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CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Applicant Name:
Panasonic Corporation of North America
One Panasonic Way, 4B-8
Secaucus, NJ 07094
United States

Date of Testing:
09/16/2008 - 09/26/2008 and 01/12/2009 - 01/15/2009
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.: 0808221180.ACJ

FCC ID: ACJ9TGCF-H11

APPLICANT: PANASONIC CORPORATION OF NORTH AMERICA

EUT Type:	Tablet PC with 802.11abgn, EVDO, GSM, WCDMA and Bluetooth
Application Type:	Certification
FCC Rule Part(s):	§2.1093; FCC/OET Bulletin 65 Supplement C [July 2001]
FCC Classification:	FCC Part 15 Frequency Hopping Spread Spectrum Transceiver (DSS) Unlicensed National Information Infrastructure (UNII) PCS Licensed Transmitter (PCB) / Digital Transmission system (DTS)
Model(s):	CF-H1mk1
Tx Frequency:	824.70 -848.31MHz (Cellular CDMA) / 1851.25-1908.75 MHz (PCS CDMA) 824.20 - 848.8 MHz (GSM850) / 1850.2 - 1908.8 MHz (GSM1900) 826.40 - 846.6 MHz (WCDMA850) / 1852.4 - 1907.6 (WCDMA1900) 2412 - 2462 MHz (IEEE 802.11bgn) / 2402 - 2480 MHz (Bluetooth) 5180 - 5825 MHz, (IEEE 802.11a/11n)
Conducted Power:	24.92 dBm Cellular CDMA / 24.61dBm PCS CDMA 32.98 dBm GSM850 / 29.41 dBm GSM1900 24.42 dBm WCDMA850 / 24.54 dBm WCDMA1900 / 13.67 dBm Bluetooth 14.33 dBm IEEE 802.11b / 15.31 dBm - 802.11g / 15.29 dBm - 802.11n 13.88 dBm IEEE 802.11a 5.2GHz / 13.74 dBm IEEE 802.11n 5.2GHz 13.62 dBm IEEE 802.11a 5.3GHz / 12.73 dBm IEEE 802.11n 5.3GHz 14.23 dBm IEEE 802.11a 5.5GHz / 13.67 dBm IEEE 802.11n 5.5GHz 13.46 dBm IEEE 802.11a 5.8GHz / 12.79 dBm IEEE 802.11n 5.8GHz
Max. Body SAR Measurement:	0.449 W/kg 850EVDO / 0.47 W/kg 1900EVDO 1.14 W/kg GSM850 / 0.428 W/kg GSM1900 0.512 W/kg WCDMA850 / 0.743 W/kg WCDMA1900 / 0.019 W/kg Bluetooth 0.136 W/kg IEEE 802.11b / 0.138 W/kg - 802.11g, 0.126 W/kg – 802.11n 2.4GHz 0.293 W/kg IEEE 802.11a 5.2GHz / 0.253 W/kg IEEE 802.11n 5.2GHz 0.286 W/kg IEEE 802.11a 5.3GHz / 0.170 W/kg IEEE 802.11n 5.3GHz 0.331 W/kg IEEE 802.11a 5.5GHz / 0.286 W/kg IEEE 802.11n 5.5GHz 0.152 W/kg IEEE 802.11a 5.8GHz / 0.266 W/kg IEEE 802.11n 5.8GHz
EUT Serial No.:	*Pre-Production* [S/N: 8HKSA00136]

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-2005 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-2003.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1 INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.[1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-2005 *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz* ©2005 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [3] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

1.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 1-1).

Equation 1-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho\, dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

2 TEST SITE LOCATION

2.1 INTRODUCTION

The map at the right shows the location of the PCTEST LABORATORY in Columbia, Maryland. It is in proximity to the FCC Laboratory, the Baltimore-Washington International (BWI) airport, the city of Baltimore and Washington, DC (See Figure 2-1).

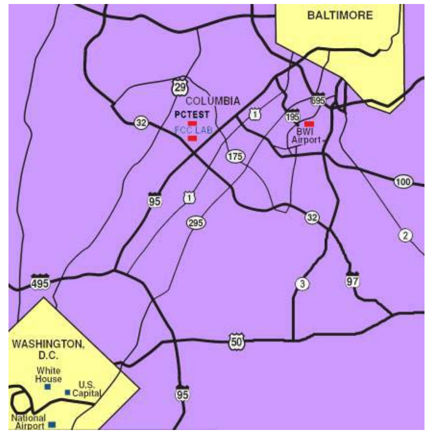
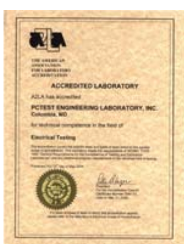


Figure 2-1
Map of the Greater Baltimore and Metropolitan Washington, D.C. area

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49' 38" W longitude. The facility is 1.5 miles north of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on January 27, 2006 and Industry Canada.

2.2 Test Facility / Accreditations:

Measurements were performed at an independent accredited PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing-Aid Compatibility (HAC), CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and all Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS and CDMA, and EvDO mobile phones.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO Data, CDMA 1xRTT Data.

3 SAR MEASUREMENT SETUP

3.1 Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. The DASY4 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Pentium 4 computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure 3-1).

3.2 System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the Gateway Pentium 4 2.53 GHz computer with Windows XP system and SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

3.3 System Electronics

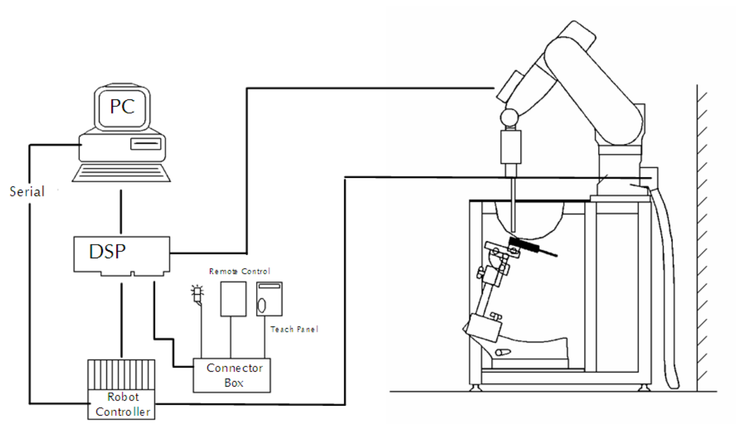


Figure 3-1
SAR Measurement System Setup

The DAE4 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. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [7].

3.4 Automated Test System Specifications

<u>Positioner</u>

Robot:	Stäubli Unimation Corp. Robot RX60L
Repeatability:	0.02 mm
No. of Axes:	6

<u>Data Acquisition Electronic System (DAE)</u>

Cell Controller

Processor:	Pentium 4
Clock Speed:	2.53 GHz
Operating System:	Windows XP Professional

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter & control logic
Software:	DASY4, SEMCAD software
Connecting Lines:	Optical Downlink for data and status info Optical upload for commands and clock

<u>PC Interface Card</u>

Function:	166MHz low power Pentium MMX 32MB chipdisk Link to DAE 16-bit A/D converter for surface detection system Two Serial & Ethernet link to robotics Direct emergency stop output for robot

<u>Phantom</u>

Type:	SAM Twin Phantom (V4.0)
Shell Material:	Composite
Thickness:	2.0 ± 0.2 mm

Figure 3-2
DASY4 SAR Measurement System

4 DASY E-FIELD PROBE SYSTEM

4.1 Probe Measurement System

Figure 4-1
SAR System

The SAR measurements were conducted with the dosimetric probe EX3DV4, designed in the classical triangular configuration [7] (see Figure 4-1) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip (see Figure 4-2). It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Figure 5-1). The approach is stopped at reaching the maximum.

4.2 Probe Specifications

Model:	EX3DV4
Frequency Range:	10 MHz – 6.0 GHz
Calibration:	In brain and muscle simulating tissue at Frequencies from 835 up to 5800MHz
Linearity:	± 0.2 dB (30 MHz to 6 GHz)
Dynamic Range:	10 mW/kg – 100 W/kg
Probe Length:	330 mm
Probe Tip Length:	20 mm
Body Diameter:	12 mm
Tip Diameter:	2.5 mm
Tip-Center:	1 mm
Application:	SAR Dosimetry Testing
	Compliance tests of mobile phones

Figure 4-2
Near-Field Probe

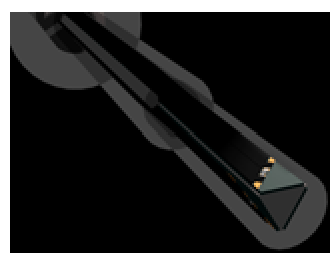


Figure 4-3
Triangular Probe Configuration

5 PROBE CALIBRATION PROCESS

5.1 Dosimetric Assessment Procedure

Each E-Probe/Probe amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

5.2 Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

5.3 Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

SAR = $$C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds),
C = heat capacity of tissue (brain or muscle),
ΔT = temperature increase due to RF exposure.

SAR = $$\frac{|E|^2 \cdot \sigma}{\rho}$$

where:

σ = simulated tissue conductivity,
ρ = Tissue density

SAR is proportional to ΔT/Δt, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

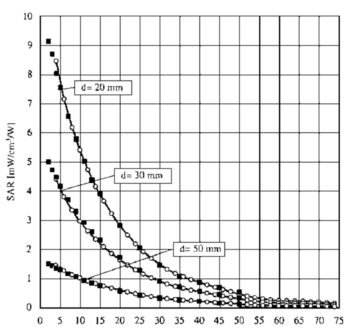


Figure 5-1 E-Field and Temperature measurements at 900MHz [7]

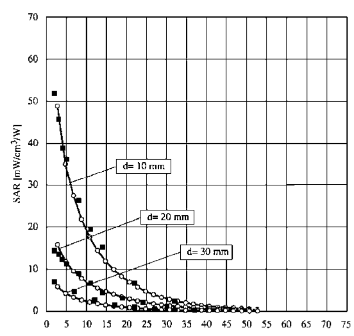


Figure 5-2 E-Field and temperature measurements at 1.9GHz [7]

6 PHANTOM AND EQUIVALENT TISSUES

6.1 SAM Phantoms

Figure 6-1
SAM Phantoms

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [11][12]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

6.2 Brain & Muscle Simulating Mixture Characterization

Figure 6-2
Head Simulated

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution (see Table 6-1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in the following table. Other head and body tissue parameters that have not been specified in IEEE-1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove [13].(See Table 6-1)

Table 6-1
Composition of the Brain & Muscle Tissue Equivalent Matter

Frequency (MHz)	300	450		835	900			1450	1800				1900		1950	2000	2100		2450		3000
Recipe #	1	1	3	1	1	2	3	1	1	2	2	3	1	2	4	1	1	2	2	3	2
Ingredients (% by weight)																					
1,2-Propanediol						64.81															
Bactericide	0.19	0.19	0.50	0.10	0.10		0.50					0.50								0.50	
Diacetin			48.90				49.20					49.43								49.75	
DGBE								45.41	47.00	13.84	44.92		44.94	13.84	45.00	50.00	50.00	7.99	7.99		7.99
HEC	0.98	0.98		1.00	1.00																
NaCl	5.95	3.95	1.70	1.45	1.48	0.79	1.10	0.67	0.36	0.35	0.18	0.64	0.18	0.35				0.16	0.16		0.16
Sucrose	55.32	56.32		57.00	56.50																
Triton X-100										30.45				30.45				19.97	19.97		19.97
Water	37.56	38.56	48.90	40.45	40.92	34.40	49.20	53.80	52.64	55.36	54.90	49.43	54.90	55.36	55.00	50.00	50.00	71.88	71.88	49.75	71.88
Measured dielectric parameters																					
ε_r'	46.00	43.4	44.3	41.6	41.2	41.8	42.7	40.9	39.3	41	40.4	39.2	39.9	41	40.1	37	36.8	41.1	40.3	39.2	37.9
σ(S/m)	0.86	0.85	0.9	0.9	0.98	0.97	0.99	1.21	1.39	1.38	1.4	1.4	1.42	1.38	1.41	1.4	1.51	1.55	1.88	1.82	2.46
Temp. (°C)	22	22	20	22	22	22	20	22	22	21	22	20	21	21	20	22	22	20	20	20	20
Target dielectric parameters (Table 2)																					
ε_r'	45.30	43.50		41.5	41.50			40.5	40.0								39.80		39.2		38.5
σ(S/m)	0.87	0.87		0.9	0.97			1.2	1.4								1.49		1.8		2.4
NOTE—Multiple columns for any single frequency are optional recipes. Recipe #, reference: 1 (Kanda et al. [B85]), 2 (Vigneras [B143]), 3 (Peyman and Gabriel [B119]), 4 (Fukunaga et al. [B50]).																					

*The formulas containing Triton X-100 and corresponding measured parameters are under review and verification.

7 DOSIMETRIC ASSESSMENT & PHANTOM SPECS

7.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed point was measured and used as a reference value.
2. The SAR distribution at the exposed side of the phantom was measured at a distance of 3.0mm from the inner surface of the shell. The horizontal grid spacing was 15mm x 15mm.
3. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see Figure 7-1):
   a. The data at the surface was extrapolated since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm [15]. A polynomial of the fourth order was calculated through the points in the z-axis. This polynomial was then used to evaluate the points between the surface and the probe tip.
   b. The maximum interpolated value was found with a software algorithm. Around this maximum, the SAR values averaged over the spatial volumes (1g or 10g) were computed using 3D-Spline interpolation. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions) [15][16]. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 1, was re-measured to measure drift. If the value drifted by more than 5%, the evaluation was repeated.

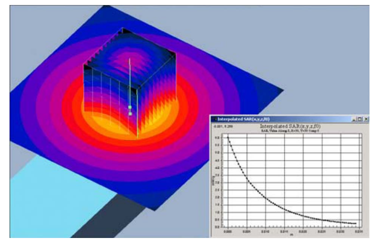


Figure 7-1
Sample SAR Area Scan

7.2 Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Figure 7-2). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimized reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15cm to minimize reflections from the upper surface.

Figure 7-2
SAM Twin Phantom Shell

8 DEFINITION OF REFERENCE POINTS

8.1 SAR for Notebooks and Lap-touching Devices

Lap-touching devices that have transmitting antennas located less than 20 cm from the lap of the user require routine SAR evaluation. Such devices are considered portable and are capable of being held to the body. Devices are to be setup touching the phantom and are configured with maximum output power during SAR assessment for a worst-case SAR evaluation.

Figure 8-1
Notebook Setup for SAR

8.2 Integral Antenna PCMCIA and CompactFlash Cards

KDB 497522. Integral-antenna PCMCIA and CompactFlash radio cards are common module-like devices meant to be purchased and installed without tools or special skills by consumers. The common host configurations (platforms, categories) are notebook (laptop) computers with PCMCIA slot(s) in the keyboard section, and PDAs (personal digital assistants or palmtop computers). Integral-antenna radio cards installed in PDAs with body-worn and/or held-to-ear configurations, and in all notebook computers, must be evaluated under portable RF exposure conditions per 47 C.F.R. 2.1093(b). To better represent the range of near field topography and environment of various notebook and PDA hosts, SAR evaluation using a minimum of <u>three</u> hosts within each platform type (three PDAs, three notebooks, etc.) is recommended by FCC. Hosts shall be modern, current-market, and expected final installations for the PC Cards.

Figure 8-2
CompactFlash radio card in PDA host configuration

For notebook computers with multiple card slots (e.g., two stacked), RF exposure should be evaluated with the transmitter installed in the slot(s) producing the highest SAR (See Figure 8-3). The minimum number of positions that should be evaluated for notebook computers and body-worn PDAs are bottom-face in parallel and in contact (0 cm) with flat phantom, and device perpendicular to phantom with recommended spacing of 1.5 cm.

Figure 8-3
PCMCIA Radio Card in a notebook host configuration

8.3 Positioning for Convertible and Slate Tablet Computers

Figure 8-4
Tablet Computer Form Factors

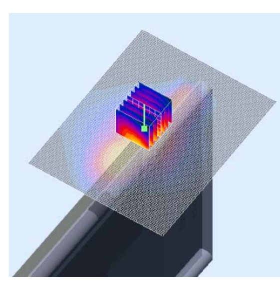


Figure 8-5
Tablet PC Body SAR

KDB 447498. Tablet (notepad) computers are tested in a lap-held position with the bottom of the computer in direct contact against a flat phantom for all user-enabled portrait and landscape positions.

8.4 SAR Testing with IEEE 802.11 a/b/g Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

8.4.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

8.4.2 Frequency Channel Configurations [22]

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz §15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11, 15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels. These are referred to as the “default test channels”. 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.

Mode		GHz	Channel	Turbo Channel	“Default Test Channels”			
					§15.247		UNII	
					802.11b	802.11g		
802.11 b/g		2.412	1		√	∇		
		2.437	6	6	√	∇		
		2.462	11		√	∇		
802.11a	UNII	5.18	36				√	
		5.20	40	42 (5.21 GHz)				*
		5.22	44					*
		5.24	48	50 (5.25 GHz)			√	
		5.26	52				√	
		5.28	56	58 (5.29 GHz)				*
		5.30	60					*
		5.32	64				√	
		5.500	100	Unknown				*
		5.520	104				√	
		5.540	108					*
		5.560	112					*
		5.580	116				√	
		5.600	120					*
		5.620	124				√	
		5.640	128					*
		5.660	132					*
		5.680	136				√	
		5.700	140					*
	UNII or §15.247	5.745	149		√		√	
		5.765	153	152 (5.76 GHz)		*		*
		5.785	157		√			*
		5.805	161	160 (5.80 GHz)		*	√	
	§15.247	5.825	165		√			

8.5 Device Conducted Powers (802.11abgn WLAN)

Mode	Freq [MHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 1	2	5.5	11				
802.11b	2412	**1**	N/A	A	12.52	12.35	12.17	12.05				
802.11b	2437	**6**	N/A	A	**14.33**	14.15	14.01	13.91				
802.11b	2462	**11**	N/A	A	12.82	12.72	12.57	12.49				

Mode	Freq [MHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 6	9	12	18	24	36	48	54
802.11g	2412	**1**	N/A	A	13.60	13.61	13.59	13.58	13.47	13.23	13.25	12.12
802.11g	2437	**6**	N/A	A	15.29	**15.31**	15.27	15.25	15.12	15.05	13.52	11.44
802.11g	2462	**11**	N/A	A	14.08	14.09	14.04	13.99	13.90	13.76	13.67	11.54

Mode	Freq [MHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 13.5	27	40	54	81	108	122	135
802.11n	2422	**3**	N/A	A	13.29	13.20	13.06	12.91	12.81	12.74	11.36	9.76
802.11n	2437	**6**	N/A	A	15.21	15.12	14.99	15.28	15.16	13.61	11.72	9.63
802.11n	2452	**9**	N/A	A	**15.29**	15.27	15.15	14.99	14.88	13.32	11.44	9.32

Mode	Freq [MHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 6	9	12	18	24	36	48	54
802.11a	5180	36	N/A	A	12.55	12.30	12.32	12.30	12.16	12.50	11.94	9.54
802.11a	5200	40	N/A	A	13.67	13.70	13.73	13.78	13.18	13.53	11.93	9.65
802.11a	5220	44	N/A	A	13.50	13.51	13.41	13.43	13.30	13.17	11.84	9.84
802.11a	5240	48	N/A	A	13.38	**13.88**	13.32	13.37	13.25	13.61	11.87	9.41
802.11a	5260	52	N/A	A	13.46	13.42	13.15	13.17	13.07	**13.62**	11.89	9.33
802.11a	5280	56	N/A	A	13.26	13.25	13.28	13.30	13.19	12.95	11.55	9.50
802.11a	5300	60	N/A	A	12.66	13.20	13.18	13.24	13.09	12.94	11.02	8.99
802.11a	5320	64	N/A	A	12.40	12.30	12.33	12.36	12.70	12.45	10.61	8.90
802.11a	5745	149	N/A	A	13.20	13.07	13.05	**13.46**	12.98	12.88	11.52	9.50
802.11a	5765	153	N/A	A	13.13	13.09	12.97	13.02	12.90	12.83	11.41	9.41
802.11a	5785	157	N/A	A	12.48	12.45	12.84	12.81	12.75	12.65	11.16	9.22
802.11a	5805	161	N/A	A	12.59	12.43	12.31	12.32	12.18	12.09	11.13	9.24
802.11a	5825	165	N/A	A	11.99	11.94	11.91	11.89	12.36	11.46	10.65	8.74

Mode	Freq [MHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 13.5	27	40	54	81	108	122	135
802.11n	5190	38	N/A	A	12.06	11.95	11.87	11.73	11.61	11.49	9.04	6.91
802.11n	5230	46	N/A	A	**13.74**	13.60	13.50	13.41	13.25	11.40	8.84	7.37
802.11n	5270	54	N/A	A	12.58	12.55	12.44	**12.73**	12.61	11.12	9.03	7.02
802.11n	5310	62	N/A	A	12.00	11.80	11.78	11.89	12.17	10.06	8.10	6.19
802.11n	5755	151	N/A	A	**12.79**	12.64	12.46	12.33	12.24	10.75	8.83	7.20
802.11n	5795	159	N/A	A	12.19	12.02	11.95	11.83	11.75	10.35	8.39	6.97

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Mode	Freq [GHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 6	9	12	18	24	36	48	54
802.11a	5.500	100	N/A	A	12.65	12.96	12.92	12.91	12.75	12.64	11.00	8.93
802.11a	5.520	104	N/A	A	12.83	12.86	12.82	12.79	12.72	12.90	11.46	9.41
802.11a	5.540	108	N/A	A	13.35	13.25	13.24	13.81	13.70	13.53	11.63	9.50
802.11a	5.560	112	N/A	A	13.40	13.33	13.27	13.26	13.16	12.99	12.09	10.07
802.11a	5.580	116	N/A	A	14.13	14.04	**14.23**	14.08	14.05	14.04	12.38	10.36
802.11a	5.600	120	N/A	A	14.04	14.00	13.96	13.89	13.86	13.65	12.24	10.24
802.11a	5.620	124	N/A	A	13.35	13.24	13.21	13.23	13.14	13.03	11.60	9.60
802.11a	5.640	128	N/A	A	13.46	13.28	13.25	13.23	13.07	13.12	11.55	9.55
802.11a	5.660	132	N/A	A	13.03	13.00	12.89	12.88	12.75	13.11	11.70	9.70
802.11a	5.680	136	N/A	A	13.00	12.95	12.84	12.83	12.79	12.61	11.19	9.21
802.11a	5.700	140	N/A	A	12.98	12.95	12.90	12.92	12.85	12.71	11.24	9.27

Mode	Freq [GHz]	Channel	Power Cont [dBm]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 13.5	27	40	54	81	108	122	135
802.11n	5.510	102	N/A	A	12.47	12.41	12.37	12.17	12.08	10.52	8.54	6.98
802.11n	5.590	118	N/A	A	**13.67**	13.43	13.40	13.25	13.14	11.52	9.55	8.10
802.11n	5.670	134	N/A	A	12.69	12.60	12.50	12.74	12.68	11.22	9.31	7.82

WCDMA/HSDPA/HSUPA

Mode	3GPP Subtest	Band V Channel 4132	Band V Channel 4182	Band V Channel 4233	Band II Channel 9262	Band II Channel 9400	Band II Channel 9538	MPR
Rel99	1	24.22	24.42	24.20	24.54	24.25	24.08	
Rel6 HSDPA	1	24.24	24.28	24.07	24.30	24.24	23.92	0
	2	24.15	24.37	24.03	24.38	24.14	23.84	0
	3	23.81	23.73	23.57	24.34	24.07	23.94	0.5
	4	23.74	23.62	23.63	23.81	23.69	23.47	0.5
Rel6 HSUPA	1	23.85	24.12	23.88	24.48	23.95	24.03	0
	2	21.98	21.99	21.91	22.60	21.90	21.97	2
	3	22.70	22.96	22.50	23.50	22.88	22.89	1
	4	21.93	21.84	21.88	22.82	22.08	21.90	2
	5	24.03	23.91	24.00	24.57	24.20	24.06	0

GSM/GPRS/EDGE

	GSM850 Channel			GSM1900 Channel			
Mode	128	190	251	512	661	810	Modulation
GSM	32.92	32.96	32.93	29.33	29.47	29.35	GMSK
GPRS	32.98	32.70	32.64	29.34	29.41	29.30	GMSK
EGPRS	27.50	27.83	27.71	26.65	26.81	26.53	8PSK

CDMA2000 1xEV-DO

Mode	Test Case			Cell Channel			PCS Channel		
	#	FWD RC/TAP	REV RC/TAP	1013	384	777	25	600	1175
1x	1	RC1	RC1 (SO2)	24.81	24.85	24.61	24.56	24.42	24.14
	2	RC1	RC1 (SO55)	24.77	24.81	24.74	24.61	24.49	24.29
	3	RC2	RC2 (SO9)	24.68	24.85	24.64	24.59	24.45	24.26
	4	RC2	RC2 (SO55)	24.82	24.83	24.72	24.61	24.53	24.36
	5	RC3	RC3 (SO55)	24.89	24.87	24.78	24.55	24.45	24.25
	6	RC3	RC3 (SO32)	23.26	23.31	23.38	23.09	23.20	23.17
1xEVDO Rel0	7a	FTAP Rate = 307kbps (2 slot, QPSK)	RTAP rate = 9.6kbps	24.78	24.75	24.70	24.21	24.27	23.94
	7b		RTAP rate = 19.2kbps	24.75	24.83	24.50	24.25	24.26	23.87
	7c		RTAP rate = 38.4kbps	24.79	24.71	24.62	24.21	24.20	23.92
	7d		RTAP rate = 76.8kbps	24.73	24.72	24.59	24.18	24.27	23.80
	7e		RTAP rate = 153.6kbps	24.92	24.89	24.73	24.53	24.40	23.99
1xEVDO RevA	8a	FETAP rate = 307kbps (2 slot, ACK channel is transmitted at all the slots)	RETAP - payload size = 128	24.89	24.92	24.72	24.44	24.49	24.08
	8b		RETAP - payload size = 256	24.75	24.88	24.76	24.54	24.31	24.11
	8c		RETAP - payload size = 512	24.81	24.90	24.80	24.40	24.41	24.07
	8d		RETAP - payload size = 768	24.82	24.75	24.77	24.42	24.52	24.10
	8e		RETAP - payload size = 1024	24.84	24.92	24.73	24.50	24.46	24.08
	8f		RETAP - payload size = 1536	24.84	24.86	24.67	24.48	24.51	24.03
	8g		RETAP - payload size = 2048	24.91	24.88	24.71	24.56	24.41	24.02
	8h		RETAP - payload size = 3072	24.89	24.85	24.68	24.48	24.51	24.09
	8i		RETAP - payload size = 4096	24.73	24.85	24.80	24.55	24.40	24.12
	8j		RETAP - payload size = 6144	24.82	24.86	24.66	24.50	24.38	24.04
	8k		RETAP - payload size = 8192	24.78	24.90	24.83	24.52	24.49	24.15
	8l		RETAP - payload size = 12288	24.82	24.91	24.73	24.34	24.37	24.14

9 FCC 3G MEASUREMENT PROCEDURES

Power measurements were performed using a base station simulator under digital average power.

9.1 SAR Measurement Conditions for CDMA2000

The following procedures were followed according to FCC "SAR Measurement Procedures for 3G Devices" v02, October 2007.

9.1.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices", June 2006. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in "All Up" condition. .

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 13-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 13-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

Table 9-1
Parameters for Max. Power for RC1

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 9-2
Parameters for Max. Power for RC3

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

9.1.2 Body SAR Measurements

SAR is measured using FTAP/RTAP and FETAP/RETAP respectively for Rev. 0 and Rev. A devices. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations. Both FTAP and FETAP are configured with a Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. AT power control should be in All Bits Up conditions for TAP/ETAP.

Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channels in Rev. 0. Head SAR is required for EV-DO devices that support operations next to the ear; for example, with VOIP, using Subtype 2 Physical Layer configurations according to the required handset test configurations.

9.1.3 1x RTT Support

For EV-DO devices that also support 1x RTT voice and/or data operations, SAR is not required for 1x RTT when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0. Otherwise, the 'Body SAR Measurements' procedures in the 'CDMA-2000 1x Handsets' section should be applied.

9.2 Procedures Used to Establish RF Signal for SAR HSPA Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. Body exposure conditions are typically applicable to these devices, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with WCDMA and requires an active DPCCH. The default test configuration is to measure SAR in WCDMA without HSDPA, with an established radio link between the DUT and a communication test set using a 12.2 kbps RMC configured in Test Loop Mode 1; and test HSDPA within FRC and a 12.2 kbps RMC using the highest SAR configuration in WCDMA. SAR is selectively confirmed for other physical channel configurations according to output power, exposure conditions and device operating capabilities. Maximum output power is verified according to 3GPP TS 23.121 (Release 5) and SAR must be measured according to these maximum output conditions.

The handset was placed into a simulated call using a base station simulator in a shielded chamber. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR [4]. SAR measurements were taken with a fully charged battery. In order to verify that the device was tested and maintained at full power, this was configured with the base station simulator. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

9.3 SAR Measurement Conditions for HSDPA Data Devices

9.3.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC (transmit power control) set to all "1s". Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH) is tabulated in the test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations is identified.

9.3.2 Head SAR Measurements (if VoIP applicable)

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all "1s". SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than ¼ dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signaling radio bearer) using the exposure configuration that results in the highest SAR for that RF channel in 12.2 RMC.

9.3.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all "1s". In addition, body SAR is also measured in HSDPA with an FRC, together with a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

The H-set used in FRC for HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HSPDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the applicable H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the FRC for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 2 ms to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors of $\beta c=9$ and $\beta d=15$, and power offset parameters of $\Delta ACK = \Delta NACK = 5$ and $\Delta CQI=2$ is used. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the FRC.

9.4 SAR Measurement Conditions for HSPA Data Devices

9.4.1 Body SAR Measurements

When voice transmission and head exposure conditions are applicable to a WCDMA/HSPA data device, head exposure is measured according to the 'Head SAR Measurements' procedures in the 'WCDMA Handsets' section of the FCC 3G document. SAR for body exposure configurations are measured according to the 'Body SAR Measurements' procedures in the 'WCDMA Handsets' section of the FCC 3G document. In addition, body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurements should be used to test for head exposure.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and EDCH configurations for HSPA should be configured according to the β values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of the FCC 3G document.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

10 MULTIPLE ANTENNA & SEPARATION DISTANCES

Table 10-1 Maximum Conducted Power

Maximum Conducted Power						
Transmitter	Frequency Band	Highest Frequency	Conducted Power		60/f (GHz)	>60/f
	MHz	MHz	dBm	mW	mW	
GSM GPRS850	835	848.80	32.98	1,986.09	70.69	yes
GSM GPRS1900	1880	1,908.80	29.41	872.97	31.43	yes
EVDO CDMA	835	848.31	24.92	310.46	70.73	yes
EVDO PCS	1880	1,908.75	24.61	289.07	31.43	yes
WCDMA850	835	846.60	24.42	276.69	70.87	yes
WCDMA1900	1880	1,907.60	24.54	284.45	31.45	yes
Bluetooth	2441	2,480.00	13.67	23.28	24.19	no
802.11b	2437	2,462.00	14.33	27.10	24.37	yes
802.11g	2437	2,462.00	15.31	33.96	24.37	yes
802.11a	5200	5,240.00	13.88	24.43	11.45	yes
802.11a	5300	5,320.00	13.62	23.01	11.28	yes
802.11a	5500	5,600.00	14.04	25.35	10.71	yes
802.11a	5785	5,825.00	13.46	22.18	10.30	yes
802.11n	2437	2,462.00	15.29	33.81	24.37	yes
802.11n	5200	5,240.00	13.74	23.66	11.45	yes
802.11n	5300	5,320.00	12.73	18.75	11.28	yes
802.11n	5500	5,600.00	13.67	23.28	10.71	yes
802.11n	5785	5,825.00	12.79	19.01	10.30	yes

Table 10-4 Distance – Antenna to Body

Distance - Antenna to Body			
Position	Antenna		
	WWAN	WLAN	BT
Laptop	72	72	72
Tablet	>200	>200	>200

WWAN: EVDO, GSM, WCDMA, WLAN: 802.11abgn **Unit: mm**

Table 10-5 Summary of Σ SAR

Position	SAR Result [W/kg]																	
	GPRS	GPRS	EVDO	EVDO	WCDMA	WCDMA	802.11b	802.11g	802.11n	802.11a	802.11n	802.11a	802.11n	802.11a	802.11n	802.11a	802.11n	Sigma SAR
	850	1900	835	1880	850	1900	2437	2437	2437	5200	5200	5300	5300	5500	5500	5800	5800	
Tablet	1.140						0.136											1.276
Tablet	1.140							0.138										1.278
Tablet	1.140								0.126									1.266
Tablet	1.140									0.293								1.433
Tablet	1.140										0.253							1.393
Tablet	1.140											0.286						1.426
Tablet	1.140												0.170					1.310
Tablet	1.140													0.331				1.471
Tablet	1.140														0.286			1.426
Tablet	1.140															0.152		1.292
Tablet	1.140																0.191	1.331
Tablet		0.428					0.136											0.564
Tablet		0.428						0.138										0.566
Tablet		0.428							0.126									0.554
Tablet		0.428								0.293								0.721
Tablet		0.428									0.253							0.681
Tablet		0.428										0.286						0.714
Tablet		0.428											0.170					0.598
Tablet		0.428												0.331				0.759
Tablet		0.428													0.286			0.714
Tablet		0.428														0.152		0.580
Tablet		0.428															0.191	0.619
Tablet			0.449				0.136											0.585
Tablet			0.449					0.138										0.587
Tablet			0.449						0.126									0.575
Tablet			0.449							0.293								0.742
Tablet			0.449								0.253							0.702
Tablet			0.449									0.286						0.735
Tablet			0.449										0.170					0.619
Tablet			0.449											0.331				0.780
Tablet			0.449												0.286			0.735
Tablet			0.449													0.152		0.601
Tablet			0.449														0.191	0.640
Tablet				0.470			0.136											0.606
Tablet				0.470				0.138										0.608
Tablet				0.470					0.126									0.596
Tablet				0.470						0.293								0.763
Tablet				0.470							0.253							0.723
Tablet				0.470								0.286						0.756
Tablet				0.470									0.170					0.640
Tablet				0.470										0.331				0.801
Tablet				0.470											0.286			0.756
Tablet				0.470												0.152		0.622
Tablet				0.470													0.191	0.661
Tablet					0.512		0.136											0.648
Tablet					0.512			0.138										0.650
Tablet					0.512				0.126									0.638
Tablet					0.512					0.293								0.805
Tablet					0.512						0.253							0.765
Tablet					0.512							0.286						0.798
Tablet					0.512								0.170					0.682
Tablet					0.512									0.331				0.843
Tablet					0.512										0.286			0.798
Tablet					0.512											0.152		0.664
Tablet					0.512												0.191	0.703
Tablet						0.743	0.136											0.879
Tablet						0.743		0.138										0.881
Tablet						0.743			0.126									0.869
Tablet						0.743				0.293								1.036
Tablet						0.743					0.253							0.996
Tablet						0.743						0.286						1.029
Tablet						0.743							0.170					0.913
Tablet						0.743								0.331				1.074
Tablet						0.743									0.286			1.029
Tablet						0.743										0.152		0.895
Tablet						0.743											0.191	0.934

11 ANSI/IEEE C95.1-2005 RF EXPOSURE LIMITS

11.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

11.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 11-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-2005

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

1 The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2 The Spatial Average value of the SAR averaged over the whole body.
3 The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

12 MEASUREMENT UNCERTAINTIES

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E2.1	6.6	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

13 SYSTEM VERIFICATION

13.1 Tissue Verification

Table 13-1
Measured Tissue Properties

Tissue Type	Conductivity: σ (S/m)			Relative Permittivity: ε			Calibration Date
	Target	Measured	Deviation	Target	Measured	Deviation	
835MHz Brain	0.90	0.89	-1.11%	41.50	41.87	+0.89%	09/15/2008
835MHz Muscle	0.97	0.98	+1.03%	55.20	56.05	+1.54%	09/15/2008
1900MHz Brain	1.40	1.36	-2.86%	40.00	39.48	-1.30%	09/15/2008
1900MHz Muscle	1.52	1.57	+3.29%	53.30	54.44	+2.14%	09/15/2008
2450MHz Brain	1.80	1.78	-1.06%	39.20	39.51	+0.79%	09/22/2008
2450MHz Muscle	1.95	1.93	-1.08%	52.70	51.10	-3.04%	09/22/2008
5300MHz Muscle	5.42	5.54	+2.12%	48.90	51.11	+4.52%	09/22/2008
5500MHz Muscle	5.65	5.79	+2.44%	48.60	50.78	+4.49%	09/22/2008
5800MHz Muscle	6.00	6.20	+3.25%	48.20	49.63	+2.97%	09/22/2008

Tissue Type	Conductivity: σ (S/m)			Relative Permittivity: ε			Calibration Date
	Target	Measured	Deviation	Target	Measured	Deviation	
835MHz Brain	0.90	0.86	-4.44%	41.50	42.67	+2.82%	01/12/2009
835MHz Muscle	0.97	0.96	-1.03%	55.20	56.57	+2.48%	01/12/2009
1900MHz Brain	1.40	1.42	+1.43%	40.00	40.50	+1.25%	01/12/2009
1900MHz Muscle	1.52	1.55	+1.97%	53.30	55.01	+3.21%	01/12/2009
2450MHz Brain	1.80	1.80	+0.01%	39.20	39.71	+1.30%	01/12/2009
2450MHz Muscle	1.95	1.89	-3.08%	52.70	51.29	-2.68%	01/12/2009
5300MHz Muscle	5.42	5.66	+4.43%	48.90	47.31	-3.25%	01/12/2009
5500MHz Muscle	5.65	5.68	+0.53%	48.60	46.77	-3.77%	01/12/2009
5800MHz Muscle	6.00	6.17	+2.83%	48.20	48.49	+0.60%	01/12/2009

13.2 Test System Verification

Prior to assessment, the system is verified to ±10% of the specifications at 835 MHz, 1900 MHz, 2450MHz, 5200MHz, 5500 and 5800 MHz by using the system validation kit(s). (Graphic Plots Attached)

Table 13-2
System Verification Results

Date	Frequency	Ambient Temp	Liquid Temp	Input Power	Target SAR	Measured SAR	Deviation
	MHz	°C	°C	mW	W/kg	W/kg	%
09/16/2008	835	22.8	21.9	250	2.290	2.070	-9.61
09/17/2008	1900	23.0	21.8	100	3.750	3.680	-1.87
09/25/2008	2450	23.4	22.1	100	5.410	5.730	+5.91
09/26/2008	5200	23.2	21.8	100	7.2300	7.620	+5.39
09/26/2008	5500	23.3	21.9	100	7.6800	8.170	+6.38
09/26/2008	5800	23.3	21.8	100	6.7300	7.230	+7.43
01/12/2009	835	22.2	21.4	250	2.253	2.100	-6.77
01/13/2009	1900	22.0	21.1	100	3.750	3.920	+4.53
01/14/2009	2450	22.5	21.3	100	5.410	5.270	-2.59
01/15/2009	5200	22.4	21.2	100	7.2300	7.140	-1.24
01/15/2009	5500	22.4	21.2	100	7.6800	7.810	+1.69
01/15/2009	5800	224.0	21.2	100	6.7300	6.980	+3.71

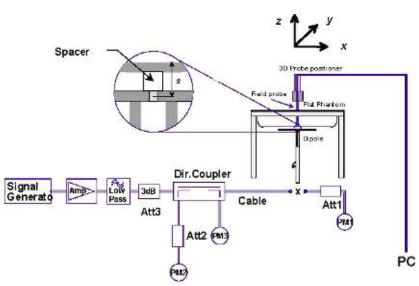

Figure 13-1
System Verification Setup Diagram

Figure 13-2
System Verification Setup Photo

14 SAR DATA SUMMARY

14.1 EVDO Body SAR Results

MEASUREMENT RESULTS								
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	SAR	Remarks
MHz	Ch.		Start	End			(W/kg)	
836.52	384	EVDO	24.89	24.72	Laptop	0.0	0.062	Rev.0
836.52	384	EVDO	24.89	24.94	Tablet Left	0.0	0.449	Rev.0
836.52	384	EVDO	24.85	24.97	Laptop	0.0	0.061	Rev.A
836.52	384	EVDO	24.85	24.86	Tablet Left	0.0	0.389	Rev.A
1880.00	600	EVDO	24.40	24.47	Laptop	0.0	0.051	Rev.0
1880.00	600	EVDO	24.40	24.31	Tablet Left	0.0	0.470	Rev.0
1880.00	600	EVDO	24.40	24.50	Laptop	0.0	0.049	Rev.A
1880.00	600	EVDO	24.40	24.40	Tablet Left	0.0	0.368	Rev.A
ANSI / IEEE C95.1 2005 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					Body 1.6 W/kg (mW/g) averaged over 1 gram			

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1.

14.2 GPRS Body SAR Results

MEASUREMENT RESULTS								
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	Number of slot	SAR
MHz	Ch.		Start	End				(W/kg)
836.6	190	GPRS	32.70	32.81	Laptop	0.0	2	**0.065**
824.2	128	GPRS	32.70	32.86	Tablet Left	0.0	2	0.820
836.6	190	GPRS	32.70	32.83	Tablet Left	0.0	2	0.984
848.8	251	GPRS	32.70	32.73	Tablet Left	0.0	2	1.140
1880.00	661	GPRS	29.41	29.24	Laptop	0.0	2	**0.016**
1880.00	661	GPRS	29.41	29.30	Tablet Left	0.0	2	0.428
ANSI / IEEE C95.1 2005 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Body** **1.6 W/kg (mW/g)** averaged over 1 gram			

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1.

14.3 WCDMA Body SAR Results

MEASUREMENT RESULTS							
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	SAR
MHz	Ch.		Start	End			(W/kg)
836.40	4182	WCDMA	24.42	24.48	Laptop	0.0	**0.061**
836.40	4182	WCDMA	24.42	24.49	Tablet Left	0.0	0.512
1880.00	9400	WCDMA	24.25	24.35	Laptop	0.0	**0.096**
1880.00	9400	WCDMA	24.25	24.10	Tablet Left	0.0	0.743
ANSI / IEEE C95.1 2005 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Body** **1.6 W/kg (mW/g)** averaged over 1 gram		

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1.

14.4 Bluetooth Body SAR Results

MEASUREMENT RESULTS							
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	SAR
MHz	Ch.		Start	End			(W/kg)
2441	39	FHSS	13.67	13.83	Laptop	0.0	**0.019**
ANSI / IEEE C95.1 2005 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					Body 1.6 W/kg (mW/g) averaged over 1 gram		

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated.
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1

14.2 IEEE 802.11b/11g/11n Body SAR Results

MEASUREMENT RESULTS									
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	Data Rate (Mbps)	SAR	Remarks
MHz	Ch.		Start	End				(W/kg)	
2412	1	DSSS	12.62	12.75	Laptop	0.0	1	0.051	802.11b
2437	6	DSSS	14.33	14.51	Laptop	0.0	1	**0.052**	802.11b
2462	11	DSSS	12.82	12.94	Laptop	0.0	1	0.047	802.11b
2412	1	OFDM	13.60	13.58	Laptop	0.0	6	0.051	802.11g
2437	6	OFDM	15.29	15.37	Laptop	0.0	6	**0.061**	802.11g
2462	11	OFDM	14.08	14.27	Laptop	0.0	6	0.060	802.11g
2422	3	OFDM	13.29	13.36	Laptop	0.0	13.5	0.060	802.11n
2437	6	OFDM	15.21	15.37	Laptop	0.0	13.5	**0.064**	802.11n
2452	9	OFDM	15.29	15.47	Laptop	0.0	13.5	0.061	802.11n
2412	1	DSSS	12.62	12.72	Tablet Right	0.0	1	0.096	802.11b
2437	6	DSSS	14.33	14.22	Tablet Right	0.0	1	**0.136**	802.11b
2462	11	DSSS	12.82	12.97	Tablet Right	0.0	1	0.126	802.11b
2412	1	OFDM	13.60	13.64	Tablet Right	0.0	6	0.121	802.11g
2437	6	OFDM	15.29	15.22	Tablet Right	0.0	6	**0.138**	802.11g
2462	11	OFDM	14.08	14.13	Tablet Right	0.0	6	0.103	802.11g
2422	3	OFDM	13.29	13.49	Tablet Right	0.0	13.5	0.114	802.11n
2437	6	OFDM	15.21	15.13	Tablet Right	0.0	13.5	**0.126**	802.11n
2452	9	OFDM	15.29	15.32	Tablet Right	0.0	13.5	0.116	802.11n
ANSI / IEEE C95.1 2005 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Body** **1.6 W/kg (mW/g)** averaged over 1 gram				

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated.
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1.

14.3 IEEE 802.11a/11n 5.2 – 53GHz Body SAR Results

MEASUREMENT RESULTS									
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	Data Rate (Mbps)	SAR	Remarks
MHz	Ch.		Start	End				(W/kg)	
5200	40	OFDM	13.67	13.83	Laptop	0.0	6	0.086	802.11a 5.2GHz
5240	48	OFDM	13.38	13.55	Laptop	0.0	6	**0.106**	802.11a 5.2GHz
5260	52	OFDM	13.46	13.63	Laptop	0.0	6	0.092	802.11a 5.3GHz
5300	60	OFDM	12.66	12.73	Laptop	0.0	6	**0.109**	802.11a 5.3GHz
5190	38	OFDM	12.06	12.17	Laptop	0.0	13.5	0.056	802.11n 5.2GHz
5230	46	OFDM	13.74	13.82	Laptop	0.0	13.5	**0.084**	802.11n 5.2GHz
5270	54	OFDM	12.58	12.74	Laptop	0.0	13.5	**0.087**	802.11n 5.3GHz
5310	62	OFDM	12.00	12.14	Laptop	0.0	13.5	0.062	802.11n 5.3GHz
5200	40	OFDM	13.67	13.86	Tablet Right	0.0	6	**0.293**	802.11a 5.2GHz
5240	48	OFDM	13.38	13.44	Tablet Right	0.0	6	0.198	802.11a 5.2GHz
5260	52	OFDM	13.46	13.62	Tablet Right	0.0	6	0.286	802.11a 5.3GHz
5300	60	OFDM	12.66	12.64	Tablet Right	0.0	6	0.158	802.11a 5.3GHz
5190	38	OFDM	12.06	12.17	Tablet Right	0.0	13.5	**0.253**	802.11n 5.2GHz
5230	46	OFDM	13.74	13.77	Tablet Right	0.0	13.5	0.249	802.11n 5.2GHz
5270	54	OFDM	12.58	12.66	Tablet Right	0.0	13.5	0.170	802.11n 5.3GHz
5310	62	OFDM	12.00	12.09	Tablet Right	0.0	13.5	0.143	802.11n 5.3GHz
ANSI / IEEE C95.1 2005 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Body** **1.6 W/kg (mW/g)** averaged over 1 gram				

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated.
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1

14.4 IEEE 802.11a/11n 5.5 – 5.8GHz Body SAR Results

MEASUREMENT RESULTS									
FREQUENCY		Modulation	Conducted Power [dBm]		Test Position	Spacing (cm)	Data Rate (Mbps)	SAR	Remarks
MHz	Ch.		Start	End				(W/kg)	
5540	108	OFDM	13.35	13.48	Laptop	0.0	6	**0.101**	802.11a 5.5GHz
5580	116	OFDM	14.13	14.31	Laptop	0.0	6	0.096	802.11a 5.5GHz
5600	120	OFDM	14.04	14.12	Laptop	0.0	6	0.096	802.11a 5.5GHz
5660	132	OFDM	13.03	13.18	Laptop	0.0	6	0.082	802.11a 5.5GHz
5745	149	OFDM	13.20	13.35	Laptop	0.0	6	0.068	802.11a 5.8GHz
5785	157	OFDM	12.48	12.62	Laptop	0.0	6	**0.092**	802.11a 5.8GHz
5825	165	OFDM	11.99	12.17	Laptop	0.0	13.5	0.090	802.11a 5.8GHz
5510	102	OFDM	12.47	12.61	Laptop	0.0	13.5	0.081	802.11n 5.5GHz
5590	118	OFDM	13.67	13.87	Laptop	0.0	13.5	**0.087**	802.11n 5.5GHz
5670	134	OFDM	12.69	12.87	Laptop	0.0	13.5	0.062	802.11n 5.5GHz
5755	151	OFDM	12.79	13.31	Laptop	0.0	13.5	**0.103**	802.11n 5.8GHz
5795	159	OFDM	12.19	12.38	Laptop	0.0	13.5	0.079	802.11n 5.8GHz
5540	108	OFDM	13.35	13.50	Tablet Right	0.0	6	0.195	802.11a 5.5GHz
5580	116	OFDM	14.13	14.16	Tablet Right	0.0	6	**0.331**	802.11a 5.5GHz
5600	120	OFDM	14.04	13.97	Tablet Right	0.0	6	0.307	802.11a 5.5GHz
5660	132	OFDM	13.03	13.18	Tablet Right	0.0	6	0.132	802.11a 5.5GHz
5745	149	OFDM	13.20	13.30	Tablet Right	0.0	6	**0.152**	802.11a 5.8GHz
5785	157	OFDM	12.48	12.34	Tablet Right	0.0	6	0.112	802.11a 5.8GHz
5825	165	OFDM	11.99	11.98	Tablet Right	0.0	13.5	0.142	802.11a 5.8GHz
5510	102	OFDM	12.47	12.63	Tablet Right	0.0	13.5	0.136	802.11n 5.5GHz
5590	118	OFDM	13.67	13.54	Tablet Right	0.0	13.5	**0.286**	802.11n 5.5GHz
5670	134	OFDM	12.69	12.54	Tablet Right	0.0	13.5	0.103	802.11n 5.5GHz
5755	151	OFDM	12.79	12.97	Tablet Right	0.0	13.5	**0.266**	802.11n 5.8GHz
5795	159	OFDM	12.19	12.38	Tablet Right	0.0	13.5	0.236	802.11n 5.8GHz
ANSI / IEEE C95.1 2005 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**Body** **1.6 W/kg (mW/g)** averaged over 1 gram				

Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings. Standard batteries were investigated.
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is 15.1 cm. ± 0.1

15 EQUIPMENT LIST

9/16/08 – 9/26/08 Tests:

Manufacturer	Model	Description	Calibration Date	Cal Inerval	Calibration Due	Serial No.
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/11/07	Biennial	10/10/09	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	3/12/08	Annual	3/12/09	JP38020182
Agilent	E5515C	Wireless Communications Test Set	6/8/07	Biennial	6/8/09	GB46110872
Agilent	E5515C	Wireless Communications Test Set	6/8/07	Biennial	6/8/09	GB46310798
Agilent	E5515C	Wireless Communications Test Set	9/10/08	Biennial	9/10/10	GB41450275
Agilent	E6651A	Mobile WiMAX Tester	8/23/07	Biennial	8/22/09	MY47310109
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/8/07	Biennial	3/8/09	MY45470194
Index SAR	IXTL-010	Dielectric Measurement Kit	N/A		N/A	
Index SAR	IXTL-030	30MM TEM line for 6 GHz	N/A		N/A	
Rohde & Schwarz	CMU200	Base Station Simulator	5/29/08	Annual	5/29/09	836371/0079
Rohde & Schwarz	CMU200	Base Station Simulator	12/6/07	Annual	12/5/08	107826
Rohde & Schwarz	CMU200	Base Station Simulator	7/23/08	Annual	7/23/09	109892
Rohde & Schwarz	NRVD	Dual Channel Power Meter	12/12/06	Biennial	12/11/08	101695
Rohde & Schwarz	NRVS	Single Channel Power Meter	7/3/07	Biennial	7/2/09	835360/0079
Rohde & Schwarz	NRV-Z32	Peak Power Sensor (100uW-2W)	12/21/06	Biennial	12/20/08	100155
Rohde & Schwarz	NRV-Z33	Peak Power Sensor (1mW-20W)	11/28/06	Biennial	11/27/08	100004
Rohde & Schwarz	NRV-Z53	Power Sensor	7/3/07	Biennial	7/2/09	846076/0007
SPEAG	D1450V2	1450 MHz SAR Dipole	6/11/07	Biennial	6/10/09	1025
SPEAG	D1765V2	1765 MHz SAR Dipole	6/11/07	Biennial	6/10/09	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	1/23/07	Biennial	1/22/09	502
SPEAG	D1900V2	1900 MHz SAR Dipole	1/23/07	Biennial	1/22/09	5d080
SPEAG	D2300V2	2300 MHz SAR Dipole	3/6/08	Biennial	3/6/10	1008
SPEAG	D2450V2	2450 MHz SAR Dipole	9/26/07	Biennial	9/25/09	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/17/07	Biennial	1/16/09	797
SPEAG	D2600V2	2600 MHz SAR Dipole	1/30/08	Biennial	1/29/10	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/25/07	Biennial	9/24/09	1007
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/24/07	Biennial	1/23/09	1057
SPEAG	D835V2	835 MHz SAR Dipole	1/8/07	Biennial	1/7/09	4d047
SPEAG	D835V2	835 MHz SAR Dipole	8/27/07	Biennial	8/26/09	4d026
SPEAG	DAE3	Dasy Data Acquisition Electronics	11/13/07	Annual	11/12/08	455
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/26/08	Annual	6/26/09	704
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/30/08	Annual	1/29/09	649
SPEAG	ES3DV2	SAR Probe	10/23/07	Annual	10/22/08	3022
SPEAG	EX3DV4	SAR Probe	6/26/08	Annual	6/26/09	3589
SPEAG	EX3DV4	SAR Probe	8/26/08	Annual	8/26/09	3561
SPEAG	EX3DV4	SAR Probe	1/31/08	Annual	1/30/09	3550

1/12/09 – 1/15/09 Tests:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/11/2007	Biennial	10/11/2009	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	3/12/2008	Annual	3/12/2009	JP38020182
Agilent	E5515C	Wireless Communications Test Set	9/10/2008	Biennial	9/10/2010	GB41450275
Agilent	E5515C	Wireless Communications Test Set	6/8/2007	Biennial	6/8/2009	GB46110872
Agilent	E5515C	Wireless Communications Test Set	6/8/2007	Biennial	6/8/2009	GB46310798
Agilent	E6651A	Mobile WiMAX Tester	8/23/2007	Biennial	8/23/2009	MY47310109
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/8/2007	Biennial	3/8/2009	MY45470194
Gigatronics	80701A	(0.05-18GHz) Power Sensor	8/18/2008	Annual	8/18/2009	1833460
Gigatronics	8651A	Universal Power Meter	8/18/2008	Annual	8/18/2009	8650319
Index SAR	IXTL-010	Dielectric Measurement Kit	N/A		N/A	N/A
Index SAR	IXTL-030	30MM TEM line for 6 GHz	N/A		N/A	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	7/23/2008	Annual	7/23/2009	109892
Rohde & Schwarz	CMU200	Base Station Simulator	5/29/2008	Annual	5/29/2009	836371/0079
Rohde & Schwarz	NRVD	Dual Channel Power Meter	8/20/2008	Biennial	8/20/2010	101695
Rohde & Schwarz	NRVS	Single Channel Power Meter	7/3/2007	Biennial	7/3/2009	835360/0079
Rohde & Schwarz	NRV-Z32	Peak Power Sensor (100uW-2W)	12/5/2008	Biennial	12/5/2010	100155
Rohde & Schwarz	NRV-Z33	Peak Power Sensor (1mW-20W)	12/5/2008	Biennial	12/5/2010	100004
Rohde & Schwarz	NRV-Z53	Power Sensor	7/3/2007	Biennial	7/3/2009	846076/0007
SPEAG	D1450V2	1450 MHz SAR Dipole	6/11/2007	Biennial	6/11/2009	1025
SPEAG	D1765V2	1765 MHz SAR Dipole	6/11/2007	Biennial	6/11/2009	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	1/23/2007	Biennial	1/23/2009	502
SPEAG	D1900V2	1900 MHz SAR Dipole	1/23/2007	Biennial	1/23/2009	5d080
SPEAG	D2300V2	2300 MHz SAR Dipole	3/6/2008	Biennial	3/6/2010	1008
SPEAG	D2450V2	2450 MHz SAR Dipole	9/26/2007	Biennial	9/26/2009	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/17/2007	Biennial	1/17/2009	797
SPEAG	D2600V2	2600 MHz SAR Dipole	1/30/2008	Biennial	1/30/2010	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/25/2007	Biennial	9/25/2009	1007
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/24/2007	Biennial	1/24/2009	1057
SPEAG	D835V2	835 MHz SAR Dipole	8/27/2007	Biennial	8/27/2009	4d026
SPEAG	D835V2	835 MHz SAR Dipole	1/8/2007	Biennial	1/8/2009	4d047
SPEAG	DAE3	Dasy Data Acquisition Electronics	10/17/2008	Annual	10/17/2009	455
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/30/2008	Annual	1/30/2009	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/25/2008	Annual	8/25/2009	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/26/2008	Annual	6/26/2009	704
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/30/2008	Annual	7/30/2009	859
SPEAG	EX3DV4	SAR Probe	1/31/2008	Annual	1/31/2009	3550
SPEAG	EX3DV4	SAR Probe	8/26/2008	Annual	8/26/2009	3561
SPEAG	EX3DV4	SAR Probe	6/26/2008	Annual	6/26/2009	3589

Notes:

The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Validation measurement is performed by PCTEST prior to SAR evaluation. The brain simulating material is calibrated by PCTEST using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material.

16 CONCLUSION

16.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

17 REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz, New York: IEEE, April 2006.

[3] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[4] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, July 2001.

[5] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.

[6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 120-124.

[9]K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Head Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[13] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[15] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[17] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.

[18] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[19] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[20] Prof. Dr. Niels Kuster, ETH, Eidgen□ssische Technische Hoschschule Z□rich, Dosimetric Evaluation of the Cellular Phone.

[21] FCC SAR Measurement Procedures for 3G Devices v2.0, October 2007

[22] SAR Measurement procedures for IEEE 802.11a/b/g rev 1.2, May 2007

[23] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.

[24] FCC Public Notice DA-02-1438. Office of Engineering and Technology Announces a Transition Period for the Phantom Requirements of Supplement C to OET Bulletin 65, June 19, 2002

[25] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands) Issue 2, November 2005

[26] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 1999

[27] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas v01r02 #648474, April 2008

[28] FCC Application Note for SAR Probe Calibration and System Verification Consideration for Measurements at 150 MHz – 3 GHz, Rev 1.1, January 2007

[29] FCC SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens, v01, December 2007

[30] FCC SAR Measurement Requirements for 3 – 6 GHz Rev1.1, October 2006