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SAR Test Report

Report Number: M080821_CERT_MC8781_SAR_GSM-UMTS

Test Sample:	Portable TABLET Computer
Radio Module Under Test:	WWAN MC8781
Host PC Model:	ST6010
WWAN FCC ID:	N7NMC8781-F
WWAN IC ID:	2417C-MC8781
Date of Issue:	16th September 2008

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SAR TEST REPORT
Report Number: M080821_CERT_MC8781_SAR_GSM-UMTS
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1.0 GENERAL INFORMATION

Test Sample:	Portable TABLET Computer with Intel or Atheros WLAN Modules
Radio Module Under Test:	WWAN GSM/UMTS Module MC8781
Interface Type:	Mini-PCI Module
Device Category:	Portable Transmitter
Test Device:	Pre-Production Unit
Host PC model:	ST6010
WWAN FCC ID:	N7NMC8781-F
WWAN IC:	2417C-MC8781
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.** Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) RSS-102 Issue 2 November 2005
Statement Of Compliance:	The Fujitsu TABLET Computer ST6010 with Sierra Wireless GSM/UMTS Module MC8781 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.
Test Dates:	27th August – 11th September 2008

Test Officer:

Peter Jakubiec
Test Officer

Authorised Signature:

Peter Jakubiec
EMC Technologies Pty Ltd

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SAR TEST REPORT
Portable TABLET Computer
Model: ST6010
Report Number: M080821_CERT_MC8781 _SAR_GSM-UMTS

2.0 INTRODUCTION

Specific Absorption Rate (SAR) testing was performed on the Fujitsu TABLET PC, Model: ST6010 with SIERRA Mini-PCI Wireless WAN Module (UMTS/GSM), Model: MC8781. The Mini-PCI Wireless WAN (WWAN) was tested in the dedicated host – ST SERIES, Model ST6010.

3.0 SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 WWAN Details

Transmitter:	Mini-Card UMTS Module
FCC ID	N7NMC8781-F
IC	2417C-MC8781
Wireless Module:	UMTS
Model Number:	MC8781
Manufacturer:	Sierra Wireless
GSM Frequency Bands:	850 / 900 / 1800 / 1900 MHz
UMTS Frequency Bands:	Band I(2100MHz) / Band II(1900MHz) / Band V(850MHz)
Features:	EGPRS, GPRS, UMTS and HSDPA, and HSUPA
Output Power:	32 +/- 1dBm in 850 band 29 +/- 1dBm in 1900 band 23 +/- 1dBm in UMTS bands

3.2 Test Signal, Frequency and Output Power

The EUT was provided by Fujitsu Limited. It was put into operation using an Anritsu Radio Communication Analyser MT8820A. The channels utilised in the measurements were the traffic channels shown in the table below. The power level was set to Class 4 for 850 MHz and Class 1 for 1900 MHz GSM bands and class 3 for 850 and 1900 MHz UMTS bands.

Channels and Output power:

Channel and Mode	Frequency MHz	Average Output Power dBm
GPRS Mode		
Channels 128, 190 and 251	824.2, 836.6 and 848.8	33
Channels 512, 661 and 810	1850.2, 1880 and1909.8	30
UMTS Mode		
Channels 4132, 4183 and 4233	826.4, 836.6 and 846.6	24
Channels 9262, 9400 and 9538	1852.4, 1880 and 1907.6	24

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3.3 EUT (Notebook PC) Details

Host notebook :	ST series
Model Name:	ST6010
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Core2 Duo SU9400 1.4GHz
LCD	12.1"WXGA
Wired LAN:	Intel 82567LF : 10 Base-T/100 Base-TX/1000Base-T
Modem:	None
Port Replicator Model:	FPCPRxx (New)
AC Adapter Model:	60W: SED80N2-16.0(Sanken)
Voltage:	16 V
Current Specs:	3.75A
Watts:	60W

Host System # 1 : FCC Granted HOST PC FCC ID: **EJE-WB0070**, IC ID: **337J-WB0070**

Radio Module # 1:	WLAN WiFi Link 5300(Shirley Peak) (11a/b/g/n)
WLAN Model Number::	WLAN Radio 533AN_HMW
WLAN Manufacturer:	Intel Corp.
Interface Type:	Half Mini-Card Wireless LAN Module
Radio Module # 2:	Bluetooth module
Model Number:	EYSMJCS
Manufacturer:	TAIYO YUDEN
Interface Type:	USB

Host System # 2 : FCC Granted HOST PC FCC ID: **EJE-WB0072**, IC ID: **337J-WB0072**

Radio Module # 1:	WLAN (HB92 IEEE802.11a/b/g/n)
WLAN Model Number::	WLAN Radio AR5BHB92
WLAN Manufacturer:	Atheros Corp.
Interface Type:	Half Mini-Card Wireless LAN Module
Radio Module # 2:	Bluetooth module
Model Number:	EYSMJCS
Manufacturer:	TAIYO YUDEN
Interface Type:	USB

3.4 Test sample Accessories

3.4.1 Battery Types

One type of Fujitsu Lithium Ion Battery is used to power the Portable TABLET Computer Wireless WAN Model: MC8781. SAR measurements were performed with the battery as shown below.

Standard Battery

Battery #1		Battery #2	
Model	FPCBP 207	Model	FPCBP 207
V/mAh	10.8V/5800mAh	V/mAh	10.8V/5800mAh

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4.0 TEST SIGNAL, FREQUENCY AND OUTPUT POWER

The Portable Tablet Computer Wireless WAN had a total of 423 channels within the 824.2 to 848.8 MHz and 1850.2 to 1909.8 MHz GPRS frequency bands and 379 channels within the frequency ranges 826.4 to 846.6 MHz and 1852.4 to 1907.6 MHz. For the SAR measurements the device was operating at full transmit power.

The frequency span of the GSM and UMTS 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 TABLET 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 table below.

Table: Frequency and Conducted Power Results GSM

Coding Scheme	GPRS Power Class	RF Channel	Measured Power (dBm)
CS1	10	128	30.39
CS1	10	190	30.42
CS1	10	251	30.67
CS1	11	128	**27.38**
CS1	11	190	**27.38**
CS1	11	251	**27.58**
CS1	12	128	**24.47**
CS1	12	190	**24.40**
CS1	12	251	**24.62**

Coding Scheme	EGPRS Power Class	RF Channel	Measured Power (dBm)
MCS5	10	128	25.32
MCS5	10	190	25.72
MCS5	10	251	25.93
MCS5	11	128	**25.15**
MCS5	11	190	**25.62**
MCS5	11	251	**25.84**
MCS5	12	128	**25.12**
MCS5	12	190	**25.52**
MCS5	12	251	**25.78**

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Coding Scheme	GPRS Power Class	RF Channel	Measured Power (dBm)
CS1	10	512	28.55
CS1	10	661	28.42
CS1	10	810	28.44
CS1	11	512	**28.40**
CS1	11	661	**28.30**
CS1	11	810	**28.36**
CS1	12	512	**28.32**
CS1	12	661	**28.23**
CS1	12	810	**28.16**

Coding Scheme	EGPRS Power Class	RF Channel	Measured Power (dBm)
MCS5	10	512	25.61
MCS5	10	661	25.60
MCS5	10	810	25.59
MCS5	11	512	**25.53**
MCS5	11	661	**25.46**
MCS5	11	810	**25.61**
MCS5	12	512	**25.54**
MCS5	12	661	**25.48**
MCS5	12	810	**25.50**

Conducted Power Measurement UMTS 850 MHz

Configuration:
12.2 kbps RMC
Test Loop Mode 1
βc = 8, βd = 15 (3GPP default)
TPC (Transmit Power Control) = All 1s

Channel No.	βc	βd	Result (dBm)
4132	8	15	22.52
4183	8	15	22.39
4233	8	15	22.50

Conducted Power Measurement UMTS + HSDPA 850 MHz

Configuration:
Device HSDPA Category 6 (Downlink 3.6 Mbps and Uplink 384 kbps)
H-Set = 3
QPSK in H-Set (3)
CQI Fidback Cycle = 4ms; CQI Repetition Rate = 2ms
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2

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Sub Test No.	βc	βd	ΔAKN	ΔNAKN	ΔCQI	Result (dBm)		
						4132	4183	4233
1	2	15	8	8	8	22.60	22.31	22.26
2	12	15	8	8	8	22.06	21.71	21.82
3	15	8	8	8	8	22.10	21.70	21.87
4	15	4	8	8	8	21.58	21.30	21.44
1	2	15	5	5	2	22.62	22.27	22.27
2	12	15	5	5	2	22.20	21.90	22.13
3	15	8	5	5	2	20.91	20.74	20.64
4	15	4	5	5	2	20.17	20.02	19.97

Conducted Power Measurement UMTS 1900 MHz

Configuration:
12.2 kbps RMC
Test Loop Mode 1
βc = 8, βd = 15 (3GPP default)
TPC (Transmit Power Control) = All 1s

Channel No.	βc	βd	Result (dBm)
9262	8	15	24.74
9400	8	15	24.67
9538	8	15	23.75

Conducted Power Measurement UMTS + HSDPA 1900 MHz

Configuration:
Device HSDPA Category 6 (Downlink 3.6 Mbps and Uplink 384 kbps)
H-Set = 3
QPSK in H-Set (3)
CQI Fidback Cycle = 4ms; CQI Repetition Rate = 2ms
3GPP default HS-DPCCH power offset parameters Δ_{AKN} = 5; Δ_{NAKN} = 5; Δ_{CQI} = 2

Sub Test No.	βc	βd	ΔAKN	ΔNAKN	ΔCQI	Result (dBm)		
						9262	9400	9538
1	2	15	8	8	8	24.79	24.72	23.73
2	12	15	8	8	8	25.14	25.17	23.88
3	15	8	8	8	8	25.47	25.43	24.28
4	15	4	8	8	8	25.15	25.06	23.70
1	2	15	5	5	2	24.77	24.66	23.58
2	12	15	5	5	2	25.11	25.03	23.69
3	15	8	5	5	2	24.43	24.36	23.11
4	15	4	5	5	2	24.12	23.92	22.84

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

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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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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 in the range 43% to 51%. 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 and SN3563 probes were less than 5μV in both air and liquid mediums.

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6.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

Applicable Head Configurations	: None
Applicable Body Configurations	: Tablet Position

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 probes ET3DV6 Serial: 1380 and EX3DV4 Serial: 3563 designed in the classical triangular configuration and optimised for dosimetric evaluation. The probes have 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 (900MHz, 1800MHz and 5200MHz)

The following tables 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

1. Validation Date & Frequency	2. ϵ_r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
27th August 2008 1800MHz	38.6	1.39	9.29	4.92
31st August 2008 900MHz	40.5	0.98	2.60	1.67
1st September 2008 900MHz	40.9	0.99	2.64	1.70
11th September 2008 900MHz	40.6	0.98	2.68	1.71
11th September 2008 5200MHz	35.6	4.67	22.2	6.30

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6.4.2 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 900 and 1800 MHz. 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 during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below.

Table: Deviation from reference validation values @ (900MHz, 1800 MHz and 5200MHz)

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)
900MHz 31st August 2008	2.6	10.40	10.9	-4.59	10.8	-3.70
900MHz 1st September 2008	2.64	10.56	10.9	-3.12	10.8	-2.22
900MHz 11th September 2008	2.68	10.72	10.9	-1.65	10.8	-0.74
1800MHz 27th August 2008	9.29	37.16	38.2	-2.72	38.1	-2.47
5200MHz 11th September 2008	22.2	88.80	89.6 (EMCT Reference)	-0.89 (Deviation from EMCT)	N/A	N/A

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

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6.4.3 Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 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 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 91 and P 10.1 was used. The phantom thickness is 2.0mm+/-0.2 mm and was filled with the required tissue simulating liquid. Below table provides a summary of the measured phantom properties.

Table: 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

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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	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
900 MHz Brain	40.5-40.9	41.5 ±5% (39.4 to 43.6)	0.98-0.99	0.97 ±5% (0.92 to 1.02)	1000
1800 MHz Brain	38.6	40.0 ±5% (38.0 to 42.0)	1.39	1.40 ±5% (1.33 to 1.47)	1000
5200 MHz	35.6	36.0 ±5% (34.2 to 37.8)	4.67	4.76 ±5% (4.43 to 4.90)	1000

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

Table: Measured Body Simulating Liquid Dielectric Values at 850MHz

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
825 MHz Body	53.9	55.2 ±5% (52.4 to 58.0)	0.97-0.98	0.97 ±5% (0.92 to 1.02)	1000
835 MHz Body	53.8	55.2 ±5% (52.4 to 58.0)	0.98-0.99	0.97 ±5% (0.92 to 1.02)	1000
850 MHz Body	53.6-53.7	55.2 ±5% (52.4 to 58.0)	1.00	0.97 ±5% (0.92 to 1.02)	1000

Note: The body liquid parameters were within the required tolerances of ±5%.

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Table: Measured Body Simulating Liquid Dielectric Values at 1880MHz

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
1850 MHz Body	50.9	53.3 ±5% (50.6 to 56.0)	1.47	1.52 ±5% (1.44 to 1.60)	1000
1880.0 MHz Body	50.8	53.3 ±5% (50.6 to 56.0)	1.49	1.52 ±5% (1.44 to 1.60)	1000
1910 MHz Body	50.7	53.3 ±5% (50.6 to 56.0)	1.51	1.52 ±5% (1.44 to 1.60)	1000

Note: The body liquid parameters were within the required tolerances of ±5%.

Table: Measured Body Simulating Liquid Dielectric Values at 5200MHz

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
5320 MHz Body	44.3	48.8 ±10% (43.9 to 53.7)	5.33	5.4 ±10% (4.86 to 5.94)	1000

Note: The body 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 (%)
27th August 2008	20.1	19.8	45
31st August 2008	20.5	20.3	51
1st September 2008	20.4	20.1	43
11th September 2008	20.6	20.2	35

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6.7 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: Tissue Type: Brain @ 850/900MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	41.05
Salt	1.35
Sugar	56.5
HEC	1.0
Bactericide	0.1

Table: Tissue Type: Brain @ 1800MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	61.17
Salt	0.31
Bactericide	0.29
Triton X-100	38.23

Table: Tissue Type: Body @ 850/900MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	56
Salt	0.76
Sugar	41.76
HEC	1.21
Bactericide	0.27

*Refer "OET Bulletin 65 97/01 P38"

Table: Tissue Type: Body @ 1800MHz
Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	40.4
Salt	0.5
Sugar	58
HEC	1
Bactericide	0.1

Table: Tissue Type: Muscle @ 5600MHz

Volume of Liquid: 60 Litres

EMCT Liquid

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 TABLET underneath the phantom surface. Small pieces of foam were then used to press the TABLET flush against the phantom surface.

Refer to Appendix for photographs of device positioning

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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 3.9 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 75 mm x 105 mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.

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.

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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 and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table: Uncertainty Budget for DASY4 V4.7 Build 53 – EUT SAR

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	E.4.1	3.34	N	1	1	1	3.3	3.3	7
Output Power Variation – SAR Drift Measurement	7.2.3	4.74	R	1.73	1	1	2.7	2.7	∞
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				10.2	9.7	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				20.4	19.47	

Estimated total measurement uncertainty for the DASY4 measurement system was ±10.2%. The extended uncertainty (K = 2) was assessed to be ±20.4% based on 95% confidence level. The uncertainty is not added to the measurement result.

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Table: Uncertainty Budget for DASY4 V4.7 Build 53 – Validation

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.

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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	11-July-2009	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	24-July-2009	✓
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	14-July-2009	
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	14-July-2009	✓
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	7-July-2010	✓
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	16-July-2010	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	8-July-2010	✓
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	5-March-2009	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	06-July-2009	
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	*In test	
RF Amplifier	Mini-Circuits	ZHL-42	N/A	*In test	✓
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	*In test	✓
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	✓
RF Power Meter Dual	Hewlett Packard	437B	3125012786	07-July-2009	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	09-July-2009	✓
RF Power Meter Dual	Gigatronics	8542B	1830125	24-June-2009	
RF Power Sensor	Gigatronics	80301A	1828805	24-June-2009	
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.

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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 tablet can be operated in. The "ST SERIES" PC can be used on the lap or hand held as a Tablet PC. WLAN and UMTS/GSM antennas are located at the edges of the LCD screen.

10.1.1 "Tablet" 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 "Tablet" position. The Transceiver was placed at the bottom of the phantom and suspended in such way that the back 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.

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

Table: Testing configurations

Phantom Configuration	Device Mode WWAN Band Name	Test Configurations		
		Channel (Low)	Channel (Middle)	Channel (High)
Tablet	WCDMA 850 MHz		x	
	WCDMA 1900 MHz		x	
	GPRS 850 MHz		x	
	GPRS 1900 MHz		x	
	OFDM 5.2GHz Ant. A			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)

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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 10.2.

11.1.1 SAR Results

There are two modes of operation which include UMTS and GPRS transmission. Refer to section 7.2 for selection of all device test configurations. Table below displays the SAR results.

Table: SAR MEASUREMENT RESULTS – 900MHz GPRS

Test Position	Plot No.	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Tablet Ant. OUT GPRS Class 10	1	128	824.2	1.44	0.055
	2	190	836.6	1.55	-0.192
	3	251	848.8	1.49	-0.019
Tablet Ant. OUT GPRS Class 11	4	190	836.6	1.17	-0.067
Tablet Ant. OUT GPRS Class 12	5	190	836.6	0.77	-0.045
Tablet Ant. IN GPRS Class 10	6	190	836.6	0.01	0.201

NOTE: The measurement uncertainty of 20.4% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 1900MHz GPRS

Test Position	Plot No.	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Tablet Ant. OUT GPRS Class 12	7	512	1850.2	1.51	-0.021
	8	661	1880.0	1.51	-0.053
	9	810	1909.8	1.46	-0.031
Tablet Ant. OUT GPRS Class 10	10	661	1880.0	0.90	-0.119
Tablet Ant. OUT GPRS Class 11	11	661	1880.0	1.31	-0.102
Tablet Ant. IN GPRS Class 12	12	661	1880.0	0.01	-2.92 (N/A)

NOTE: The measurement uncertainty of 20.4% was not added to the result.

Table: SAR MEASUREMENT RESULTS – 850MHz UMTS

Test Position	Plot No.	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Tablet Ant. IN	-	4183	836.6	Noise Floor	N/A
Tablet Ant. OUT	13	4132	826.4	0.82	0.032
	14	4183	836.6	0.82	-0.022
	15	4233	846.6	0.91	-0.023

NOTE: The measurement uncertainty of 20.4% was not added to the result.

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Table: SAR MEASUREMENT RESULTS – 1900MHz UMTS

Test Position	Plot No.	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Tablet Ant. IN	-	9400	1880.0	Noise Floor	N/A
Tablet Ant. OUT	16	9262	1852.4	0.98	-0.005
	17	9400	1880.0	0.97	-0.024
	18	9538	1907.6	0.93	-0.165

NOTE: The measurement uncertainty of 20.4% was not added to the result.

The highest SAR level recorded was 1.55 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in Tablet Ant. OUT position in GPRS Class 10 mode, utilizing channel 190 (836.6MHz).

Table: MULTIBAND SAR MEASUREMENT RESULTS – 900MHz GPRS and 5.2GHz OFDM (533AN_HMW**)**

Test Position	Plot No.	Test Channels	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Tablet	19	190/64	836.6/5320	1.37	-0.187

NOTE: The measurement uncertainty of 20.4% was not added to the result.

12.0 COMPLIANCE STATEMENT

The Fujitsu TABLET PC, Model: ST6010 with SIERRA WIRELESS Mini-PCI Wireless WAN Module (UMTS/GSM), Model: MC8781 was found to comply with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded was 1.55 mW/g for a 1g cube. This value was measured at 836.6 MHz (channel 190) in the “Tablet Ant. OUT” position in GPRS Class 10 transmission mode. This was below the limit of 1.6 mW/g for uncontrolled exposure, but was within the band of measurement uncertainty around the limit.

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