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SAR Test Report

Report Number: M080325 _ CERT_533AN_HMW _SAR_5.6

Test Sample:	Portable Notebook Computer
Host Model Number:	E8420
Radio Modules:	WLAN 533AN_HMW & Bluetooth EYTF3CS FS
Tested For:	Fujitsu Australia Pty Ltd
WLAN FCC ID:	EJE-WB0056
WLAN IC:	337J-WB0056
Date of Issue:	30th April 2008

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1.0 GENERAL INFORMATION

Test Sample:	Portable Notebook Computer
Model Name:	E8420
Radio Modules:	WLAN 533AN_HMW & Bluetooth EYTF3CS FS
Interface Type:	Mini-PCI Module
Device Category:	Portable Transmitter
Test Device:	Pre-Production Unit
FCC ID:	EJE-WB0056
IC:	337J-WB0056
RF exposure Category:	General Population/Uncontrolled
Manufacturer:	Fujitsu Limited

Test Standard/s:

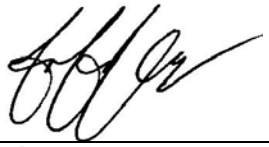
1. Evaluating Compliance with FCC Guidelines For Human Exposure to Radiofrequency Electromagnetic Fields
   Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)
2. Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of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

Statement Of Compliance: The Fujitsu Notebook Computer E8420 with Wireless LAN model 533AN_HMW and Bluetooth module EYTF3CS FS 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.

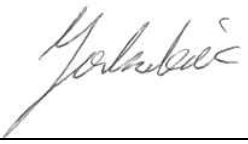
Test Dates:	18th, 20th, 25th – 26th March 2008
Tested for:	Fujitsu Australia Pty Ltd
Address:	1230 Nepean Highway, Cheltenham VIC 3192
Contact:	Praveen Rao
Phone:	+61 3 9265 0210
Fax:	+61 3 9265 0656
E-mail:	Praveen.rao@au.fujitsu.com

Test Officer:



Kim Long
SAR Engineer

Authorised Signature:



Peter Jakubiec

SAR TEST REPORT
Portable Notebook Computer
Model: E8420
Report Number: M080325 _ CERT_533AN_HMW _SAR_5.6

2.0 INTRODUCTION

Testing was performed on the Fujitsu Notebook PC, Model: E8420 with INTEL Mini-PCI Wireless LAN Module (Shirley Peak 802.11a/b/g/n), Model: 533AN_HMW & TAIYO YUDEN Bluetooth Module, Model: EYTF3CS FS. The Shirley Peak module is an OEM product. The Mini-PCI Wireless LAN (WLAN) was tested in the dedicated host – ELEN, Model E8420.

The measurement test results mentioned hereon only apply to the 5GHz frequency band; an additional report titled "M080325 _ CERT_533AN_HMW _SAR_2.4_FCC" applies to the 2450MHz frequency range.

The 533AN_HMW WLAN module was originally certified by Intel as a modular approval under FCC ID: PD9533ANH (Canada ID: 1000M-533ANH). The Radio modules are installed in a controlled environment at the Fujitsu notebook production/assembly factory.

The Bluetooth module was originally certified by TAIYO YUDEN as a modular approval under FCC ID: RYYEYTF3CSFT (Canada ID: 43989A-RYTF3CSF). The Radio modules are installed in a controlled environment at the Fujitsu notebook production/assembly factory.

3.0 SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 EUT (WLAN) Details

Transmitter:	Half Mini-Card Wireless LAN Module
Wireless Module:	WiFi Link 5300(Shirley Peak) (11a/b/g/n)
Model Number:	533AN_HMW
Manufacturer:	Intel Corporation
Modulation Type:	Direct Sequence Spread Spectrum (DSSS for 802.11b) Orthogonal Frequency Division Multiplexing (OFDM for 802.11g) Orthogonal Frequency Division Multiplexing (OFDM for 802.11a) Orthogonal Frequency Division Multiplexing (OFDM for 802.11n)
2.4 GHz (802.11b/g/n):	DBPSK, DQPSK, CCK, 16QAM and 64QAM
5 GHz (802.11a/n):	BPSK, QPSK, 16QAM and 64QAM
Maximum Data Rate:	802.11b = 11Mbps, 802.11g and 802.11a = 54Mbps 802.11n = 450 Mbps
Frequency Ranges:	2.412–2.462 GHz for 11b/g/n 5.18-5.32 GHz, 5.50-5.70 GHz and 5.745-5.825 GHz for 11a/n
Number of Channels:	11 channels for 802.11b/g/n 24 channels for 802.11a/n with 20 MHz bandwidth 18 channels for 802.11n with 40 MHz bandwidth
Antenna Types:	Tx1: Nissei Electric Inverted F Antenna – P/N: CP313551 Tx2: Nissei Electric Inverted F Antenna – P/N: CP313552 Tx3: Nissei Electric Inverted F Antenna – P/N: CP313553 Location: Top edge of LCD screen(Tx1, Tx2), Right palm rest(Tx3)
Power Supply:	3.3 VDC from PCI bus

Channels and Output power setting:

Channel and Mode	Frequency MHz	Average Output Power dBm
802.11b/g/n mode		
Channel 1	2412	12.5
Channel 6	2437	16.5
Channel 11	2462	12.5
802.11a/n mode with 20MHz Bandwidth		
Channel 1	2412	12.5
Channel 6	2437	16.5
Channel 13	2462	12.5
Channel 36	5180	14.5
Channel 52	5260	14.5
Channel 64	5320	14.5
Channel 100	5500	16.5
Channel 120	5600	16.5
Channel 140	5700	16.5
Channel 149	5745	16.5
Channel 157	5785	16.5
Channel 165	5825	16.5
802.11n mode with 40MHz Bandwidth		
Channel 3	2422	12.5
Channel 6	2437	16.5
Channel 9	2452	13.5
Channel 38	5190	14.5
Channel 54	5270	16.5
Channel 62	5310	13.5
Channel 102	5510	16.5
Channel 118	5590	16.5
Channel 134	5670	16.5
Channel 151	5755	16.5
Channel 159	5795	16.5

NOTE: For 2450 MHz SAR results refer to report titled “M080325_CERT_533AN_HMW_SAR_2.4_FCC”.

3.2 EUT (Bluetooth) Details

Transmitter:	Bluetooth
Model Number:	EYTF3CS FS
Manufacturer:	TAIYO YUDEN
Network Standard:	Bluetooth™ RF Test Specification
Modulation Type:	Frequency Hopping Spread Spectrum (FHSS)
Frequency Range:	2402 MHz to 2480 MHz
Number of Channels:	79
Carrier Spacing:	1.0 MHz
Antenna Types:	Taiyo Yuden Monopole Antenna, Model: CP331590 Location: Right hinge of LCD screen.
Max. Output Power:	4 dBm
Reference Oscillator:	16 MHz (Built-in)
Power Supply:	3.3 VDC from host.

Frequency allocation:

Channel Number	Frequency (MHz)	Bluetooth Utility power setting
1	**2402**	Power (Ext, Int) = 0, 96
2	2403	
-	-	
39	2440	
40	**2441**	
41	2442	
-	-	
78	2479	
79	**2480**	

3.3 EUT (Notebook PC) Details

EUT:	ELEN
Model Name:	LifeBook E-series
Model Number:	E8420
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Core2 Duo T9600 2.80GHz
LCD	15”WUXGA / 15”WSXGA+ / 15”WXGA
Wired LAN:	Intel 82567LM : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: D40
Port Replicator Model:	FPCPR63
AC Adapter Model:	80W: SEC100P2-19.0(Sanken), ADP-80NB A(Delta), SEC100P3-19.0(Sanken, 3pin) 100W: SED110P2-19.0(Sanken)
Voltage:	19 V
Current Specs:	4.22A / 5.27
Watts:	80W / 100W

3.4 Test sample Accessories

3.4.1 Battery Types

One type of Fujitsu Lithium Ion Battery is used to power the Portable Notebook Computer Wireless LAN Model: 533AN_HMW. SAR measurements were performed with the battery as shown below.

Standard Battery

Model	Erie-6cell B Unit Sample	Erie-8cell C0 Unit Sample
Serial No.	W01A-L02AE	W01A-L08AE

4.0 TEST SIGNAL, FREQUENCY AND OUTPUT POWER

INTEL's CRTU test tool was used to configure the WLAN for testing. The Portable Tablet Computer Wireless LAN had a total of 11 channels (USA model) within the 2412 to 2462 MHz frequency band and 17 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//5600/5800MHz frequency range. An additional report titled *"M080325 _ CERT_533AN_HMW _SAR_2.4_FCC"* 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 frequency span of the 2450MHz 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. The EUT is capable of using two antennas transmitting simultaneously (HT8 DATA mode) the power level is 3dB lower (50%) than if a single antenna was transmitting, and also the EUT is capable of using three antennas transmitting simultaneously (HT16 DATA mode) the power level is 5dB lower than if a single antenna was transmitting. 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. All power levels were found to be equal or higher than the manufacturer specifications (listed in the "Channels and Output power setting" table) to ensure conservative SAR measurement.

4.1 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.

5.0 DETAILS OF TEST LABORATORY

5.1 Location

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176 Harrick Road
Keilor Park, (Melbourne) Victoria
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Facsimile: +61 3 9331 7455
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website: www.emctech.com.au

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 OET65C 01/01
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.

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±1°C, the humidity was 57%. 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 SN3563 probe was less than 5μV in both air and liquid mediums.

6.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

6.1 Probe Positioning System

The measurements were performed with the state-of-the-art automated near-field scanning system **DASY4 V4.7 Build 53** 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.

6.2 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 ±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.

6.3 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.

6.4 Validation

6.4.1 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. ∈r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
20th March 2008	35.7	4.82	19.1	5.43
25th March 2008	35.2	4.98	20.7	5.92
26th March 2008	34.8	5.37	20.2	5.65

6.4.2 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)
5200MHz	19.1	76.4	77.6	-1.55
5500MHz	20.7	82.8	79.8	3.76
5800MHz	20.2	80.8	76.3	5.90

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

6.4.3 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.

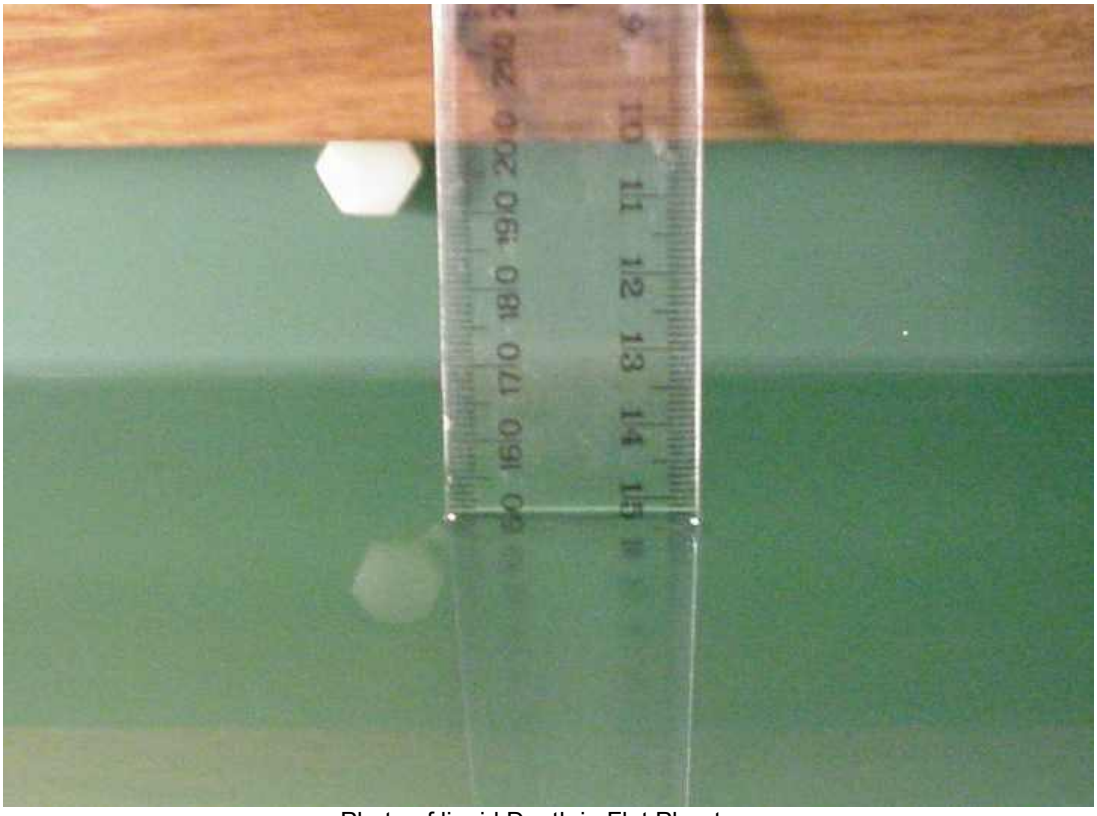

Photo of liquid Depth in Flat Phantom

6.5 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+/-0.2 mm and was filled with the required tissue simulating liquid. Table below provides a summary of the measured phantom properties. *Refer to Appendix C Part 4, for details of P 10.1 phantom dielectric properties and loss tangent*.

Table: Phantom Properties

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

6.6 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	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
5200 MHz Brain	35.7	36.0 ±5% (34.2 to 37.8)	4.82	4.76 ±5% (4.43 to 4.90)	1000
5500 MHz Brain	35.2	35.6 ±5% (33.9 to 37.4)	4.98	5.21 ±5% (4.82 to 5.32)	1000
5800 MHz Brain	34.8	35.3 ±5% (33.5 to 37.1)	5.37	5.27 ±5% (5.01 to 5.53)	1000

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

Table: Measured Body Simulating Liquid Dielectric Values for 5200MHz range

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
5190 MHz Muscle	47.8	49.0 ±10% (44.1 to 53.9)	5.37	5.3 ±10% (4.77 to 5.83)	1000
5260 MHz Muscle	47.6	48.9 ±10% (44.01 to 53.8)	5.51	5.4 ±10% (4.86 to 5.94)	1000
5310 MHz Muscle	47.4	48.8 ±10% (43.9 to 55.3)	5.60	5.4 ±10% (4.86 to 5.94)	1000

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

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
5500 MHz Muscle	47.3	48.6 ±10% (43.7 to 53.4)	5.70	5.6 ±10% (5.04 to 6.16)	1000
5600 MHz Muscle	47.0	48.5 ±10% (43.8 to 53.5)	5.90	5.77 ±10% (5.20 to 6.34)	1000
5700 MHz Muscle	46.6	48.4 ±10% (43.6 to 53.2)	6.07	5.9 ±10% (5.31 to 6.49)	1000

Table: Measured Body Simulating Liquid Dielectric Values for 5800MHz range

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
5745 MHz Muscle	46.6	48.3 ±10% (43.47 to 53.13)	6.09	5.9 ±10% (5.31 to 6.49)	1000
5785 MHz Muscle	46.5	48.2 ±10% (43.38 to 53.02)	6.19	6.0 ±10% (5.4 to 6.60)	1000
5825 MHz Muscle	46.3	48.2 ±10% (43.38 to 53.02)	6.22	6.0 ±10% (5.4 to 6.60)	1000

NOTE: The muscle liquid parameters were within the required tolerances of ±10%.

6.6.1 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: Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
20th March 2008	22.4	21.9	54.0
25th March 2008	21.6	21.1	61.0
26th March 2008	21.8	21.3	54.0

6.7 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

Composition
Distilled Water
Salt
Triton X-100

6.8 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

7.0 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 130mm x 180mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation. Around this point, a volume of 24 mm x 24 mm x 20 mm is assessed by measuring 7 x 7 x 9 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.

8.0 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 V4.7 Build 53 – 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	4.8	N	1	1	1	4.8	4.8	∞
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	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	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	4.32	R	1.73	1	1	2.5	2.5	∞
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									
Test Sample Positioning	E.4.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty	E.4.1	3.34	N	1	1	1	3.3	3.3	7
Output Power Variation – SAR Drift Measurement	6.6.2	10.69	R	1.73	1	1	6.2	6.2	∞
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	10	N	1	0.64	0.43	6.4	4.3	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	5	N	1	0.6	0.49	3.0	2.5	5
Combined standard Uncertainty			RSS				13.2	12.1	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				26.4	24.16	

Estimated total measurement uncertainty for the DASY4 measurement system was ±13.2%. The extended uncertainty (K = 2) was assessed to be ±26.4% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table: Uncertainty Budget for DASY4 Version V4.7 Build 53 – 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 ±10.3%. The extended uncertainty (K = 2) was assessed to be ±20.5% based on 95% confidence level. The uncertainty is not added to the measurement result.

9.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table: SPEAG DASY4 Version V4.7 Build 53

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	✓
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	✓
SAM Phantom	SPEAG	N/A	1260	Not applicable	
SAM Phantom	SPEAG	N/A	1060	Not applicable	✓
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	✓
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	
Flat Phantom	SPEAG	PO1A 6mm	1003	Not Applicable	
Data Acquisition Electronics	SPEAG	DAE3 V1	359	03-July-2008	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	26-Feb-09	✓
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	18-Dec-2008	
Probe E-Field	SPEAG	ET3DV6	1377	09-July-2008	
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	13-July-2008	✓
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	14-Dec-2009	
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	14-Dec-2008	
Antenna Dipole 900 MHz	SPEAG	D900V2	047	6-July-2008	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	30-June-2008	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	3-July-2008	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	5-March-2009	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	06-July-2008	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	13-Dec-2008	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	07-Dec-2009	✓
RF Amplifier	EIN	603L	N/A	Not applicable	
RF Amplifier	Mini-Circuits	ZHL-42	N/A	Not applicable	
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	Not applicable	✓
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	✓
RF Power Meter Dual	Hewlett Packard	437B	3125012786	30-May-2008	
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	30-May-2008	
RF Power Meter Dual	Gigatronics	8542B	1830125	11-May-2008	✓
RF Power Sensor	Gigatronics	80301A	1828805	11-May-2008	✓
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	✓
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	✓
Network Analyser	Hewlett Packard	8714B	GB3510035	06-Sept-2008	
Network Analyser	Hewlett Packard	8753ES	JP39240130	02 Oct-2008	✓
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	
Dual Directional Coupler	NARDA	3022	75453	*In test	✓

* Calibrated during the test for the relevant parameters.

10.0 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 "ELEN" can be used in a conventional laptop position only. The two of the antennas location in the "ELEN" 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 not required in this position. The third antenna however, (antenna C) is in the base of the PC and requires SAR testing.

10.1 Positions

The "ELEN" Portable PC can only be operated as a conventional notebook laptop. Due to the location of the WLAN transmitter at the base of the notebook, (Antenna C), testing was performed with the base pressed against the surface of the phantom, "Laps On" position.

10.1.1 "Laps On" 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 "Laps On" position. The transceiver was placed at the bottom of the phantom and suspended in such way that the base of the device was touching the phantom. This device orientation simulates the PC's 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 position. *Refer to Appendix A for photos of measurement positions.*

10.2 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 4.0 were recorded. The following table represents the matrix used to determine what testing was required.

Table: Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			CHANNEL 1 (Low)	Channel 6 (Middle)	Channel 11 (High)
Laps On	OFDM 5.2GHz	C		X	
	OFDM 5.2GHz (20 MHz)	C		X	
	OFDM 5.2GHz (40 MHz)	C		X	
	OFDM 5.5GHz	C		X	
	OFDM 5.5GHz (20 MHz)	C		X	
	OFDM 5.5GHz (40 MHz)	C		X	
	OFDM 5.8GHz	C		X	
	OFDM 5.8GHz (20 MHz)	C		X	
	OFDM 5.8GHz (40 MHz)	C		X	

Legend

X	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.

10.3 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)

10.4 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)

11.0 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.

11.1 5 GHz Band SAR Results

Table: SAR MEASUREMENT RESULTS Lower Band – OFDM Mode

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Lap On	1	C	6	-	52	5260	0.35	0.13
Lap On	2	C	HT0	20	36	5180	0.26	0.41
Lap On	3	C	HT0	20	52	5260	0.50	0.11
Lap On	4	C	HT0	20	64	5320	0.34	0.22
Lap On	5	C	HT0	40	54	5270	0.42	-0.28

NOTE: The measurement uncertainty of 26.4% for 5GHz testing is not added to the result.

The highest SAR level recorded in the 5.2 GHz band was 0.50 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in the Lap On position in OFDM mode transmitting at HT0 Mbps with 20 MHz channel bandwidth, utilizing channel 52 (5260 MHz) and antenna C.

Table: SAR MEASUREMENT RESULTS Middle Band – OFDM Mode

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Lap On	6	C	6	-	100	5500	0.13	-0.39
Lap On	7	C	6	-	120	5600	0.11	-0.05
Lap On	8	C	6	-	140	5700	0.11	-0.06
Lap On	9	C	HT0	20	120	5600	0.09	-0.35
Lap On	10	C	HT0	40	118	5590	0.10	-0.21

NOTE: The measurement uncertainty of 26.4% for 5GHz testing is not added to the result.

The highest SAR level recorded in the 5.6 GHz band was 0.13 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in Lap On position in OFDM mode transmitting at 6 Mbps, utilizing channel 100 (5500 MHz) and antenna C.

Table: SAR MEASUREMENT RESULTS Upper Band – OFDM Mode

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Lap On	11	C	6	-	157	5785	0.11	0.39
Lap On	12	C	HT0	20	149	5745	0.14	-0.44
Lap On	13	C	HT0	20	157	5785	0.12	-0.08
Lap On	14	C	HT0	20	165	5825	0.11	0.39
Lap On	15	C	HT0	40	159	5795	0.09	-0.34

NOTE: The measurement uncertainty of 26.4% for 5GHz testing is not added to the result.

The highest SAR level recorded in the 5.8 GHz band was 0.14 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in the Lap On position in OFDM mode transmitting in HT0 Mbps bit rate mode with 20 MHz channel bandwidth, utilizing channel 149 (5745MHz) and antenna C.

12.0 COMPLIANCE STATEMENT

The Fujitsu Notebook PC, Model: E8420 with INTEL Mini-PCI Wireless LAN Module (Shirley Peak 802.11a/b/g/n), Model: 533AN_HMW & TAIYO YUDEN Bluetooth Module, Model: EYTF3CS FS was found to comply with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded was 0.50 mW/g for a 1g cube. This value was measured at 5260 MHz (channel 52) in the “Lap On” position in OFDM modulation mode at the antenna C. This was below the limit of 1.6 mW/g for uncontrolled exposure, even taking into account the measurement uncertainty of 26.4 %.