SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC REPORT AND ORDER:
ET DOCKET 93-62, AND OET BULLETIN 65 SUPPLEMENT C

FOR

MB62HL 802.11ag Half Size Mini-PCI WLAN Module

MODEL: PA3459U-1MPC

MODEL (Optional): PA3461U/E-1MPC

FCC ID: CJ6UPA3459WL

REPORT NUMBER: 05U3390-5B)

(Additional Test)

ISSUE DATE: June 15, 2005

Prepared for

Toshiba Corporation Digital Media Network Company
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Prepared by

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LAB CODE:200065-0

Revision History

Rev.	Revisions	Revised By

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: May 20 – 22 and June 14-15, 2005

APPLICANT:	Toshiba Corporation Digital Media Network Company
ADDRESS:	Ome Complex, 2-9, Suehiro-cho, Tokyo, 198-8710, Japan
FCC ID:	CJ6UPA3459WL or PA3461U/E-1MPC (Optional)
MODEL:	PA3459U-1MPC
DEVICE CATEGORY:	Portable Device
EXPOSURE CATEGORY:	General Population/Uncontrolled Explosure

MB62HL 802.11ag Half Size Mini-PCI WLAN Module installed in Toshiba Firebolt 10 (PortegeM200) Laptop, including co-location with the Toshiba PA3232U-1BTM (BC02) and PA3418U-1BTM (BC04) Bluetooth radio cards.

Test Sample is a:	Production unit
Modulation type:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11ag
Antenna(s)	The radio utilizes two antennas for diversity (main and auxiliary). HTL008 (PIFA Film Antenna): 2.89 dBi @ 2.4GHz w/o cable loss HTL017 (PIFA Film Antenna): 4.24 dBi @ 2.4GHz w/o cable loss TIAN01 (PIFA Film Antenna): 4.02 dBi @ 2.4GHz w/o cable loss

FCC Rule Parts	Frequency Range [MHz]	The Highest SAR Values [1g_mW/g]	Max. Average Output Power [dBm]
15.247	2412 - 2462	0.577	18.30
15.401	5180 - 5320	0.610	15.40
	5745 - 5825	0.395	15.40

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C (Edition 01-01).

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Released For CCS By:

Hsin Fu Shih

Hsin Fu Shih (Sunny Shih)
COMPLIANCE CERTIFICATION SERVICES

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1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

MB62HL 802.11a/b/g Half Size Mini-PCI WLAN Module installed in Toshiba Firebolt 10 (PortegeM200) Laptop, including co-location with the Toshiba PA3232U-1BTM (BC02) and PA3418U-1BTM (BC04) Bluetooth radio cards.	
Normal operation:	Lap-held position
Accessory:	N/A
Earphone/Headset Jack:	N/A
Duty cycle:	100% for DSSS & OFDM
Host Device(s):	Toshiba, Firebolt10 (PORTEGE M200)
Power supply:	Power supplied through the laptop computer (host device)

2 FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

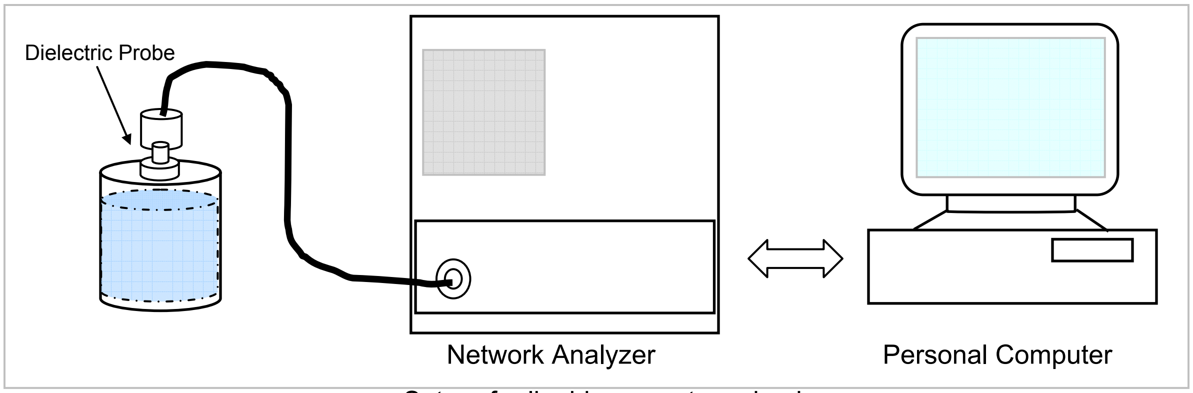
LAB CODE:200065-0

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

3 SIMULATING LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below.



Set-up for liquid parameters check

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom (for 150 – 3000 MHz and 5800 MHz)

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE Standard 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom (for 3000 MHz – 5800 MHz)

In the current guidelines and draft standards for compliance testing of mobile phones (i.e., IEEE P1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given only at 3.0 GHz and 5.8 GHz. As an intermediate solution, dielectric parameters for the frequencies between 5 to 5.8 GHz were obtained using linear interpolation (see table below).

SPEAG has developed suitable head and body tissue simulating liquids consisting of the following ingredients: de-ionized water, salt and a special composition including mineral oil and an emulgators. Dielectric parameters of these liquids were measured suing a HP 8570C Dielectric Probe Kit in conjunction with HP 8753ES Network Analyzer (30 kHz – 6G Hz). The differences with respect to the interpolated values were well within the desired ±5% for the whole 5 to 5.8 GHz range.

f (MHz)	Head Tissue		Body Tissue		Reference
	rel. permitivity	conductivity	rel. permitivity	conductivity	
3000	38.5	2.40	52.0	2.73	Standard
5800	35.3	5.27	48.2	6.00	Standard
5000	36.2	1.45	49.3	5.07	Interpolated
5100	36.1	4.55	49.1	5.18	Interpolated
5200	36.0	4.66	49.0	5.30	Interpolated
5300	35.9	4.76	48.9	5.42	Interpolated
5400	35.8	4.86	48.7	5.53	Interpolated
5500	35.6	4.96	48.6	5.65	Interpolated
5600	35.5	5.07	48.5	5.77	Interpolated
5700	35.4	5.17	48.3	5.88	Interpolated

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

3.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =24°C; Relative humidity = 40% Measured by: David Garcia

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	ε"	Relative Permittivity (ϵ_r):	52.7	52.3858	-0.60	± 5
			14.6997	Conductivity (σ):	1.95	2.00352	2.74	± 5

Liquid Check
Ambient temperature: 24.0 deg. C, Liquid temperature: 23.0 deg. C
May 20, 2005 11:29 AM

Frequency	e'	e"
2400000000.	52.5700	14.4904
2410000000.	52.5332	14.5337
2420000000.	52.5020	14.5592
2430000000.	52.4519	14.6134
2440000000.	52.4447	14.6401
2450000000.	52.3858	14.6997
2460000000.	52.3627	14.7175
2470000000.	52.3051	14.7696
2480000000.	52.2665	14.7938
2490000000.	52.2340	14.8303
2500000000.	52.2037	14.8644

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where $f = \text{target } f * 10^6$

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =24°C; Relative humidity = 40% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	є"	Relative Permittivity (ϵ_r):	52.7	53.3976	1.32	± 5
			14.4407	Conductivity (σ):	1.95	1.96822	0.93	± 5

Liquid Check
Ambient temperature: 24.0 deg. C, Liquid temperature: 23.0 deg. C
May 22, 2005 03:43 PM

Frequency	e'	e"
2400000000.	53.5768	14.2142
2410000000.	53.5342	14.2528
2420000000.	53.5070	14.3108
2430000000.	53.4777	14.3451
2440000000.	53.4391	14.3887
2450000000.	53.3976	14.4407
2460000000.	53.3633	14.4644
2470000000.	53.3480	14.5186
2480000000.	53.3006	14.5536
2490000000.	53.2544	14.5999
2500000000.	53.2379	14.6579

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where $f = \text{target } f * 10^6$

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Parameter Check Result @ Muscle 5200 & 5800 MHz

Ambient Temperature = 25.0 °C; Relative humidity = 40% Measured by: James Lee

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
5200	24.5	15	e'	Relative Permittivity (e"):	49.0	49.5824	1.19	± 5
			18.5689	Conductivity (σ):	5.30	5.37166	1.35	± 5
5800	24.5	15	e'	Relative Permittivity (e"):	48.2	48.4209	0.46	± 5
			19.3070	Conductivity (σ):	6.00	6.22962	3.83	± 5

Liquid Check
Ambient temperature: 25.0 deg. C, Liquid temperature: 24.5 deg. C
June 14, 2005 07:35 PM

Frequency	e'	e"
4600000000.	50.7584	17.6705
4650000000.	50.6441	17.7535
4700000000.	50.5802	17.8566
4750000000.	50.4272	17.9044
4800000000.	50.3777	18.0079
4850000000.	50.2562	18.0537
4900000000.	50.1766	18.1549
4950000000.	50.0693	18.2202
5000000000.	49.9552	18.2843
5050000000.	49.8769	18.3897
5100000000.	49.7517	18.4303
5150000000.	49.6647	18.5282
5200000000.	49.5824	18.5689
5250000000.	49.4678	18.6598
5300000000.	49.3729	18.7113
5350000000.	49.2569	18.7768
5400000000.	49.1784	18.8365
5450000000.	49.0639	18.9023
5500000000.	48.9937	18.9808
5550000000.	48.8998	19.0536
5600000000.	48.7807	19.0866
5650000000.	48.7065	19.1755
5700000000.	48.6326	19.1862
5750000000.	48.5051	19.2623
5800000000.	48.4209	19.3070
5850000000.	48.2918	19.3960
5900000000.	48.2118	19.4356
5950000000.	48.1006	19.4866
6000000000.	48.0155	19.5506

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 \, e'' = 2 \pi f \varepsilon_0 \, e''$$

where $f = \text{target } f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

4 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3-SN: 3531 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  (For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.)
- Special 5 x 5 x 7 fine cube was chosen for cube integration(dx=dy=7.5mm; dz=5mm).
  (For 5 GHz band - Special 7 x 7 x 8 fine cube was chosen for cube integration (dx=dy=4.3mm; dz=3mm))
- Distance between probe sensors and phantom surface was set to 2.5 mm.
  (For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.0 mm
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

Reference SAR Values

The reference SAR values were using measurement results indicated in the dipole calibration document (See attached dipole certificate).

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
2450	52.0	23.8	54.8	25.4

Reference SAR Values

The reference SAR values were calculated using finite-difference time-domain FDTD method (feed point-impedance set to 50 ohms) and the mechanical dimensions of the D5GHzV2 dipole (manufactured by SPEAG).

f (MHz)	**Head Tissue**		**Body Tissue**		
	$\mathbf{SAR_{1g}}$	$\mathbf{SAR_{10g}}$	$\mathbf{SAR_{1g}}$	$\mathbf{SAR_{10g}}$	$\mathbf{SAR_{Peak}}$
5000	72.9	20.7	68.1	19.2	260.3
5100	74.6	21.1	78.8	19.6	272.3
5200	76.5	21.6	71.8	20.1	284.7
5800	78.0	21.9	74.1	20.5	324.7

4.1 SYSTEM PERFORMANCE CHECK RESULTS

@ System Validation Dipole: D2450V2 SN: 748

Date: May 20, 2005

Ambient Temperature = 24°C, Relative humidity = 40% Measured by: David Garcia

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	23	15	12.8	51.2	54.8	-6.57	± 10

Date: May 22, 2005

Ambient Temperature = 24°C, Relative humidity = 40% Measured by: Sunny Shih

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]		Normalized to 1 W			
2450	23	15	12.7	50.8	54.8	-7.30	± 10

@ System Validation Dipole: D5GHzV2 SN 1003

Date: Jun 14, 2005

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: James Lee

Body Simulating Liquid			Measured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
5200	24.5	15	18.1	72.4	71.8	0.84	± 10

Body Simulating Liquid			Measured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
5800	24.5	15	19.2	76.8	74.1	3.64	± 10

5 SAR MEASUREMENT PROCEDURE

A summary of the procedure follows:

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.

b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 2.5 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

   (For 5 GHz band - The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 2.0 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 10 mm x 10 mm. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified)

c) Around this point, a volume of X=Y= 30 and Z=21 mm is assessed by measuring 5 x 5 x 7 mm points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

   (For 5 GHz band - Around this point, a volume of X=Y=Z=30 mm is assessed by measuring 7 x 7 x 8 mm points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:)

   (i) The data at the surface are extrapolated, since the centre of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

   (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

   (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

   (iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.

DASY4 SAR MEASUREMENT PROCEDURE

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 1.2 mm for an EX3DV3 probe type).

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

(For 5 GHz band – Same as above except the Zoom Scan measures 7 x 7 x 8 points.)

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

6 PROCEDURES USED TO ESTABLISH TEST SIGNAL

The following procedures had been used to prepare the EUT for the SAR test.

The client supplied a special driving program (ART_v5.2 Build # 58) to program the EUT to continually transmit the specified maximum power and also to change the channel frequency.

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11b Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	18.25
Middle	2437	18.30
High	2462	18.13

802.11g Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	16.20
Middle	2437	16.40
High	2462	16.10

The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5180	15.10
Middle	5260	15.40
High	5320	15.36

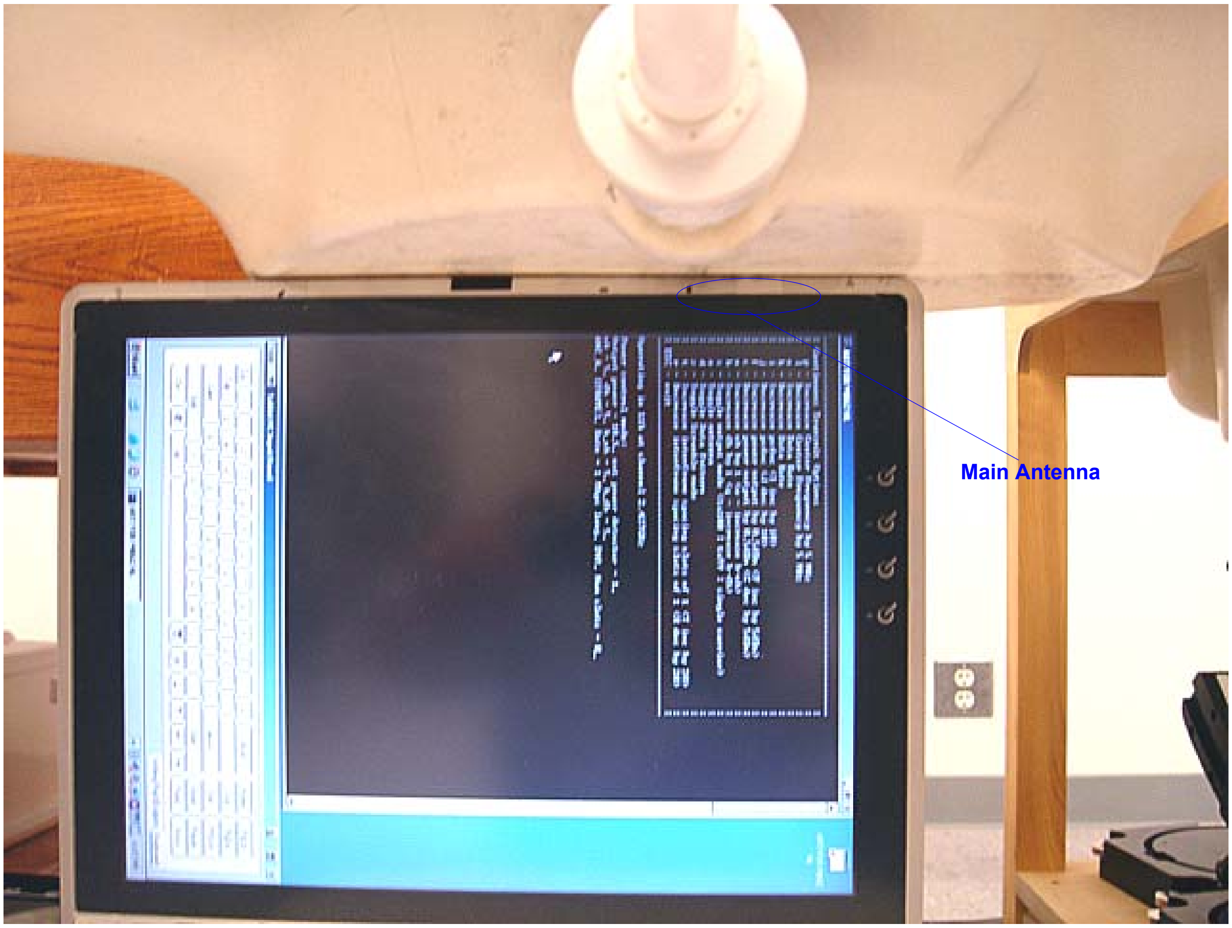
The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5745	15.40
Middle	5785	15.20
High	5825	15.35

7 SAR MEASUREMENT RESULT (2.4 GHZ)

7.1 Test Position 1 – Main Antenna (HTL017)



802.11b						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412			0.000	
0	6	2437	0.330	-0.185	0.344	1.6
0	11	2462			0.000	
802.11g						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412			0.000	
0	6	2437	0.229	-0.210	0.240	1.6
0	11	2462			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

7.2 Test Position 2 – Aux Antenna (HTL017)

802.11b

Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412	0.567	-0.079	0.577	1.6
0	6	2437	0.438	-0.190	0.458	1.6
0	11	2462	0.416	0.000	0.416	1.6

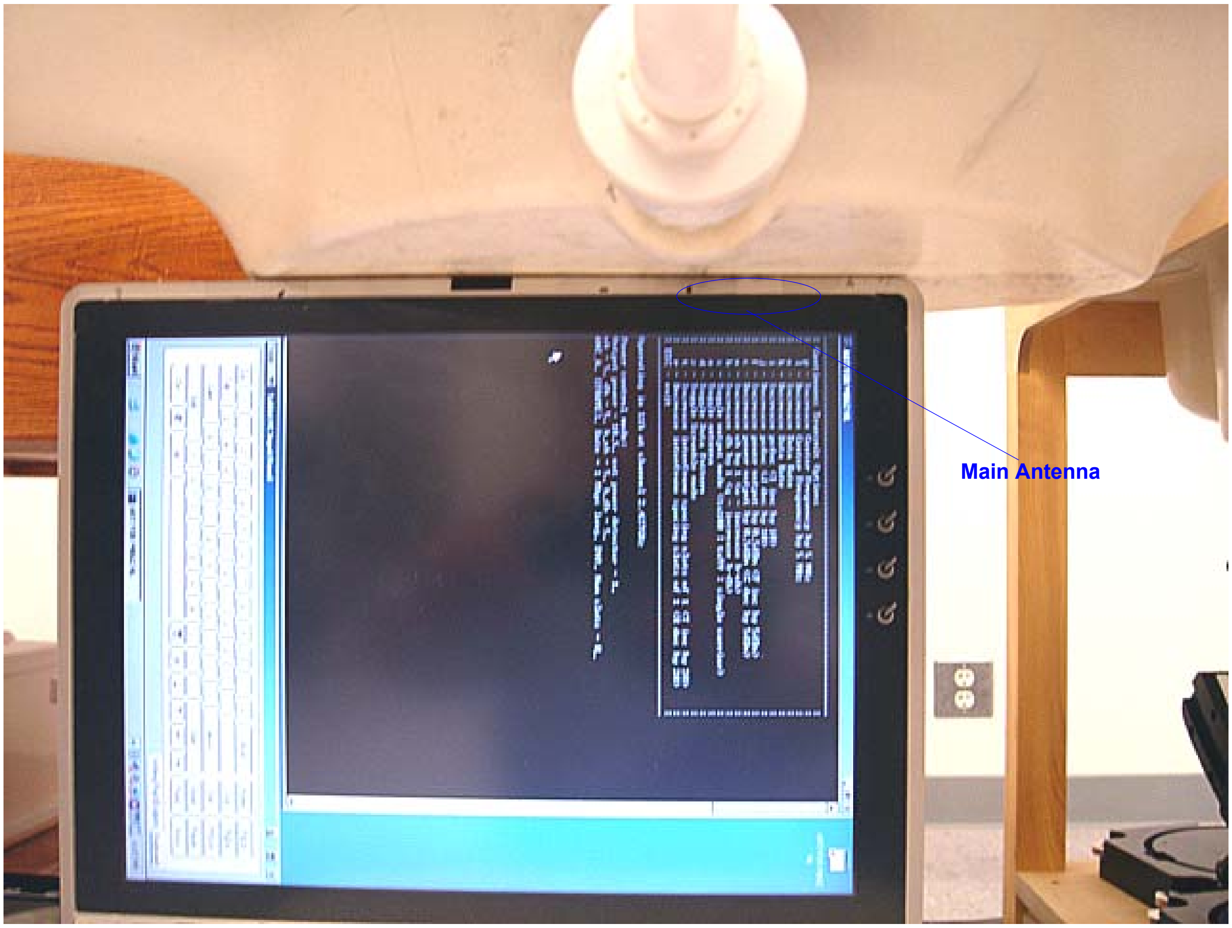
802.11g

Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412			0.000	
0	6	2437	0.298	-0.130	0.307	1.6
0	11	2462			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

7.3 Test Position 1 – Main Antenna (TIAN01)



802.11b						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412			0.000	
0	6	2437	0.155	-0.136	0.160	1.6
0	11	2462			0.000	
802.11g						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412			0.000	
0	6	2437	0.101	-0.138	0.104	1.6
0	11	2462			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

7.4 Test Position 2 – Aux Antenna (TIAN01)

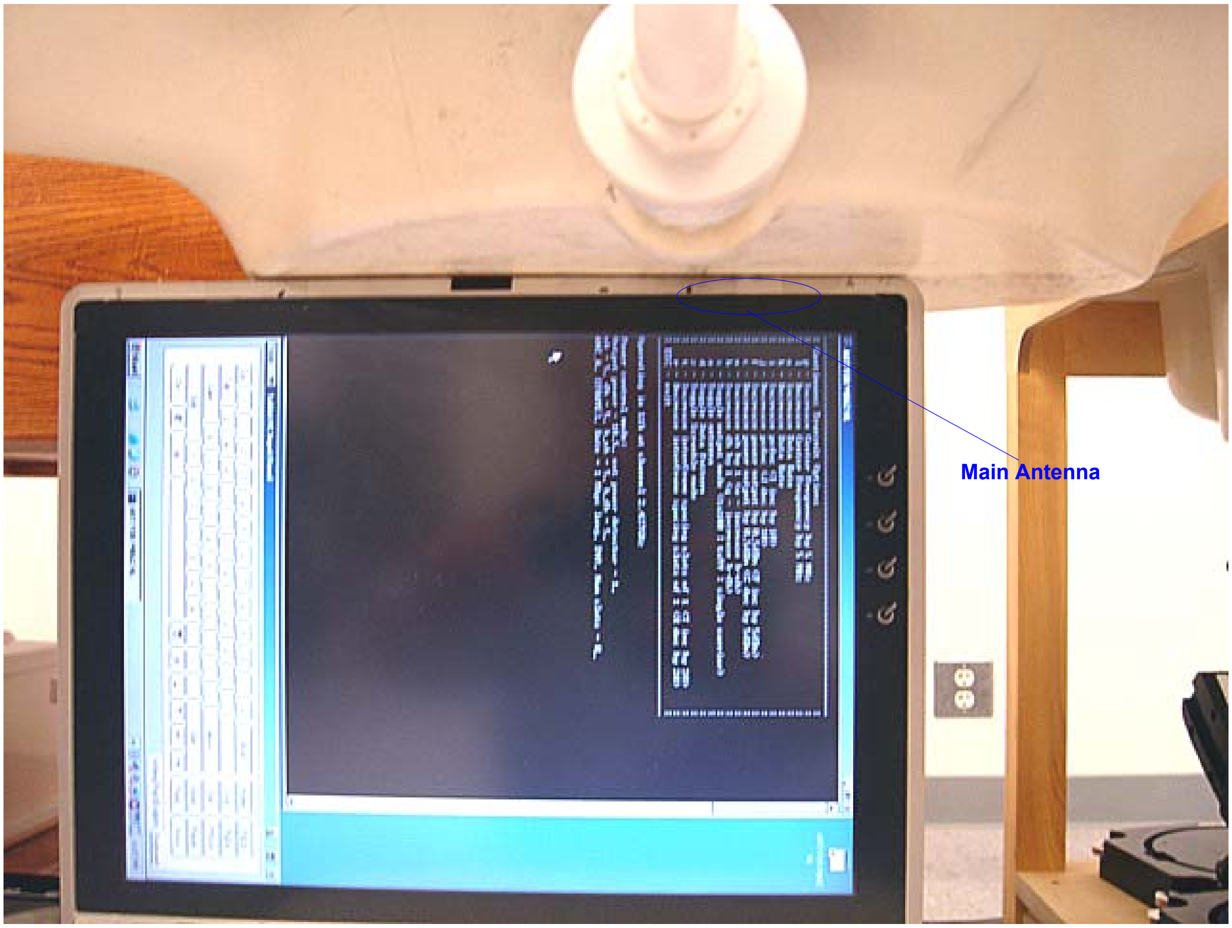
802.11b						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412	0.386	-0.149	0.399	1.6
0	6	2437	0.382	-0.123	0.393	1.6
0	11	2462	0.368	-0.046	0.372	1.6
802.11g						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	1	2412			0.000	
0	6	2437	0.259	-0.126	0.267	1.6
0	11	2462			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8 SAR MEASUREMENT RESULT (5 GHZ)

8.1 Test Position 1 – Main Antenna (HTL017)



802.11a (5.2 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	36	5180			0.000	
0	52	5260	0.362	-0.122	0.372	1.6
0	64	5320			0.000	
802.11a (5.8 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	149	5745	0.383	-0.129	0.395	1.6
0	157	5785			0.000	
0	165	5820			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

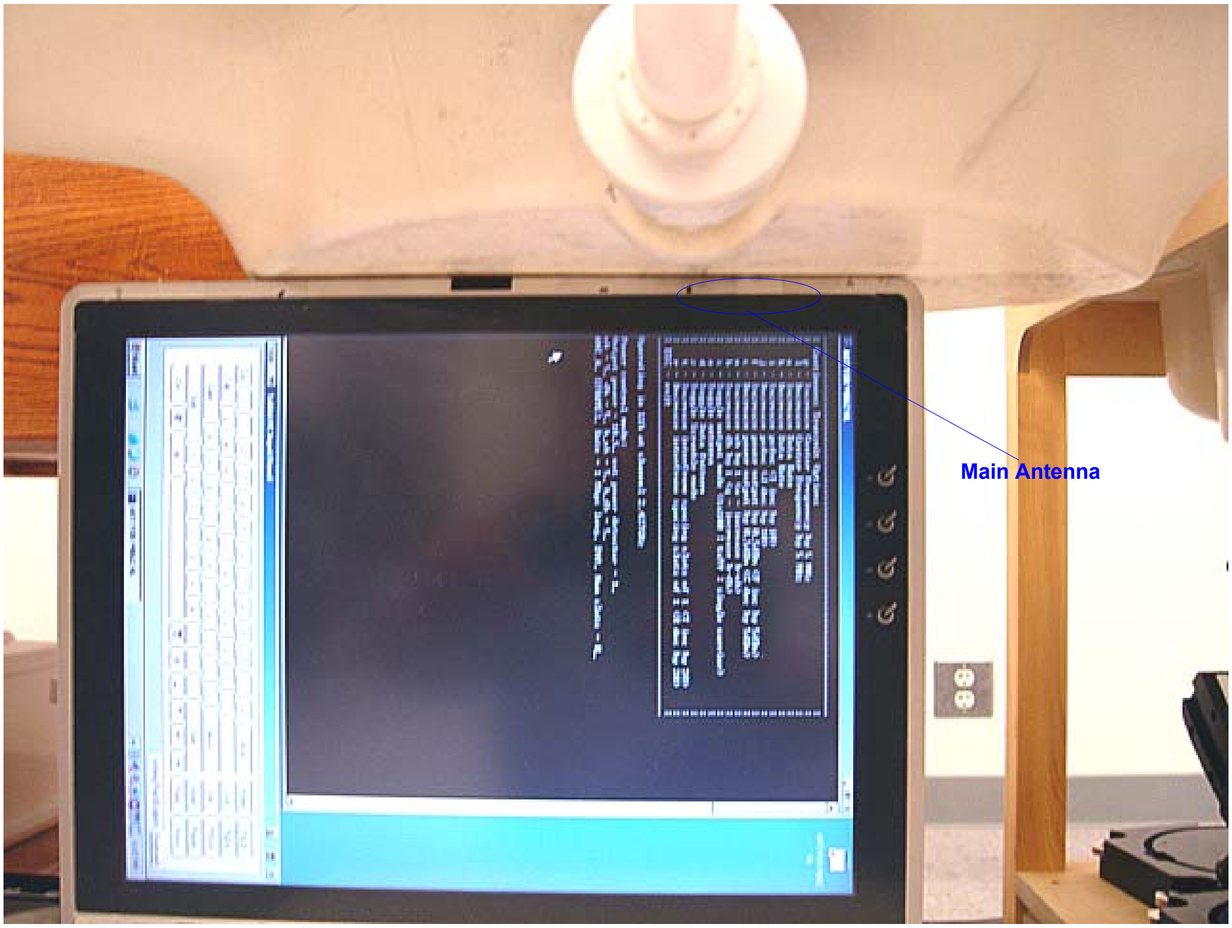
8.2 Test Position 2 – Aux Antenna (HTL017)

802.11a (5.2 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	36	5180			0.000	
0	52	5260	0.188	-0.179	0.196	1.6
0	64	5320			0.000	
802.11a (5.8 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	149	5745	0.372	-0.090	0.380	1.6
0	157	5785			0.000	
0	165	5820			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.3 Test Position 1 – Main Antenna (TIAN01)



802.11a (5.2 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	36	5180			0.000	
0	52	5260	0.589	-0.115	0.605	1.6
0	64	5320			0.000	
802.11a (5.8 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	149	5745	0.141	-0.131	0.145	1.6
0	157	5785			0.000	
0	165	5820			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

8.4 Test Position 2 – Aux Antenna (TIAN01)

802.11a (5.2 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	36	5180			0.000	
0	52	5260	0.588	-0.160	0.610	1.6
0	64	5320			0.000	
802.11a (5.8 GHz band)						
Separation. distance (mm)	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
0	149	5745	0.220	-0.170	0.229	1.6
0	157	5785			0.000	
0	165	5820			0.000	

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

9 MEASUREMENT UNCERTAINTY

9.1 MEASUREMENT UNCERTAINTY FOR 300 MHZ – 3000 MHZ

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	1.59	R	1.732	1	1	0.92	0.92
RF Ambient Conditions - Reflections	0.00	R	1.732	1	1	0.00	0.00
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty	RSS					11.44	10.49
Expanded Uncertainty (95% Confidence Interval)	K=2					22.87	20.98

Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

9.2 MEASUREMENT UNCERTAINTY 3 GHZ – 6 GHZ

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	3.00	R	1.732	1	1	1.73	1.73
RF Ambient Conditions - Reflections	3.00	R	1.732	1	1	1.73	1.73
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty	RSS					11.66	10.73
Expanded Uncertainty (95% Confidence Interval)	K=2					23.32	21.46

Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

10 EQUIPMENT LIST & CALIBRATION

Name of Equipment	Manufacturer	Type/Model	Serial Number	Cal. Due date
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A
Robot Remote Control	Stäubli	CS7MB	3403-91535	N/A
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041	N/A
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A
S-Parameter Network Analyzer	Agilent	8753ES-6	US39173569	8/19/05
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A
E-Field Probe	SPEAG	EX3DV3	3531	7/18/05
E-Field Probe	SPEAG	EX3DV4	3552	3/19/06
Thermometer	ERTCO	639-1	8402	10/13/2005
Thermometer	ERTCO	639-1	8404	10/21/2005
Thermometer	ERTCO	637-1	8661	10/21/2005
SAM Phantom (SAM1)	SPEAG	TP-1185	QD000P40CA	N/A
SAM Phantom (SAM2)	SPEAG	TP-1015	N/A	N/A
Data Acquisition Electronics	SPEAG	DAE3 V1	500	2/7/06
System Validation Dipole	SPEAG	D2450V2	748	5/14/06
System Validation Dipole	SPEAG	D5GHzV2	1003	10/5/05
Signal General	R&H	SMP 04	DE34210	5/5/05
Power Meter	Giga-tronics	8651A	8651404	9/16/05
Power Sensor	Giga-tronics	80701A	1834588	9/16/05
Amplifier	Mini-Circuits	ZVE-8G	0360	N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A
Radio Communication Tester	Rohde & Schwarz	CMU 200	838114/032	12/17/06
Simulating Liquid	CCS	M2450	N/A	Within 24 hrs of first test
Simulating Liquid	SPEAG	M5200-5800	N/A	Within 24 hrs of first test

11 ATTACHMENT

No.	Contents	No. of page (s)
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1-2	System Performance Check Plot (5 GHz)	2
2-1	SAR Test Plot (2.4 GHz)	15
2-3	SAR Test Plot (5 GHz)	10

END OF REPORT