞
Probe Positioning with respect to Phantom Shell	E.6.3	5.7	R	1.73	1	1	3.3	3.3	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	4	R	1.73	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	2.9	N	1	1	1	2.9	2.9	11
Device Holder Uncertainty	E.4.1	3.6	N	1	1	1	3.6	3.6	7
Output Power Variation – SAR Drift Measurement	6.6.2	5	R	1.73	1	1	2.9	2.9	∞
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	10	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	1.6	1.1	5
Liquid Permittivity – Deviation from target values	E.3.2	10	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	2.5	N	1	0.6	0.49	1.5	1.2	5
Combined standard Uncertainty			RSS				12.6	12.1	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				25.3	24.17	

Estimated total measurement uncertainty for the DASY4 measurement system was $\pm 12.6\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 25.3\%$ based on 95% confidence level. The uncertainty is not added to the measurement result.

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Table: Uncertainty Budget for DASY4 Version V4.6 Build 23.7 – Validation 5GHz

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) (standard calibration)	E.2.1	6.6	N	1	1	1	6.6	6.6	∞
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	2	R	1.73	1	1	1.2	1.2	∞
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	0.075	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.73	1	1	0.5	0.5	∞
Probe Positioning with respect to Phantom Shell	E.6.3	5.7	R	1.73	1	1	3.3	3.3	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	4	R	1.73	1	1	2.3	2.3	∞
Test Sample Related									
Dipole Axis to Liquid distance	E.4.2	2	N	1	1	1	2.0	2.0	11
Output Power Variation – SAR Drift Measurement	6.6.2	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	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	1.6	1.1	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	0.6	0.49	1.5	1.2	5
Combined standard Uncertainty			RSS				10.3	10.0	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				20.5	20.02	

Estimated total measurement uncertainty for the DASY4 measurement system was $\pm 10.3\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 20.5\%$ based on 95% confidence level. The uncertainty is not added to the measurement result.

6.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table: SPEAG DASY4 Version V4.6 Build 23.7

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	12-July-2007	No
Data Acquisition Electronics	SPEAG	DAE3 V1	442	08-Dec-2006	Yes
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	No
Probe E-Field	SPEAG	ET3DV6	1380	14-Dec-2006	No
Probe E-Field	SPEAG	ET3DV6	1377	14-July-2007	Yes
Probe E-Field	SPEAG	ES3DV6	3029	Non Compliance	No
Probe E-Field	SPEAG	EX3DV4	3563	14-July-2007	No
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	26-Oct-2007	No
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	15-Dec-2006	No
Antenna Dipole 900 MHz	SPEAG	D900V2	047	6-July-2008	No
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	30-June-2008	No
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	3-July-2008	No
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	2-Nov-2006	Yes
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	1-July-2007	No
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	27-Oct-2007	No
RF Amplifier	EIN	603L	N/A	In test	No
RF Amplifier	Mini-Circuits	ZHL-42	N/A	In test	No
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	In test	Yes
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*Not Required	No
RF Power Meter Dual	Hewlett Packard	437B	3125012786	30-May-2007	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	30-May-2007	Yes
RF Power Meter Dual	Gigatronics	8542B	1830125	18-April-2007	Yes
RF Power Sensor	Gigatronics	80301A	1828805	18-April-2007	Yes
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*Not Required	Yes
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*Not Required	Yes
Network Analyser	Hewlett Packard	8714B	GB3510035	31-Aug-2007	No
Network Analyser	Hewlett Packard	8753ES	JP39240130	30-Sept-2007	Yes
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	In test	No
Dual Directional Coupler	NARDA	3022	75453	In test	Yes

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

7.0 OET BULLETIN 65 – SUPPLEMENT C TEST METHOD

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 LifeBook P series “Mistletoe” can be used in a conventional laptop position (see Appendix A1). The antenna location in the “Mistletoe” 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.

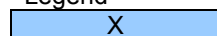
7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

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. The worst-case result was verified with the Bluetooth transmitting at full power, co-transmitting with the WLAN.

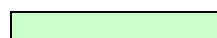
Table: Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			Channel (Low)	Channel (Middle)	Channel (High)
Notebook	OFDM 5GHz All Bands	A		X	
		B		X	

Legend



Testing Required in this configuration



Testing required in this configuration only if SAR of middle channel is more than 3dB below the SAR limit or it is the worst case.

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)

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

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.

8.1 5.6 GHz Band SAR Results

There is one mode of operation within the 5200/5600/5800MHz bands. Refer to section 7.2 for selection of all device test configurations. Table below displays the SAR results for the OFDM mode. Only the 5600MHz mode was tested due to the extremely low SAR levels recorded.

Table: SAR MEASUREMENT RESULTS Middle Band – OFDM Mode

1. Test Position	3. Antenna	4. Test Channel	5. Test Freq (MHz)	6. Measured 1g SAR Results (mW/g)	7. Measured Drift (dB)
*Notebook Bluetooth OFF	A	120	5600	<*0.005	N/A
*Notebook Bluetooth ON	B	120	5600	<*0.005	N/A

NOTE: The measurement uncertainty of 25.3% for 5GHz testing is not added to the result.

*The measured SAR is less than or equal to the noise floor of the DASY4 system.

The 1g averaged SAR level could not be evaluated because the SAR levels were less than or equal to the measurement sensitivity of the DASY4 system. Two scans were performed one with the Antenna A transmitting (Bluetooth Off), and one scan with the Antenna B transmitting (Bluetooth On).

9.0 COMPLIANCE STATEMENT

The model AR5BxB6, FCC ID: EJE-WB0045, IC: 337J- WB0045 Portable NOTEBOOK Computer Wireless LAN was found to comply with the FCC and RSS-102 SAR requirements.

The 1g averaged SAR level could not be evaluated because the SAR levels were below the measurement sensitivity of the DASY4 system. Two scans were performed one with the Antenna A transmitting (Bluetooth Off), and one scan with the Antenna B transmitting (Bluetooth On). This was below the limit of 1.6 mW/g for uncontrolled exposure, even taking into account the measurement uncertainty of 25.3 %.

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

www.emctech.com.au

APPENDIX A1 TEST SAMPLE PHOTOGRAPHS

AR5BxB6 Host



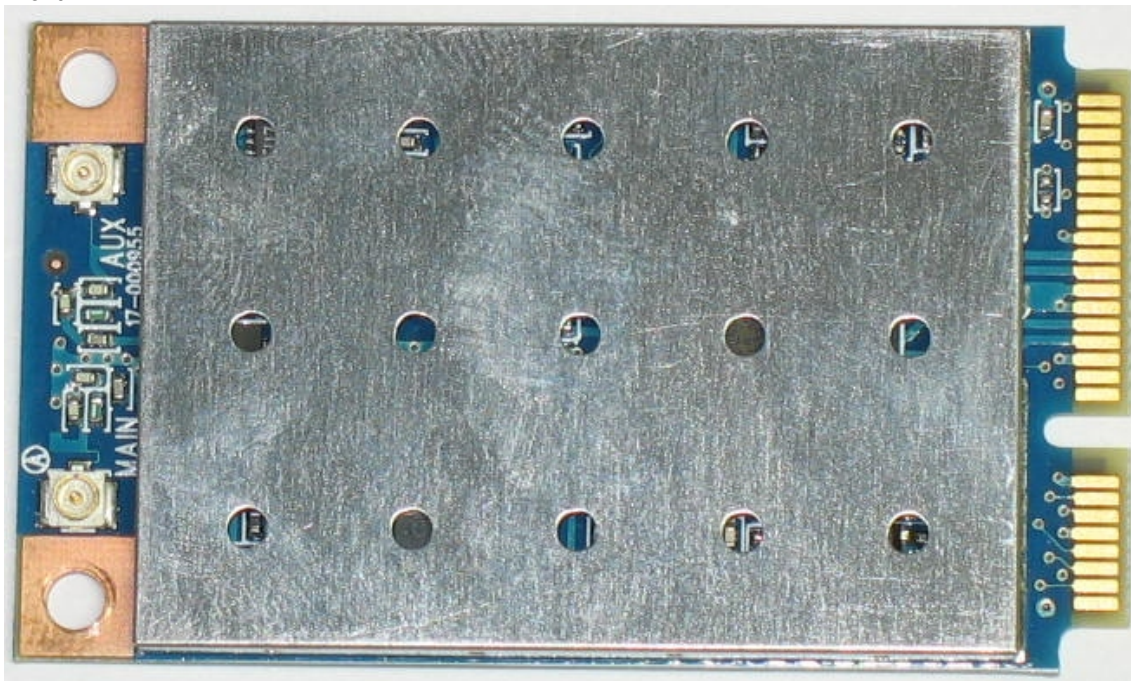
AR5BxB6 Host



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

APPENDIX A2 TEST SAMPLE PHOTOGRAPHS

Model: AR5BxB6 – WLAN Module
Front



Back



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

APPENDIX A3 TEST SAMPLE PHOTOGRAPHS

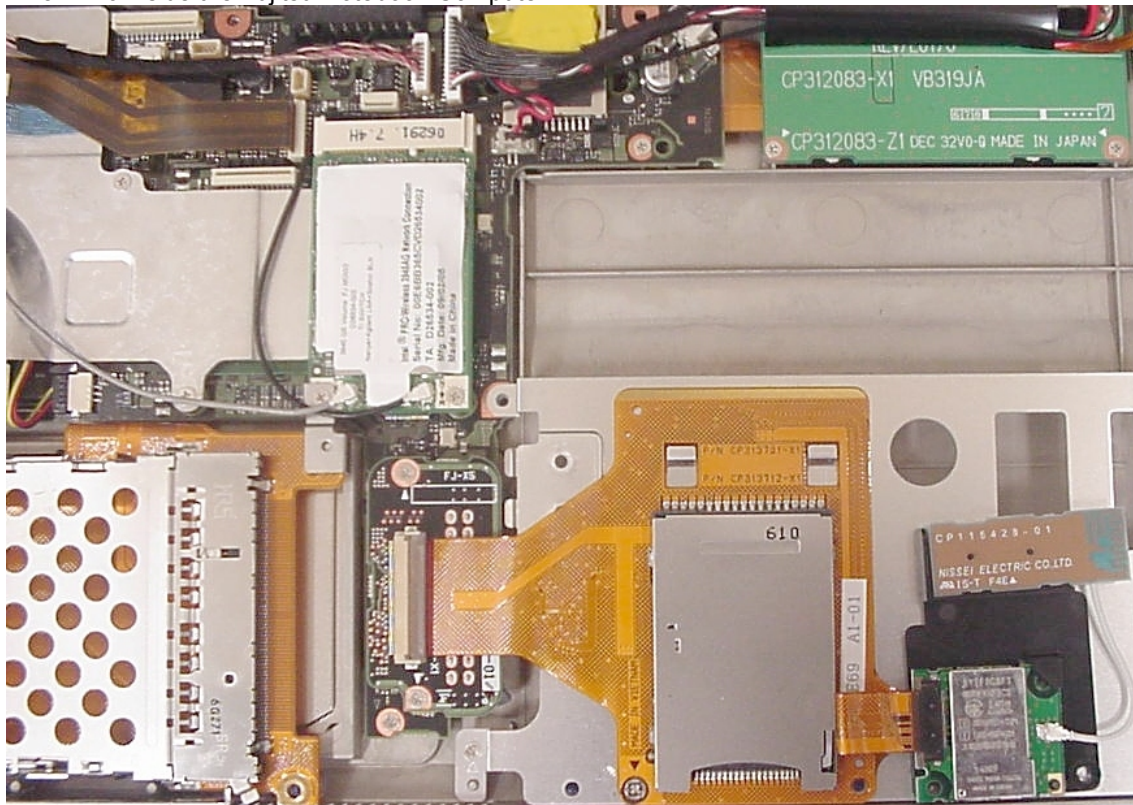
Battery 1



Battery 2



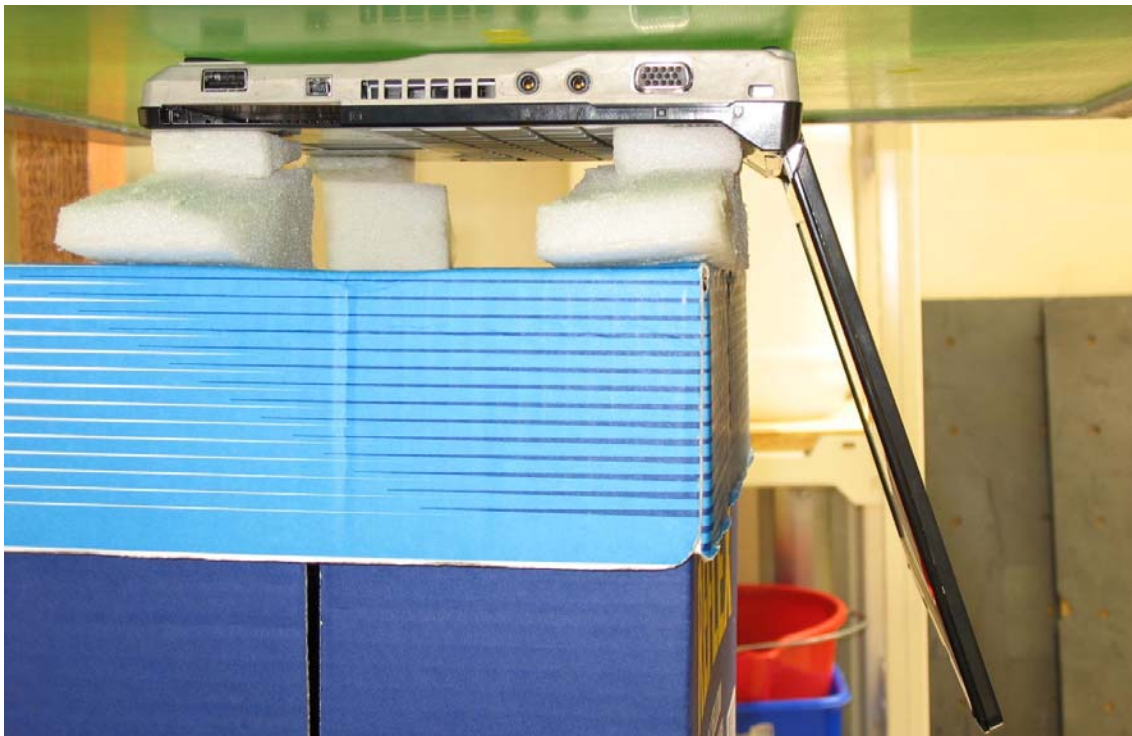
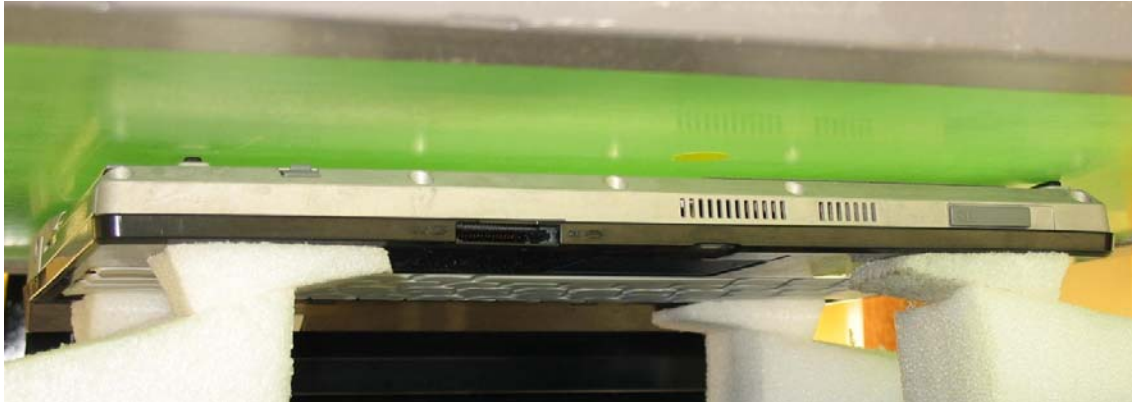
AR5BxB6 inside the Fujitsu Notebook Computer



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

APPENDIX A4 TEST SETUP PHOTOGRAPHS

Notebook Position



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

www.emctech.com.au

APPENDIX B PLOTS OF THE SAR MEASUREMENTS

Plots of the measured SAR distributions inside the phantom are given in this Appendix for the Validation only. The DASY4 system was unable to evaluate the SAR levels of the “Notebook” position because the fields were below the system noise floor. The spatial peak SAR values were assessed with the procedure described in this report.

Table: 5200 MHz Band SAR Measurement Plot Numbers

Table: Validation Plots

Plot 1	Validation 5500 MHz 19 th August 2006
Z-Axis graphs for Plots 1	

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Test Date: 19 October 2006

File Name: [Validation 5500MHz \(DAE359 Probe EX3DV4\) 19-10-06.da4](#)

DUT: Dipole 5200_5800 MHz; Type: D5GHzV2; Serial: 1008

* Communication System: CW 5500 MHz; Frequency: 5500 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 5.12654$ mho/m, $\epsilon_r = 34.5683$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn359; Probe: EX3DV4 - SN3563add; ConvF(4.02, 4.02, 4.02)

- Phantom: SAM 22; Serial: 1260; Phantom section: Flat Section

Channel 1 Test 2/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 49.5 mW/g

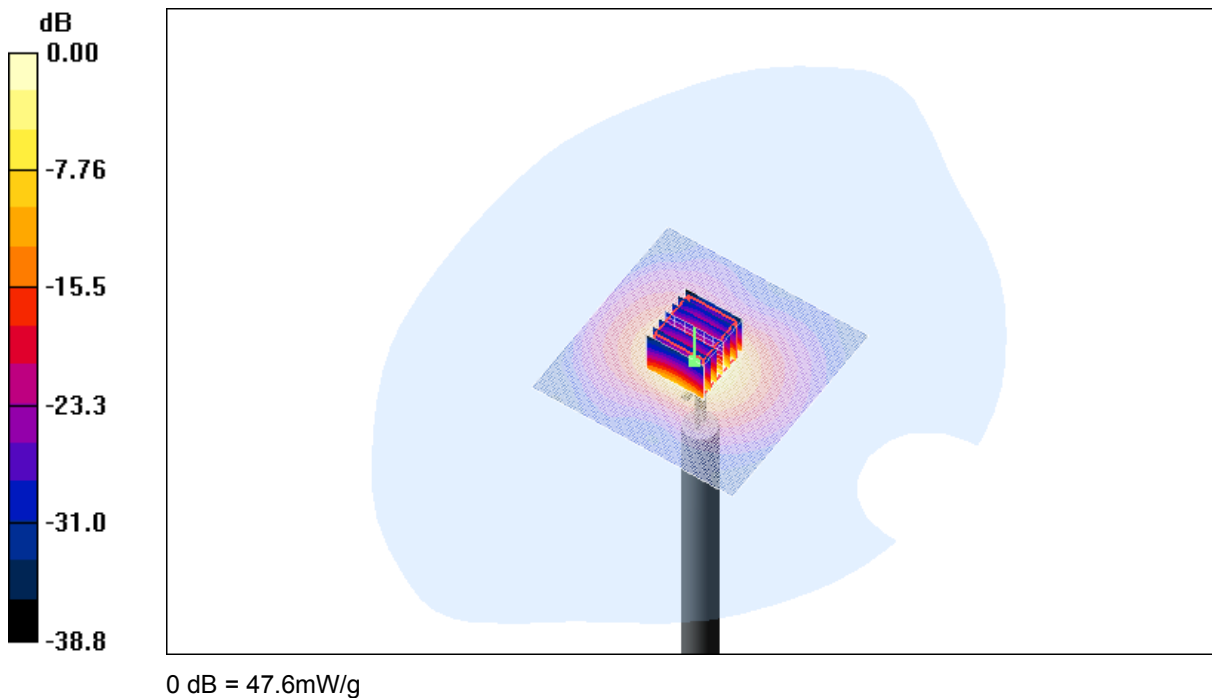
Channel 1 Test 2/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 102.6 V/m; Power Drift = 0.094 dB

Peak SAR (extrapolated) = 93.6 W/kg

SAR(1 g) = 23.1 mW/g; SAR(10 g) = 6.61 mW/g

Maximum value of SAR (measured) = 47.6 mW/g



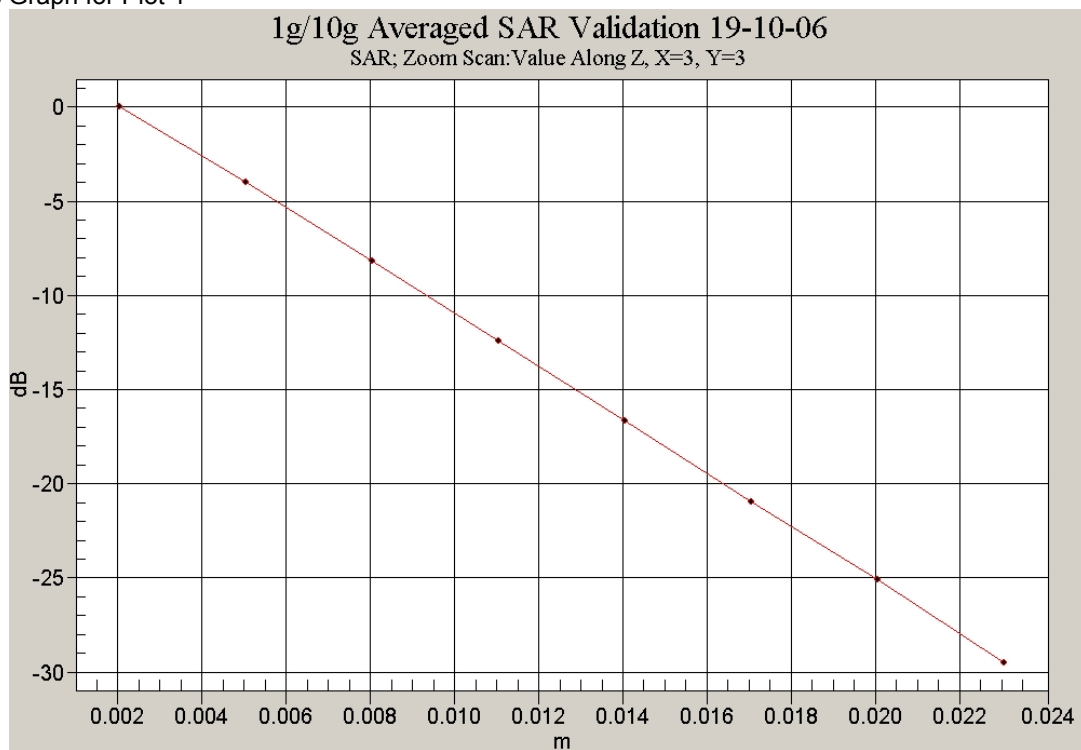
SAR MEASUREMENT PLOT 1

Ambient Temperature
Liquid Temperature
Humidity

21.5 Degrees Celsius
21.0 Degrees Celsius
43.0 %

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

Z-Axis Graph for Plot 1



This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

APPENDIX C

SAR TESTING EQUIPMENT CALIBRATION CERTIFICATE ATTACHMENTS

Calibration Certificate Attachments

1. 5800MHz E-Field Probe Calibration Sheet
2. 5GHz Dipole Calibration Sheet

This document shall not be copied or reproduced, except in full without the written permission of the Technical Director , EMC Technologies Pty. Ltd.

[www. emctech.com.au](http://www.emctech.com.au)