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SAR COMPLIANCE EVALUATION REPORT

Applicant Name:

Samsung Electronics, Co. Ltd.
18600 Broadwick St.
Rancho Dominguez, CA 90220
United States

Date of Testing:

08/10/10 - 08/13/10

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Test Report Serial No.:

OY1008091321-R1.A3L

FCC ID:

A3LSHWM180S

APPLICANT:

SAMSUNG ELECTRONICS, CO. LTD.

EUT Type:

1900 GPRS Mini-Tablet with Bluetooth and WLAN

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093; FCC/OET Bulletin 65 Supplement C [June 2001]

FCC Classification:

Unlicensed Transmitter National Infrastructure (UNII)

PCS Licensed Transmitter (PCB)

Digital Transmission System (DTS)

Model(s):

SHW-M180S

Tx Frequency:

1850.20 - 1909.80 MHz (GSM 1900)

2412-2462 MHz(WLAN 802.11b/g/n)

5 GHz (WLAN 802.11a/n)

Conducted Power:

30.04 dBm GPRS 1900

16.47 dBm 2.4 GHz WLAN

15.56 dBm 5 GHz WLAN

Max. SAR Measurement:

0.45 W/kg GPRS 1900 Body SAR

0.62 W/kg 2.4 GHz WLAN Body SAR

0.63 W/kg 5 GHz WLAN Body SAR

Test Device Serial No.:

Pre-Production [S/N: FH-177-A, FH-177-B]

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.

Note: This revised Test Report (S/N: OY1008091321-R1.A3L) supersedes and replaces the previously issued test report on the same subject EUT for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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



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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]

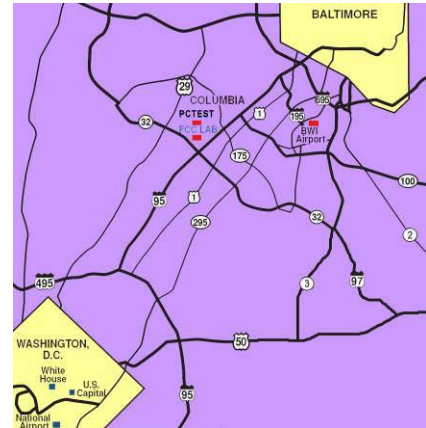
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2 TEST SITE LOCATION

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).

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.



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

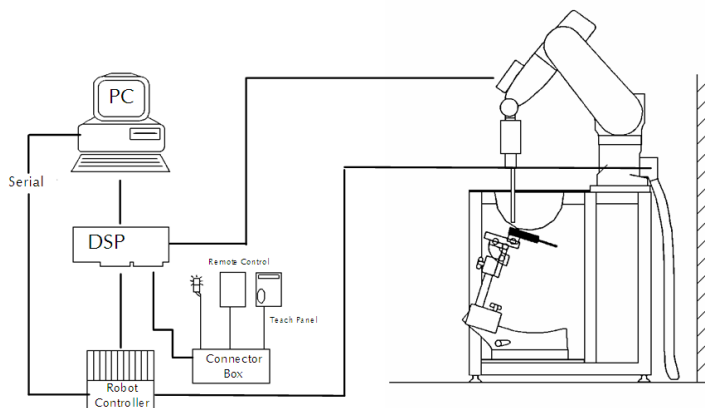


Figure 3-1
SAR Measurement System Setup

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].

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3.4 Automated Test System Specifications

Positioner

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

Data Acquisition Electronic System (DAE)

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

PC Interface Card

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

Phantom

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



Figure 3-2
DASY4 SAR Measurement System

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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

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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/cm²) 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/cm².

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.

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

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;

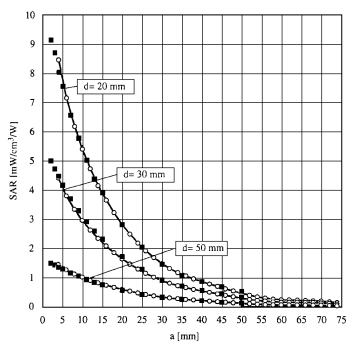


Figure 5-1 E-Field and Temperature measurements at 900MHz [7]

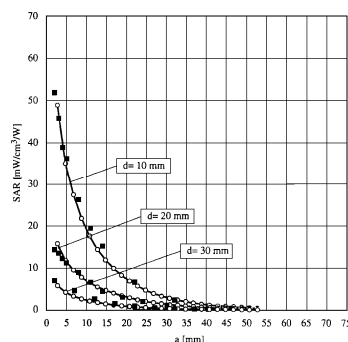


Figure 5-2 E-Field and temperature measurements at 1.9GHz [7]

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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. Hartsgröve [13]. (See Table 6-1)

Table 6-1
Composition of the Body Tissue Equivalent Matter

Frequency (MHz)	1900	2450	5200-5800
Tissue	Body	Body	Body
Ingredients (% by weight)			
Bactericide			
DGBE	29.44	26.7	
DEGEE			10.67
HEC			
NaCl	0.39	0.1	
Sucrose			
Triton X-100			10.67
Water	70.16	73.2	78.67

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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 head was measured at a distance of 3.0mm from the inner surface of the shell. The area covered the entire dimension of the head and 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 z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
 - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z 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. If the value changed by more than 5%, the evaluation is repeated.

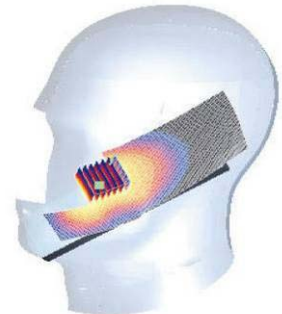


Figure 7-1
Sample SAR Area Scan

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

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8 RF EXPOSURE LIMITS

8.1 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.

8.2 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 8-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT <i>General Population</i> (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT <i>Occupational</i> (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.

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9 MEASUREMENT UNCERTAINTIES

Applicable for 835 - 2450 MHz.

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	5.5	N	1	1.0	1.0	5.5	5.5	∞
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	11.8	11.5
Expanded Uncertainty (95% CONFIDENCE LEVEL)							k=2	23.7	23.0
									299

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

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Applicable for 5.2-5.8 GHz.

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	6.55	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
Expanded Uncertainty (95% CONFIDENCE LEVEL)							k=2	24.7	24.0
									299

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

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties

Calibrated for Tests Performed on	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
08/10/2010	1900M	1850	1.503	51.55	1.52	53.30	-1.12%	-3.28%
		1880	1.534	51.40	1.52	53.30	0.92%	-3.56%
		1910	1.578	51.27	1.52	53.30	3.82%	-3.81%
08/13/2010	1900M	1850	1.464	52.51	1.52	53.30	-3.68%	-1.48%
		1880	1.500	52.40	1.52	53.30	-1.32%	-1.69%
		1910	1.533	52.27	1.52	53.30	0.86%	-1.93%
08/11/2010	1900M	1850	5.296	47.14	5.26	49.06	0.68%	-3.90%
		1880	5.304	47.20	5.31	49.00	-0.11%	-3.68%
		1910	5.378	47.13	5.36	48.95	0.34%	-3.71%
08/12/2010	5200-5800M	5170	5.431	46.91	5.38	48.92	0.95%	-4.11%
		5210	5.481	46.85	5.43	48.87	0.94%	-4.12%
		5250	5.537	46.88	5.47	48.81	1.22%	-3.96%
		5270	5.677	46.49	5.62	48.65	1.01%	-4.44%
		5310	5.737	46.34	5.66	48.59	1.36%	-4.63%
		5350	5.809	46.40	5.71	48.54	1.73%	-4.41%
		5470	5.805	46.37	5.73	48.51	1.31%	-4.41%
		5510	5.869	46.12	5.78	48.46	1.54%	-4.83%
		5550	5.945	46.11	5.83	48.40	1.97%	-4.73%
		5570	5.966	46.23	5.85	48.38	1.98%	-4.44%
		5610	5.999	45.95	5.90	48.32	1.68%	-4.90%
		5650	6.085	45.87	5.95	48.27	2.27%	-4.97%
		5670	6.135	45.95	5.97	48.24	2.76%	-4.75%
		5710	6.149	45.87	6.00	48.20	2.48%	-4.83%
		5750	6.208	46.23	6.05	48.62	2.61%	-4.92%

Note: KDB 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50 MHz of the DUT frequencies.

The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies (per IEEE 1528 6.6.1.2). The SAR test plots may slightly differ from the table above since the DASY software rounds to three significant digits.

10.2 Measurement Procedure for Tissue verification

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity , for example from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

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10.3 Test System Verification

Prior to assessment, the system is verified to $\pm 10\%$ of the manufacturer SAR measurement on the reference dipole at the time of calibration.

Table 10-2
System Verification Results

System Verification TARGET & MEASURED										
Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Tissue Frequency (MHz)	Dipole SN	Tissue Type	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation (%)
08/10/2010	24.4	23.1	0.040	1900	5d080	Body	1.63	40.5	40.75	0.62%
08/11/2010	24	23.5	0.025	2450	719	Body	1.26	51.4	50.4	-1.95%
08/12/2010	24.7	23.4	0.024	5200	1007	Body	1.74	78.9	72.5	-8.11%
08/12/2010	24.4	23.3	0.025	5500	1007	Body	2.13	84.1	85.2	1.31%
08/12/2010	24.5	23.5	0.025	5800	1007	Body	1.86	72.3	74.4	2.90%
08/13/2010	24.1	23.4	0.100	1900	502	Body	4.3	41.5	43	3.61%

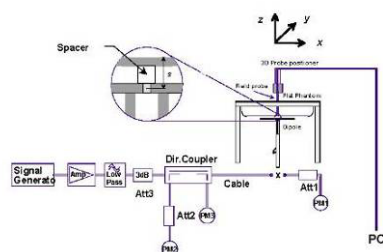


Figure 10-1
System Verification Setup Diagram



Figure 10-2
System Verification Setup Photo

10.4 Justification for Extended SAR Dipole Calibrations

SAR dipoles with extended calibrations beyond 1 year were confirmed for maintaining return loss (< -20 dB, within 20% of prior measurement) and impedance (within 5 ohms from prior measurement) per KDB 450824.

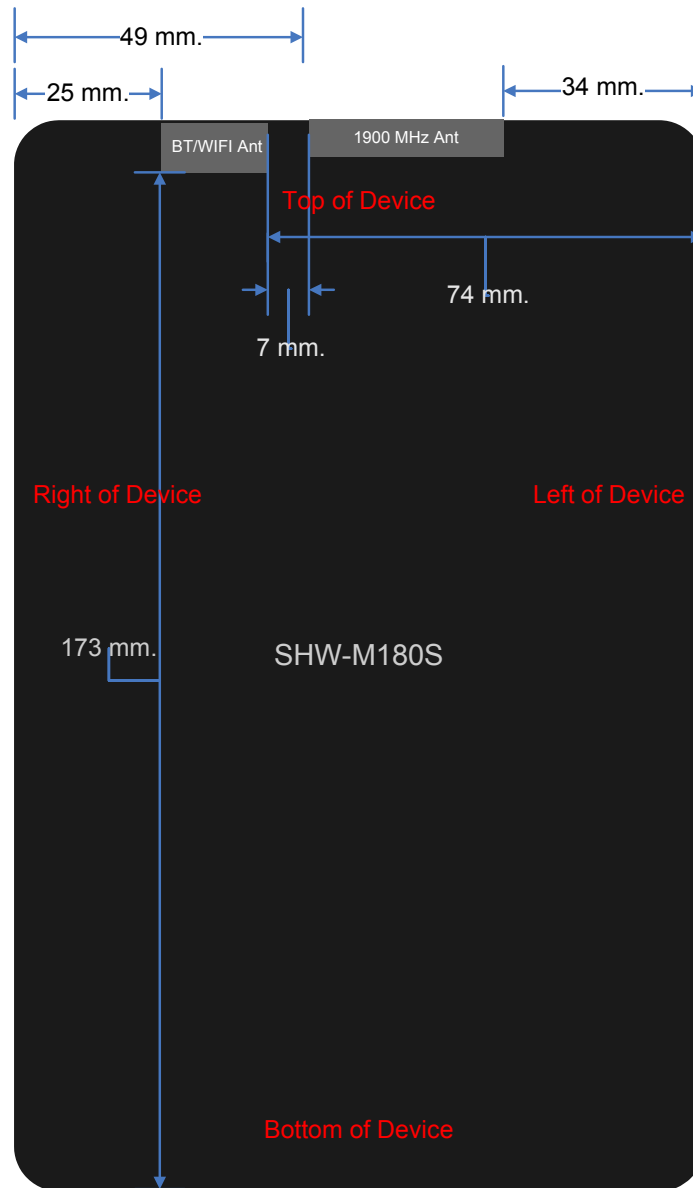
D1900V2 SN:5d080					D2450V2 SN: 719				
Date	Return Loss (dB)	Δ %	Impedance (Ω)	$\Delta\Omega$	Date	Return Loss (dB)	Δ %	Impedance (Ω)	$\Delta\Omega$
8/18/2009	-24.3		50		8/27/2009	-28.6		53.4	
8/19/2010	-22.4	-7.8%	51	1.0	8/19/2010	-27.5	-3.8%	51	-2.4

D5GHZV2 SN: 1007					D1900V2 SN:502				
Date	Return Loss (dB)	Δ %	Impedance (Ω)	$\Delta\Omega$	Date	Return Loss (dB)	Δ %	Impedance (Ω)	$\Delta\Omega$
8/19/2009	-35.2		49.7		1/20/2009	-26.8		47.1	
8/19/2010	-31.5	-10.5%	48.4	-1.3	8/19/2010	-27.2	1.5%	48.9	1.8

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11 SAR TEST CONSIDERATIONS

11.1 Multiple Antenna/Transmission Information for SHW-M180S



11.2 Mini-Tablet Edge testing for SAR

A general composite test separation distance of 5 mm was considered for the transmitting modes of the device according to KDB Inquiry 502978 since the device was smaller than a standard larger tablet. Larger tablets would mostly be used touching the body, whereas this 7" device was small enough to be handheld. The inquiry includes also an additional conservative test distance for the top of the tablet.

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11.3 Top Edge SAR Testing Distance

From the FCC meeting on 6/4/2010 and KDB Inquiry 502978, a composite and conservative test separation distance of 7.5 mm were considered for the top edge (where the antennas are located).

The test separation distance for 7.5 mm edge testing is based on arguments that the dominant antennas were located at the top edge of the device and the display supports a fixed up-right orientation because of the location of the front-facing video conference camera at the top of the device. The back of the device has a flash camera that is not used for video conference calls, but for regular camera picture taking features.

However, for this application, a test separation distance of 5 mm was applied for all edges and back configurations.

11.4 Antenna Distances to edges against normal distance thresholds

Frequency (GHz)	Power (mW)	60/f	P/60/f-1	distance threshold (5+1/2n)
1.9	1009.00	31.58	30.95	204.76 mm
2.45	44.36	24.49	0.81	54.06 mm
5.6	48.75	10.71	3.55	67.75 mm

Given that the WIFI antenna was closest to both the top and right side of the device, and the distance thresholds were met, WIFI testing on the left and bottom edge of the device was determined to be much lower than that of the closer edges, and is thus not included in this report.

11.5 Simultaneous Transmission Analysis

All antennas may transmit simultaneously with one another, including 5 GHz.

Bluetooth and WIFI cannot transmit simultaneously since it shares the same circuit path and are switched by the radio.

Simult Tx	Configuration	GPRS SAR (W/kg)	WIFI SAR (W/kg)	Σ GPRS + WIFI (W/kg)
Body SAR	Lap Back	0.446	0.634	1.08
	Edge - Top	0.342	0.474	0.82
	Edge - Right	0.02	0.046	0.07
	Edge - Left	0.024	0	0.02
	Edge - Bottom	0.008	0.00	0.01

Considering the above numerical summed SAR, the worst-case summed SAR is below the SAR limit. Therefore, the actual simultaneous transmission cases will not exceed the SAR limit. Therefore, no volumetric aggregate SAR evaluation is required.

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12 FCC GPRS MEASUREMENT PROCEDURES

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

12.1 Procedures Used to Establish RF Signal for SAR

The device 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, it 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.

FCC KDB 941225 was considered for the power measurements and SAR testing.

12.2 RF Conducted Powers

12.2.1 GSM Conducted Powers

		RF Conducted Power Table			
		GPRS Data			
Band	Channel	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot
PCS	512	30.04	27.65	25.72	24.35
	661	29.76	27.34	25.43	24.09
	810	29.82	27.42	25.48	24.20

GSM Device Class: C (only voice or only data connection possible)

GPRS Multislot Class: 12 (4 Tx max slots uplink)

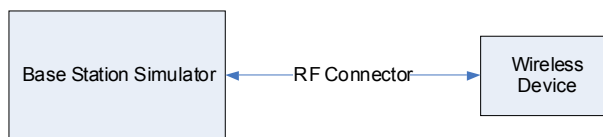


Figure 12-1
Power Measurement Setup

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13 FCC IEEE 802.11 MEASUREMENT PROCEDURES

13.1 SAR Testing with IEEE 802.11 a/b/g Transmitters (if applicable)

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.

13.1.1 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.



13.1.2 Frequency Channel Configurations²²

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 13-1
802.11 Test Channels per FCC Requirements

Mode	GHz	Channel	Turbo Channel	“Default Test Channels”		UNII	
				§15.247	802.11g		
802.11 b/g	2.412	1		√	▽		
	2.437	6	6	√	▽		
	2.462	11		√	▽		
802.11a	5.18	36				√	*
	5.20	40	42 (5.21 GHz)				*
	5.22	44				√	*
	5.24	48				√	*
	5.26	52	50 (5.25 GHz)			√	*
	5.28	56					*
	5.30	60	58 (5.29 GHz)				*
	5.32	64				√	*
	5.500	100					*
	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					*
	5.745	149		√		√	*
UNII or §15.247	5.765	153	152 (5.76 GHz)		*		*
	5.785	157		√			*
	5.805	161	160 (5.80 GHz)		*	√	*
	§15.247	5.825	165	√			*

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13.2 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated connection using the manufacturer provided test software. SAR measurements were taken with a fully charged battery. Power was manually set.

13.2.1 IEEE 802.11b Conducted Powers

Mode	Freq [MHz]	Channel	Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1	15.89	15.99	15.85	15.85
802.11b	2437	6	16.47	16.44	16.43	16.44
802.11b	2462	11	16.13	16.21	16.24	16.14

13.2.2 IEEE 802.11g Conducted Powers

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	14.16	14.12	14.15	14.02	14.10	13.94	14.02	14.03
802.11g	2437	6	14.66	14.46	14.46	14.34	14.33	14.37	14.34	14.35
802.11g	2462	11	14.95	14.74	14.81	14.75	14.74	14.73	14.62	14.63

13.2.3 IEEE 802.11n Conducted Powers

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40	54	81	108	122	135
802.11n	2412	1	14.17	14.18	14.11	14.15	14.12	14.02	14.02	14.04
802.11n	2437	6	14.66	14.40	14.44	14.34	14.36	14.31	14.33	14.35
802.11n	2462	11	15.07	14.83	14.74	14.80	14.73	14.70	14.72	14.69

13.2.4 IEEE 802.11a Conducted Powers

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36	15.19	15.03	15.06	15.03	15.03	14.92	14.88	15.14
802.11a	5200	40	14.83	14.84	15.07	14.74	15.03	14.98	14.97	14.93
802.11a	5220	44	14.54	14.56	14.75	14.57	14.72	14.33	14.42	14.18
802.11a	5240	48	14.79	14.87	14.76	14.52	14.60	14.62	14.80	15.14
802.11a	5260	52	14.81	14.55	14.48	14.29	14.65	14.66	14.82	14.85
802.11a	5280	56	14.69	14.43	14.44	14.56	14.79	14.78	14.69	14.67
802.11a	5300	60	14.68	14.79	14.54	14.80	14.66	14.74	14.65	14.70
802.11a	5320	64	14.58	14.58	14.61	14.65	14.71	14.79	14.75	14.81
802.11a	5500	100	15.21	15.40	15.41	15.41	15.18	15.32	15.33	15.22
802.11a	5520	104	15.21	15.08	15.33	15.14	15.11	15.03	15.01	15.00
802.11a	5540	108	15.09	15.12	15.08	15.07	14.93	14.91	14.93	14.99
802.11a	5560	112	14.97	15.09	15.07	15.00	15.19	15.22	15.14	15.15
802.11a	5580	116	15.11	15.03	15.18	15.16	15.13	15.07	15.08	15.07
802.11a	5600	120	15.56	15.44	15.37	15.34	15.36	15.31	15.29	15.21
802.11a	5620	124	15.07	14.93	15.10	15.12	15.04	15.02	15.05	15.09
802.11a	5640	128	15.09	15.12	14.96	15.10	15.12	15.03	15.06	14.94
802.11a	5660	132	15.02	14.95	15.05	14.91	15.00	15.08	14.96	14.95
802.11a	5680	136	15.00	15.06	15.04	15.03	15.00	14.76	14.93	14.85
802.11a	5700	140	15.13	15.14	15.10	15.07	15.03	15.19	15.28	15.02
802.11a	5745	149	14.99	14.84	14.64	14.53	14.43	14.46	14.43	14.44
802.11a	5765	153	14.56	14.60	14.58	14.38	14.66	14.37	14.55	14.57
802.11a	5785	157	14.84	14.57	14.52	14.55	14.55	14.42	14.45	14.42
802.11a	5805	161	14.60	14.55	14.53	14.51	14.46	14.42	14.32	14.38
802.11a	5825	165	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

13.2.5 IEEE 802.11 n Conducted Powers

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40	54	81	108	122	135
802.11n	5180	36	15.09	15.16	15.12	14.87	14.97	14.91	14.83	14.83
802.11n	5200	40	14.79	14.49	14.57	14.49	14.46	14.72	14.73	14.79
802.11n	5220	44	14.26	14.55	13.95	14.31	14.26	14.44	14.27	14.75
802.11n	5240	48	14.44	14.33	14.15	14.55	14.67	14.78	14.89	14.89
802.11n	5260	52	14.79	14.41	14.42	14.39	14.32	14.38	14.69	14.81
802.11n	5280	56	14.67	14.75	14.48	14.48	14.68	14.72	14.73	14.73
802.11n	5300	60	14.49	14.36	14.12	14.34	13.84	14.01	14.24	14.12
802.11n	5320	64	14.43	14.32	14.37	14.47	14.60	14.57	14.52	14.43
802.11n	5500	100	15.16	15.16	15.15	15.13	15.06	15.05	15.19	15.18
802.11n	5520	104	14.93	14.81	14.74	14.87	14.96	15.03	14.99	14.92
802.11n	5540	108	14.57	14.91	14.84	14.93	14.75	15.53	15.17	15.09
802.11n	5560	112	15.16	14.68	15.04	15.06	15.22	15.21	15.12	15.16
802.11n	5580	116	15.21	15.11	15.12	15.10	15.06	15.02	15.04	15.03
802.11n	5600	120	15.31	15.40	15.26	15.28	15.25	15.17	15.11	15.09
802.11n	5620	124	15.10	15.07	15.11	15.03	15.04	15.03	14.97	15.00
802.11n	5640	128	15.03	15.06	15.09	15.02	15.08	15.00	15.07	14.98
802.11n	5660	132	15.08	15.09	15.10	15.12	15.14	15.01	15.03	14.91
802.11n	5680	136	14.87	15.03	14.97	14.90	14.87	14.67	14.08	14.76
802.11n	5700	140	15.01	15.05	14.98	14.99	14.96	15.11	15.17	14.92
802.11n	5745	149	14.49	14.45	14.52	14.52	14.38	14.43	14.40	14.36
802.11n	5765	153	14.67	14.48	14.56	14.90	14.84	14.45	14.44	14.50
802.11n	5785	157	14.49	14.42	14.44	14.42	14.45	14.48	14.36	14.31
802.11n	5805	161	14.44	14.40	14.41	14.40	14.37	14.34	14.32	14.27
802.11n	5825	165	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a



Figure 13-1
Power Measurement Setup

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14 SAR DATA SUMMARY

14.1 Body SAR Results

MEASUREMENT RESULTS									
FREQUENCY		Service	C_Power[dBm]		Spacing	GPRS Tx Slots	Mini Tablet Position	Side	SAR (W/kg)
MHz	Ch.		Start	End					
1880	661	GPRS	27.34	27.33	0.5 cm	2	Lap	back	0.446
1880	661	GPRS	25.43	25.39	0.5 cm	3	Lap	back	0.425
1880	661	GPRS	24.09	24.07	0.5 cm	4	Lap	back	0.425
1880	661	GPRS	27.34	27.74	0.5 cm	2	Edge	top	0.342
1880	661	GPRS	25.43	25.79	0.5 cm	3	Edge	top	0.334
1880	661	GPRS	24.09	24.45	0.5 cm	4	Edge	top	0.330
1880	661	GPRS	27.34	27.49	0.5 cm	2	Edge	bottom	0.008
1880	661	GPRS	25.43	25.59	0.5 cm	3	Edge	bottom	0.007
1880	661	GPRS	24.09	23.91	0.5 cm	4	Edge	bottom	0.007
1880	661	GPRS	27.34	27.63	0.5 cm	2	Edge	left	0.024
1880	661	GPRS	25.43	25.38	0.5 cm	3	Edge	left	0.024
1880	661	GPRS	24.09	23.95	0.5 cm	4	Edge	left	0.024
1880	661	GPRS	27.34	27.58	0.5 cm	2	Edge	right	0.020
1880	661	GPRS	25.43	25.24	0.5 cm	3	Edge	right	0.018
1880	661	GPRS	24.09	24.37	0.5 cm	4	Edge	right	0.019
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 were according to FCC/OET Bulletin 65, Supplement C.
2. All modes of operation were investigated, and worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. Batteries are fully charged for all readings.
5. Liquid tissue depth was at least 15.0 cm.
6. A conservative 5mm test distance spacing was used for all edges per KDB Inquiry 502978 and FCC meeting on 06/04/10. See Section 11.2 for more details.
7. Justification for reduced test configurations per KDB 941225: The source-based time-averaged output power was evaluated for all multi-slot operations for GPRS/EDGE. In addition to the worst-case reported, all source-based time-averaged powers within 10% of the worst-case were additionally included in the evaluation.
8. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

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14.2 WLAN Body SAR Results

MEASUREMENT RESULTS									
FREQUENCY		Mode	C_Power[dBm]		Spacing	Data Rate (Mbps)	Mini Tablet Position	Side	SAR
MHz	Ch.		Start	End					(W/kg)
2437	6	IEEE 802.11b	16.88	17.10	0.5 cm	1	Lap	back	0.619
2437	6	IEEE 802.11b	16.88	16.92	0.5 cm	1	Edge	top	0.474
2437	6	IEEE 802.11b	16.88	16.66	0.5 cm	1	Edge	bottom	0.0001
2437	6	IEEE 802.11b	16.88	16.61	0.5 cm	1	Edge	right	0.046
5180	36	IEEE 802.11a	15.19	14.81	0.5 cm	6	Lap	back	0.634
5180	36	IEEE 802.11a	15.19	15.37	0.5 cm	6	Edge	top	0.177
5180	36	IEEE 802.11a	15.19	14.84	0.5 cm	6	Edge	right	0.037
5260	52	IEEE 802.11a	14.85	15.09	0.5 cm	54	Lap	back	0.335
5260	52	IEEE 802.11a	14.85	14.70	0.5 cm	54	Edge	top	0.101
5260	52	IEEE 802.11a	14.85	15.08	0.5 cm	54	Edge	right	0.029
5600	120	IEEE 802.11a	15.56	15.37	0.5 cm	6	Lap	back	0.393
5600	120	IEEE 802.11a	15.56	15.92	0.5 cm	6	Edge	top	0.245
5600	120	IEEE 802.11a	15.56	15.68	0.5 cm	6	Edge	right	0.000
5745	149	IEEE 802.11a	14.99	14.86	0.5 cm	6	Lap	back	0.526
5745	149	IEEE 802.11a	14.99	14.88	0.5 cm	6	Edge	top	0.242
5745	149	IEEE 802.11a	14.99	14.72	0.5 cm	6	Edge	right	0.000
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 were according to FCC/OET Bulletin 65, Supplement C [June 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Batteries are fully charged for all readings.
4. Tissue parameters and temperatures are listed on the SAR plots.
5. Liquid tissue depth is was at least 15.0 cm.
6. Justification for test configuration per KDB Inquiry 502978 and FCC meeting on 06/04/10. A conservative 5mm test distance spacing was used for all edges. See Section 11.2 for more details.
7. Justification for reduced test configurations per KDB 248227 and KDB inquiry 438498: Highest average RF output power channel was selected for WLAN for SAR evaluation or mid channel was tested. Other IEEE 802.11 modes were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the IEEE 802.11abn modes.

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15 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	3/31/2010	Annual	3/31/2011	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	3/30/2010	Annual	3/30/2011	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
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	9/11/2009	Annual	9/11/2010	836371/0079
Rohde & Schwarz	CMU200	Base Station Simulator	6/21/2010	Annual	6/21/2011	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	D1900V2	1900 MHz SAR Dipole	1/20/2009	Biennial	1/20/2011	502
SPEAG	D1900V2	1900 MHz SAR Dipole	8/18/2009	Annual	8/18/2010	5d080
SPEAG	D2450V2	2450 MHz SAR Dipole	8/27/2009	Annual	8/27/2010	719
SPEAG	D5GHzV2	5 GHz SAR Dipole	8/19/2009	Annual	8/19/2010	1007
SPEAG	DAE3	Dasy Data Acquisition Electronics	9/17/2009	Annual	9/17/2010	455
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/22/2010	Annual	3/22/2011	704
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/21/2010	Annual	4/21/2011	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/22/2010	Annual	1/22/2011	649
SPEAG	ES3DV2	SAR Probe	9/18/2009	Annual	9/18/2010	3022
SPEAG	EX3DV4	SAR Probe	1/26/2010	Annual	1/26/2011	3550
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/8/2010	Annual	7/8/2011	859
SPEAG	ES3DV3	SAR Probe	3/16/2010	Annual	3/16/2011	3213
SPEAG	ES3DV3	SAR Probe	4/20/2010	Annual	4/20/2011	3209
Rohde & Schwarz	SMIQ03B	Signal Generator	4/1/2010	Annual	4/1/2011	DE27259
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
Agilent	8648D	Signal Generator	4/1/2010	Annual	4/1/2011	3629U00687
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
Apriel	ALS-PR-DIEL	Dielectric Probe Kit	N/A		N/A	260-00959
Agilent	E5515C	Wireless Communications Tester	4/14/2010	Annual	4/14/2011	US41140256
SPEAG	ES3DV3	SAR Probe	2/10/2010	Annual	2/10/2011	3173

Notes:

Justification for extended SAR dipole calibration cycle for SAR dipoles is found in Section 11.3

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16 CONCLUSION

16.1 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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