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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:
12/19/09 - 01/07/10
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0912152262.ACJ

FCC ID:	**ACJ9TGCF-311**
APPLICANT:	**PANASONIC CORPORATION OF NORTH AMERICA**

EUT Type:	Notebook PC with WLAN abgn, WWAN and Bluetooth
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093; FCC/OET Bulletin 65 Supplement C [July 2001]
FCC Classification:	FCC Part 15 Frequency Hopping Spread Spectrum Transceiver (DSS) Unlicensed Transmitter National Infrastructure (UNII) PCS Licensed Transmitter(PCB) Digital Transmission System (DTS)
Model(s):	CF-31mk1
Tx Frequencies Evaluated:	2412 - 2462 MHz (WLAN) 5180 - 5825 MHz (WLAN) 2402 - 2480 MHz Bluetooth
Conducted Power:	14.22 dBm WLAN 2.4 GHz 13.86 dBm WLAN 5.2 GHz 13.39 dBm WLAN 5.3 GHz 14.05 dBm WLAN 5.5 GHz 12.92 dBm WLAN 5.8 GHz 13.67 dBm Bluetooth
Max. Body SAR Measurement:	0.047 W/kg WLAN 802.11bgn 2.4 GHz 0.287 W/kg WLAN 802.11an 5.2 GHz 0.222 W/kg WLAN 802.11an 5.3 GHz 0.259 W/kg WLAN 802.11an 5.5 GHz 0.190 W/kg WLAN 802.11an 5.8 GHz
Test Device Serial No.:	*Pre-Production* [S/N: 116]

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 C95.1-1992 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001), IEEE 1528-2003 and in applicable Industry Canada Radio Standards Specifications (RSS); for North American frequency bands only.

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. Test results reported herein relate only to the item(s) tested.

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 C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz[2] and Health Canada RF Exposure Guidelines Safety Code 6 [26]. 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 Fig. 1-1).

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

Figure 1-1
SAR Mathematical Equation

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

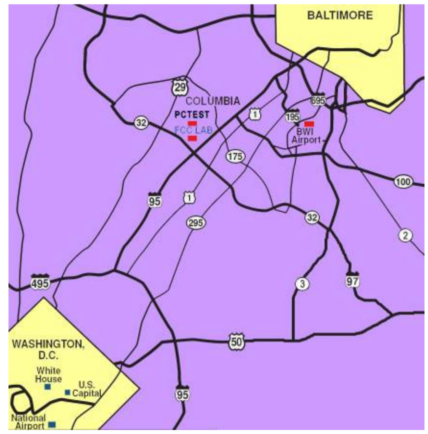


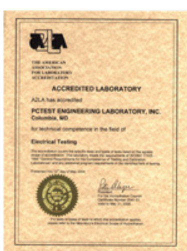
Figure 2-1
Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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).

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

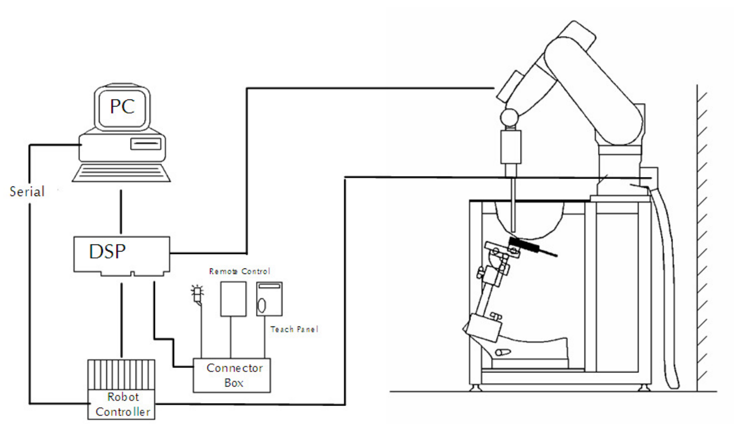


Figure 3-1
SAR Measurement System Setup

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

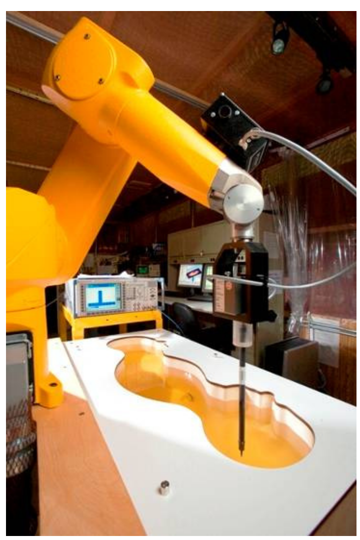


Figure 3-2
DASY4 SAR Measurement System

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 4-3) 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. 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:	ES3DV3, EX3DV4
Frequency Range:	10 MHz – 6.0 GHz (EX3DV4) 10 MHz – 4 GHz (ES3DV3)
Calibration:	In brain and muscle simulating tissue at Frequencies from 835 up to 5800MHz
Linearity:	± 0.2 dB (30 MHz to 6 GHz) for EX3DV4 ± 0.2 dB (30 MHz to 4 GHz) for ES3DV3
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 (3.9mm for ES3DV3)
Tip-Center:	1 mm (2.0 mm for ES3DV3)
Application:	SAR Dosimetry Testing Compliance tests of mobile phones Dosimetry in strong gradient fields

Figure 4-2
Near-Field Probe

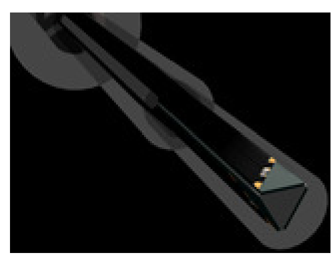


Figure 4-3
Triangular Probe Configuration

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 (1.25 g/cm3 for brain tissue)

SAR is proportional to $\Delta T/\Delta t$, 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;

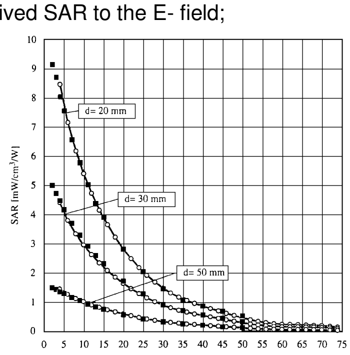


Figure 5-1 E-Field and Temperature measurements at 900MHz [7]

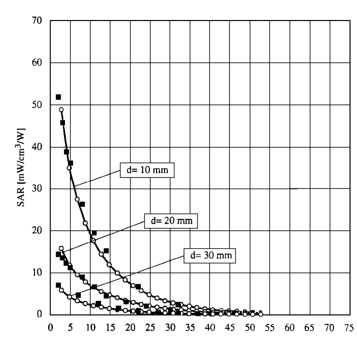


Figure 5-2 E-Field and temperature measurements at 1.9GHz [7]

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. (see Fig. 5.1)

6.2 Brain & Muscle Simulating Mixture Characterization

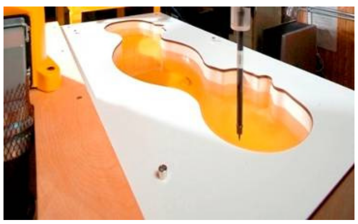


Figure 6-2
Head Simulated

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-Pro-panediol						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.

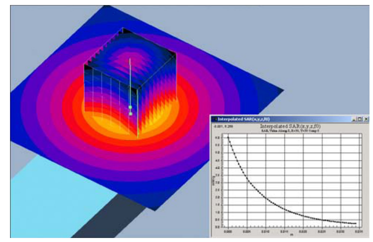


Figure 7-1
Sample SAR Area Scan

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

7.3 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.

7.3.1 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.

7.3.2 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.

Table 7-1
802.11 Test Channels per FCC Requirements

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		√			

7.4 Device Conducted Powers: WLAN 802.11abgn

Mode	Freq [MHz]	Channel	Antenna	Conducted Power [dBm] Data Rate [Mbps]							
				1	2	5.5	11				
802.11b	2412	1	B	13.54	13.00	13.50	13.05				
802.11b	2437	6	B	13.54	13.52	13.55	13.25				
802.11b	2462	11	B	12.84	13.25	13.23	13.10				
Mode	Freq [MHz]	Channel	Antenna	Conducted Power [dBm] Data Rate [Mbps]							
				6	9	12	18	24	36	48	54
802.11g	2412	1	B	11.91	11.78	11.77	11.78	11.68	11.00	11.54	10.30
802.11g	2437	6	B	**14.22**	14.16	14.03	14.01	13.84	13.80	12.50	10.70
802.11g	2462	11	B	12.56	12.50	12.45	12.44	12.28	12.20	12.22	11.15
Mode	Freq [MHz]	Channel	Antenna	Conducted Power [dBm] Data Rate [Mbps]							
				HT0	HT1	HT2	HT3	HT4	HT5	HT6	HT7
802.11 n	2422	3	B	7.42	7.43	7.77	7.15	7.08	7.00	7.01	6.90
802.11n	2437	6	B	14.05	14.00	13.93	13.68	13.61	12.20	10.49	8.80
802.11n	2452	9	B	7.73	7.78	8.14	7.50	7.40	7.84	7.38	7.31
Mode	Freq [MHz]	Channel	Antenna	Conducted Power [dBm] Data Rate [Mbps]							
				6	9	12	18	24	36	48	54
802.11a	5180	36	B	12.28	12.20	12.11	12.12	12.00	11.94	11.96	9.80
802.11a	5200	40	B	12.98	12.92	12.80	12.84	12.72	12.62	11.85	10.03
802.11a	5220	44	B	13.34	13.34	13.73	13.76	**13.86**	13.80	12.94	11.15
802.11a	5240	48	B	12.65	13.11	13.04	13.05	12.92	12.83	11.63	10.23
802.11a	5260	52	B	12.84	13.24	12.80	12.83	12.70	12.66	11.85	10.04
802.11a	5280	56	B	13.11	13.10	13.10	13.14	12.97	12.91	11.71	10.23
802.11a	5300	60	B	13.18	13.30	**13.39**	13.19	13.24	13.24	12.33	10.60
802.11a	5320	64	B	13.22	13.18	12.94	12.92	12.73	13.02	11.78	9.95
802.11a	5500	100	B	13.10	13.32	13.24	13.31	12.81	12.80	12.30	10.64
802.11a	5520	104	B	13.51	13.42	13.70	13.02	13.12	13.16	12.22	10.68
802.11a	5540	108	B	13.27	13.26	**14.05**	12.84	12.90	12.97	12.04	10.37
802.11a	5560	112	B	13.11	13.50	13.89	13.20	12.86	12.89	11.75	10.51
802.11a	5580	116	B	13.45	13.39	13.39	12.71	12.80	13.05	11.81	10.09
802.11a	5600	120	B	12.74	12.67	12.62	12.72	12.56	12.54	11.74	9.49
802.11a	5620	124	B	12.82	13.07	13.34	13.86	12.28	12.33	11.27	9.16
802.11a	5640	128	B	13.07	12.91	13.34	12.40	12.22	12.48	11.63	9.31
802.11a	5660	132	B	12.71	12.88	13.06	12.53	12.52	12.54	11.61	9.27
802.11a	5680	136	B	12.75	12.66	12.93	12.30	12.97	12.41	11.64	9.30
802.11a	5700	140	B	12.47	12.43	12.06	12.12	12.00	11.93	11.10	9.28
802.11a	5745	149	B	11.82	12.04	12.00	12.03	11.84	11.76	10.85	8.50
802.11a	5785	157	B	12.31	12.35	12.10	12.20	12.03	11.95	11.10	8.78
802.11a	5825	165	B	**12.92**	12.80	12.40	12.62	12.10	12.10	11.25	8.85
Mode	Freq [MHz]	Channel	Antenna	Conducted Power [dBm] Data Rate [Mbps]							
				HT0	HT1	HT2	HT3	HT4	HT5	HT6	HT7
802.11n	5190	38	B	9.06	9.01	8.97	8.81	8.67	8.73	8.68	8.63
802.11n	5230	46	B	12.82	12.41	12.72	12.40	12.08	11.56	9.81	7.97
802.11n	5270	54	B	12.22	12.60	12.52	12.32	12.22	11.76	10.01	8.25
802.11n	5310	62	B	10.03	10.01	9.96	9.78	9.71	9.69	9.73	8.35
802.11n	5510	102	B	11.47	11.43	11.36	11.16	11.10	10.63	10.27	8.48
802.11n	5550	110	B	11.21	11.09	11.42	11.05	11.40	11.04	9.14	7.68
802.11n	5590	118	B	12.59	12.57	12.45	11.93	11.81	11.43	10.00	8.25
802.11n	5630	126	B	10.72	10.89	10.80	10.44	10.56	10.47	8.17	6.72
802.11n	5670	134	B	11.80	11.79	11.69	11.47	11.42	11.24	9.17	5.06
802.11n	5755	151	B	11.35	11.66	11.54	11.35	11.30	10.72	8.60	5.60
802.11n	5795	159	B	12.00	11.90	11.76	11.56	11.40	11.00	8.81	6.01

8 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	
Bluetooth	2441	2,480.00	13.67	23.28	24.19	no
802.11b	2437	2,462.00	13.54	22.59	24.37	no
802.11g	2437	2,462.00	14.22	26.42	24.37	yes
802.11a	5200	5,240.00	13.86	24.32	11.45	yes
802.11a	5300	5,320.00	13.39	21.83	11.28	yes
802.11a	5500	5,600.00	14.05	25.41	10.71	yes
802.11a	5785	5,825.00	12.92	19.59	10.30	yes
802.11n	2437	2,462.00	14.05	25.41	24.37	yes
802.11n	5200	5,240.00	12.82	19.14	11.45	yes
802.11n	5300	5,320.00	12.60	18.20	11.28	yes
802.11n	5500	5,600.00	12.59	18.16	10.71	yes
802.11n	5785	5,825.00	12.00	15.85	10.30	yes

Distance - Antenna to Body				
Position	Antenna (Unit: mm			
	WWAN Main	WLAN Main	WLAN Aux	BT
Laptop	300	300	37	37

Table 10-2 Distance – Antenna to Body

Distance - Antenna to Antenna				
Antenna (Unit: mm)	WWAN Main	WLAN Main	WLAN Aux	BT
WWAN Main	N/A	120	NA	263
WLAN Main	120	N/A	NA	310
WLAN Aux	N/A	N/A	N/A	345
BT	NA	NA	345	NA

Table 10-3 Distance – Antenna to Antenna

NOTE: SAR evaluation is not required for antennas located greater than 20 cm from the body Therefore WWAN Main and WLAN Main antenna was not evaluated.
The Maximum antenna output power of Bluetooth is <60/f, therefore SAR evaluation is not required.

9 ANSI/IEEE C95.1-1992 RF EXPOSURE LIMITS

9.1 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.

9.2 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 9-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992

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.

10 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	E.2.1	6.6	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	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)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	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

11 SYSTEM VERIFICATION

11.1 Tissue Verification

Table 11-1
Measured Tissue Properties

Calibrated Date:	Tissue Type	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
12/14/2009	2450M	2401	1.897	51.50	1.95	52.70	-2.72%	-2.28%
		2450	1.978	51.31	1.95	52.70	1.44%	-2.64%
		2499	2.046	51.15	1.95	52.70	4.92%	-2.94%
01/04/2010	5200M	5170	5.296	48.71	5.26	49.15	0.61%	-0.90%
		5210	5.352	48.60	5.31	48.95	0.75%	-0.72%
		5250	5.425	48.70	5.36	48.75	1.21%	-0.10%
01/04/2010	5300M	5270	5.452	48.51	5.38	48.65	1.26%	-0.29%
		5310	5.490	48.34	5.43	48.45	1.07%	-0.23%
		5350	5.570	48.42	5.48	48.25	1.64%	0.35%
01/04/2010	5500M	5470	5.716	48.01	5.61	48.63	1.82%	-1.27%
		5510	5.709	47.95	5.66	48.59	0.83%	-1.32%
		5550	5.831	47.92	5.71	48.55	2.12%	-1.30%
01/04/2010	5600M	5570	5.828	47.87	5.73	48.53	1.64%	-1.36%
		5610	5.847	47.69	5.78	48.49	1.12%	-1.65%
		5650	5.924	47.62	5.83	48.45	1.61%	-1.71%
01/04/2010	5700M	5670	5.976	47.66	5.85	48.40	2.08%	-1.52%
		5710	5.999	47.46	5.90	48.34	1.64%	-1.81%
		5750	6.047	47.44	5.95	48.28	1.63%	-1.73%
01/04/2010	5800M	5770	6.155	47.41	5.97	48.25	3.03%	-1.73%
		5800	6.172	47.24	6.01	48.20	2.70%	-1.99%
		5850	6.195	47.26	6.07	48.13	2.06%	-1.80%

11.2 Test System Verification

Prior to assessment, the system is verified to ±10% of the specifications by using the system validation kit(s). (Graphic Plots Attached)

Table 11-2
System Verification Results

System Verification TARGET & MEASURED									
Date:	**Amb. Temp (℃)**	**Liquid Temp (℃)**	**Input Power (W)**	**Tissue Frequency (MHz)**	**Dipole SN**	**Tissue Type**	**Targeted SAR_{1g} (mW)**	**Measured SAR_{1g} (mW)**	**Deviation (%)**
12/19/2009	24.5	22.8	0.100	2450	797	Muscle	5.30	5.06	-4.53%
01/06/2010	23.4	21.7	0.025	5200	1057	Muscle	1.98	1.89	-4.42%
01/07/2010	23.6	21.9	0.025	5500	1057	Muscle	2.04	1.97	-3.43%
01/07/2010	23.8	22.1	0.025	5800	1057	Muscle	1.79	1.80	0.56%

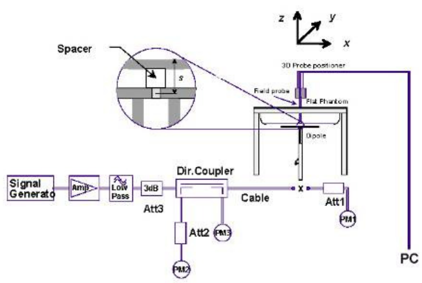


Figure 11-1
System Verification Setup Diagram

Figure 11-2
System Verification Setup Photo

12 SAR DATA SUMMARY

14.1 WLAN 802.11bgn 2.4GHz Body SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Conducted Power [dBm]		Test Position	Modulation	Data Rate (Mbps)	Spacing (cm)	Antenna	SAR
MHz	Ch.		Start	End						(W/kg)
2412	1	802.11b	13.54	13.37	Lap	DSSS	1	0.0	B	0.030
2437	6	802.11b	13.54	13.34	Lap	DSSS	1	0.0	B	0.037
2462	11	802.11b	12.84	12.66	Lap	DSSS	1	0.0	B	**0.047**
2412	1	802.11g	11.91	11.79	Lap	OFDM	6	0.0	B	0.032
2437	6	802.11g	14.22	14.03	Lap	OFDM	6	0.0	B	**0.033**
2462	11	802.11g	12.56	14.23	Lap	OFDM	6	0.0	B	0.026
2422	3	802.11n	7.42	7.55	Lap	OFDM	13.5	0.0	B	0.017
2437	6	802.11n	14.05	13.87	Lap	OFDM	13.5	0.0	B	**0.036**
2452	9	802.11n	7.73	8.30	Lap	OFDM	13.5	0.0	B	0.036
ANSI / IEEE C95.1 1992 - 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.
6. WLAN Main antenna (A) located greater than 20 cm from the body of the user and thus was not evaluated for SAR.

14.2 WLAN 802.11an 5.2GHz Body SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Conducted Power [dBm]		Test Position	Modulation	Data Rate (Mbps)	Spacing (cm)	Antenna	SAR
MHz	Ch.		Start	End						(W/kg)
5200	40	802.11a	12.98	12.93	Top	OFDM	6	*	B	**0.287**
5220	44	802.11a	13.34	13.44	Top	OFDM	6	*	B	0.221
5220	44	802.11a	13.86	13.68	Top	OFDM	24	*	B	0.199
5190	38	802.11n	9.06	9.03	Top	OFDM	13.5	*	B	0.134
5230	46	802.11n	12.82	12.98	Top	OFDM	13.5	*	B	0.259
5200	40	802.11a	12.98	12.87	Lap	OFDM	6	0.0	B	< 0.01
ANSI / IEEE C95.1 1992 - 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.
6. Due to the antenna placement and thickness of the DUT no discernable hotspot was found in the Lap position so the device was tested with the antenna (keyboard), 1.0 cm from the SAM phantom.
7. WLAN Main antenna (A) located greater than 20 cm from the body of the user and thus was not evaluated for SAR.

14.3 WLAN 802.11an 5.3GHz Band Body SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Conducted Power [dBm]		Test Position	Modulation	Data Rate (Mbps)	Spacing (cm)	Antenna	SAR
MHz	Ch.		Start	End						(W/kg)
5260	52	802.11a	12.84	12.70	Top	OFDM	6	*	B	0.185
5260	52	802.11a	13.24	13.06	Top	OFDM	9	*	B	0.180
5300	60	802.11a	13.18	13.27	Top	OFDM	6	*	B	**0.222**
5300	60	802.11a	13.39	13.23	Top	OFDM	12	*	B	0.208
5270	54	802.11n	12.22	12.27	Top	OFDM	13.5	*	B	0.205
5310	62	802.11n	10.03	10.22	Top	OFDM	13.5	*	B	0.125
5260	52	802.11a	12.84	12.70	Lap	OFDM	6	0.0	B	< 0.01
ANSI / IEEE C95.1 1992 - 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.
6. Due to the antenna placement and thickness of the DUT no discernable hotspot was found in the Lap position so the device was tested with the antenna (keyboard), 1.0 cm from the SAM phantom.
7. WLAN Main antenna (A) located greater than 20 cm from the body of the user and thus was not evaluated for SAR.

14.4 WLAN 802.11an 5.5GHz Body SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Conducted Power [dBm]		Test Position	Modulation	Data Rate (Mbps)	Spacing (cm)	Antenna	SAR
MHz	Ch.		Start	End						(W/kg)
5540	108	802.11a	13.27	13.10	Top	OFDM	6	*	B	0.228
5540	108	802.11a	14.05	13.98	Top	OFDM	12	*	B	**0.259**
5560	112	802.11a	13.11	12.97	Top	OFDM	6	*	B	0.227
5560	112	802.11a	13.89	13.81	Top	OFDM	12	*	B	0.118
5620	124	802.11a	12.82	12.96	Top	OFDM	6	*	B	0.196
5620	124	802.11a	13.86	14.00	Top	OFDM	18	*	B	0.174
5510	102	802.11n	11.47	11.34	Top	OFDM	13.5	*	B	0.132
5590	118	802.11n	12.59	12.45	Top	OFDM	13.5	*	B	0.231
5670	134	802.11n	11.80	11.97	Top	OFDM	13.5	*	B	0.120
5540	108	802.11a	13.27	13.10	Lap	OFDM	6	0.0	B	< 0.01
ANSI / IEEE C95.1 1992 - 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.
6. Due to the antenna placement and thickness of the DUT no discernable hotspot was found in the Lap position so the device was tested with the antenna (keyboard), 1.0 cm from the SAM phantom.
7. WLAN Main antenna (A) located greater than 20 cm from the body of the user and thus was not evaluated for SAR.

14.5 WLAN 802.11an 5.8GHz Body SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Conducted Power [dBm]		Test Position	Modulation	Data Rate (Mbps)	Spacing (cm)	Antenna	SAR
MHz	Ch.		Start	End						(W/kg)
5745	149	802.11a	11.82	11.64	Top	OFDM	6	*	B	0.181
5785	157	802.11a	12.31	12.21	Top	OFDM	6	*	B	0.168
5825	165	802.11a	12.92	12.73	Top	OFDM	6	*	B	0.097
5755	151	802.11n	11.35	11.37	Top	OFDM	13.5	*	B	**0.190**
5795	159	802.11n	12.00	11.83	Top	OFDM	13.5	*	B	0.137
5745	149	802.11a	11.82	11.64	Lap	OFDM	6	0.0	B	< 0.01
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General**					**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.
6. Due to the antenna placement and thickness of the DUT no discernable hotspot was found in the Lap position so the device was tested with the antenna (keyboard), 1.0 cm from the SAM phantom.
7. WLAN Main antenna (A) located greater than 20 cm from the body of the user and thus was not evaluated for SAR.

13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8648D	(9kHz-4GHz) Signal Generator	9/19/2009	Biennial	9/19/2011	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	3/25/2009	Annual	3/25/2010	JP38020182
Agilent	E5515C	Wireless Communications Test Set	9/10/2009	Annual	9/10/2010	GB46110872
Agilent	E5515C	Wireless Communications Test Set	9/11/2009	Annual	9/11/2010	GB46310798
Agilent	E5515C	Wireless Communications Test Set	8/25/2009	Annual	8/25/2010	GB41450275
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/25/2009	Biennial	3/25/2011	MY45470194
Gigatronics	80701A	(0.05-18GHz) Power Sensor	9/9/2009	Annual	9/9/2010	1833460
Gigatronics	8651A	Universal Power Meter	9/9/2009	Annual	9/9/2010	8650319
Rohde & Schwarz	CMU200	Base Station Simulator	9/11/2009	Annual	9/11/2010	836371/0079
Rohde & Schwarz	CMU200	Base Station Simulator	4/6/2009	Annual	4/6/2010	833855/0010
Rohde & Schwarz	CMU200	Base Station Simulator	9/4/2009	Annual	9/4/2010	109892
Rohde & Schwarz	NRVD	Dual Channel Power Meter	8/20/2008	Biennial	8/20/2010	101695
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
SPEAG	D1450V2	1450 MHz SAR Dipole	5/20/2009	Biennial	5/20/2011	1025
SPEAG	D1765V2	1765 MHz SAR Dipole	5/19/2009	Biennial	5/19/2011	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	1/20/2009	Biennial	1/20/2011	502
SPEAG	D1900V2	1900 MHz SAR Dipole	8/18/2009	Biennial	8/18/2011	5d080
SPEAG	D2300V2	2300 MHz SAR Dipole	3/6/2008	Biennial	3/6/2010	1008
SPEAG	D2450V2	2450 MHz SAR Dipole	8/27/2009	Biennial	8/27/2011	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/8/2009	Biennial	1/8/2011	797
SPEAG	D2600V2	2600 MHz SAR Dipole	8/12/2009	Biennial	8/12/2011	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	8/19/2009	Biennial	8/19/2011	1007
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/15/2009	Biennial	1/15/2011	1057
SPEAG	D835V2	835 MHz SAR Dipole	1/19/2009	Biennial	1/19/2011	4d047
SPEAG	D835V2	835 MHz SAR Dipole	8/24/2009	Biennial	8/24/2011	4d026
SPEAG	DAE3	Dasy Data Acquisition Electronics	9/17/2009	Annual	9/17/2010	455
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/14/2009	Annual	5/14/2010	704
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/25/2009	Annual	5/25/2010	665
SPEAG	ES3DV2	SAR Probe	9/18/2009	Annual	9/18/2010	3022
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/21/2009	Annual	7/21/2010	859
SPEAG	D750V3	750 MHz Dipole	2/19/2009	Biennial	2/19/2011	1003
Rohde & Schwarz	CMU200	Base Station Simulator	6/12/2009	Annual	6/12/2010	836536/0005
Speag	ES3DV3	SAR Probe	4/15/2009	Annual	4/15/2010	3213
Speag	ES3DV3	SAR Probe	4/15/2009	Annual	4/15/2010	3209
Rohde & Schwarz	SMIQ03B	Signal Generator	5/21/2009	Annual	5/21/2010	832810/021
Speag	D1640V2	1640 MHz Dipole	8/21/2008	Biennial	8/21/2010	321
Rohde & Schwarz	CMW500	LTE Base Station Simulator	8/25/2009	Annual	8/25/2010	100976
Anritsu	MA2481A	Power Sensor	12/2/2009	Annual	12/2/2010	5318
Anritsu	MA2481A	Power Sensor	12/3/2009	Annual	12/3/2010	5442
Anritsu	ML2438A	Power Meter	12/3/2009	Annual	12/3/2010	1190013
Anritsu	ML2438A	Power Meter	12/3/2009	Annual	12/3/2010	98150041
Anritsu	ML2438A	Power Meter	12/3/2009	Annual	12/3/2010	1070030
Anritsu	MA2481A	Power Sensor	12/2/2009	Annual	12/2/2010	5821
Anritsu	MA2481A	Power Sensor	12/3/2009	Annual	12/3/2010	8013
Anritsu	MA2481A	Power Sensor	12/3/2009	Annual	12/3/2010	2400

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.

14 CONCLUSION

14.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, 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]

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