SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC REPORT AND ORDER:
ET DOCKET 93-62 AND OET BULLETIN 65 SUPPLEMENT C
And RSS-102 Issue 1 (Provisional) September 25, 1999

FOR

Wireless LAN Mini-PCI Express, 802.11a/b/g

MODELS: PA3489U-1MPC & PA3441U-1MPC (Optional)

FCC ID: CJ6UPA3489WL

REPORT NUMBER: 05U3857-4A2

ISSUE DATE: January 10, 2006

Prepared for

Toshiba Corporation Digital Media Network Company
Ome Complex, 2-9, Suehiro-cho
Tokyo, 198-8710, Japan

Prepared by

COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885

LAB CODE:200065-0

Revision History

Rev.	Issued date	Revisions	Revised By
A	December 12, 2005	Initial Issue	HS
A1	December 19, 2005	Updated EUT description on page 2 & 5 of 32	HS
A2	January 10, 2006	Corrected typo from 2562 to 2462 on pages 16/32 to 19 of 32	HS

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: November 29, 30 & December 1, 2005

APPLICANT: ADDRESS:	Toshiba Corporation Digital Media Network Company Ome Complex, 2-9, Suehiro-cho, Tokyo, 198-8710, Japan
FCC ID: MODELS:	CJ6UPA3489WL PA3489U-1MPC & PA3441U-1MPC (Optional)
DEVICE CATEGORY: EXPOSURE CATEGORY:	Portable Device General Population/Uncontrolled Explosure

Wireless LAN Mini-PCI Express, 802.11a/b/g module installed in Toshiba Portege M400, including collocation with the Toshiba PA3418U-1BTM Bluetooth radio module.

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). PIFA Film Antenna, Type HTL017, HFT40, TBN001 and TIAN01

FCC Rule Parts	Frequency Range [MHz]	The Highest SAR Values [1g_mW/g]	Co-Location SAR Values [1g_mW/g]
15.247	2412 - 2462	0.487	0.475
	5745 - 5825	0.912	1.010
15.401	5180 - 5320	0.645	0.793

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). And RSS-102 Issue 1 (Provisional) September 25, 1999.

The maximum 1g SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg. Level defined in Supplement C (Edition 01-01) to OET Bulletin 65 (97-01).

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.

Approved & Released For CCS By:

Hsin Fu Shih
Senior Engineer
Compliance Certification Services

Tested By:

Ninous Davoudi
EMC Engineer
Compliance Certification Services

Table of Contents

1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Wireless LAN Mini-PCI Express, 802.11a/b/g module installed in Toshiba Portege M400, including co-location with the Toshiba PA3418U-1BTM Bluetooth radio module.	
Normal operation:	Lap-held position, and underarm position
Accessory:	N/A
Earphone/Headset Jack:	N/A
Duty cycle:	91% for a mode 98% for b mode 91% for g mode
Host Device(s):	Toshiba Portege M400
Antenna(s)	The radio utilizes two antennas for diversity (main and auxiliary). PIFA Film Antenna, Type HTL017, HFT40, TBN001 and TIAN01
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.”

NVLAP®

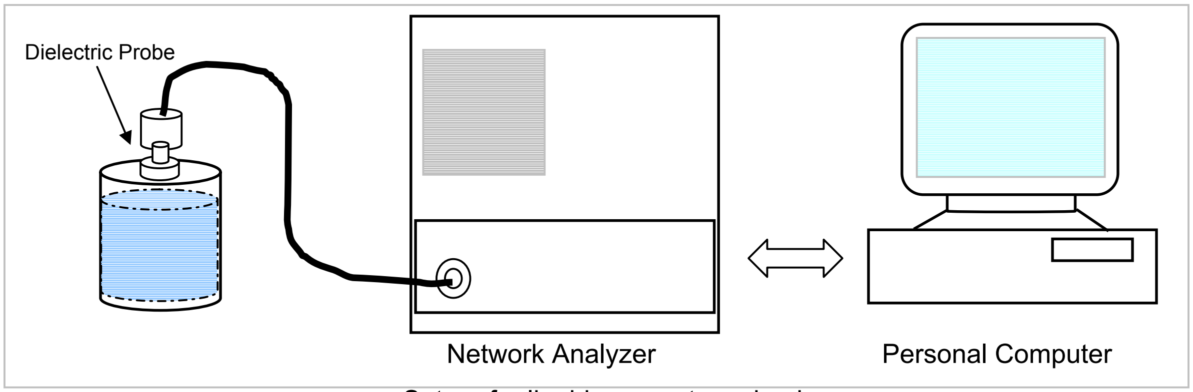
LAB CODE:200065-0

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 = 35% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22.1	15	e"	Relative Permittivity (e'):	52.7	52.2395	-0.87	± 5
			14.8297	Conductivity (σ):	1.95	2.02124	3.65	± 5

Liquid Check
Ambient temperature: 24.0 deg. C; Liquid temperature: 22.1 deg C
November 29, 2005 02:34 PM

Frequency	e'	e"
2400000000.	52.3964	14.6090
2410000000.	52.3616	14.6508
2420000000.	52.3289	14.6867
2430000000.	52.2929	14.7428
2440000000.	52.2674	14.7939
2450000000.	52.2395	14.8297
2460000000.	52.1901	14.8863
2470000000.	52.1604	14.9182
2480000000.	52.1259	14.9688
2490000000.	52.0793	15.0089
2500000000.	52.0553	15.0357

The conductivity (σ) can be given as:

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

where f = 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: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22.1	15	e"	Relative Permittivity (e'):	52.7	52.0236	-1.28	± 5
			15.0129	Conductivity (σ):	1.95	2.04621	4.93	± 5

Liquid Check
Ambient temperature: 24.0 deg. C; Liquid temperature: 22.1 deg C
November 30, 2005 01:50 PM

Frequency	e'	e"
2400000000.	52.2168	14.7867
2410000000.	52.1857	14.8249
2420000000.	52.1341	14.8666
2430000000.	52.1064	14.9169
2440000000.	52.0745	14.9506
2450000000.	52.0236	15.0129
2460000000.	51.9972	15.0334
2470000000.	51.9538	15.0841
2480000000.	51.9167	15.1236
2490000000.	51.8734	15.1719
2500000000.	51.8620	15.2257

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

Simulating Liquid Parameter Check Result @ Muscle 5200 & 5800 MHz

Ambient Temperature = 25.5°C; Relative humidity = 40% Measured by: Ninous Davoudi

Simulating Liquid f (MHz)	Temp. (°C)	Depth (cm)	Parameters		Target	Measured	Deviation (%)	Limit (%)
5200	25	15	e'	Relative Permittivity (e"):	49.0	48.1426	-1.75	± 5
			18.4544	Conductivity (σ):	5.30	5.33854	0.73	± 5
5800	25	15	e'	Relative Permittivity (e"):	48.2	46.9925	-2.51	± 5
			19.1860	Conductivity (σ):	6.00	6.19058	3.18	± 5

Liquid Check
Ambient temperature: 25.5 deg. C; Liquid temperature: 25.0 deg C
December 01, 2005 10:12 AM

Frequency	e'	e''
4600000000.	49.3075	17.5603
4650000000.	49.2037	17.6435
4700000000.	49.1269	17.7251
4750000000.	49.0270	17.7939
4800000000.	48.9397	17.8969
4850000000.	48.8528	17.9446
4900000000.	48.7379	18.0341
4950000000.	48.6192	18.1072
5000000000.	48.5487	18.1781
5050000000.	48.4435	18.2558
5100000000.	48.3531	18.3206
5150000000.	48.2398	18.3992
5200000000.	48.1426	18.4544
5250000000.	48.0357	18.5218
5300000000.	47.9439	18.5833
5350000000.	47.8431	18.6507
5400000000.	47.7421	18.7100
5450000000.	47.6263	18.7681
5500000000.	47.5377	18.8245
5550000000.	47.4378	18.8848
5600000000.	47.3649	18.9254
5650000000.	47.2551	18.9960
5700000000.	47.1783	19.0694
5750000000.	47.0606	19.1108
5800000000.	46.9925	19.1860
5850000000.	46.8706	19.2169
5900000000.	46.8022	19.3108
5950000000.	46.6959	19.3513
6000000000.	46.6027	19.4375

The conductivity (σ) can be given as:

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

where f = 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 for body-tissue

In the table below, the numerical reference SAR values of a SPEAG validation dipoles placed below the flat phantom filled with body-tissue simulating liquid are given. The reference SAR values were calculated using the finite-difference time-domain method and the geometry parameters.

Dipole Type	Distance (mm)	Frequency (MHz)	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D450V2	15	450	5.01	3.36	7.22
D835V2	15	850	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6

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		
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	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

Note: All SAR values normalized to 1 W forward power.

4.1 System Performance Check Results

System Validation Dipole: D2450V2 SN: 748

Date: 11-29-05

Ambient Temperature = 24.0°C, Relative humidity = 35% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	22.1	15	12.4	49.6	51.2	-3.13	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.71	22.84	23.7	-3.63	± 10

Date: 11-30-05

Ambient Temperature = 24.0°C, Relative humidity = 35% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	22.1	15	12.6	50.4	51.2	-1.56	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.76	23.04	23.7	-2.78	± 10

System Validation Dipole: D5GHzV2 SN 1003

Date: 12-01-05

Ambient Temperature = 25.5°C; Relative humidity = 40% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
5200	25	15	17.9	71.6	71.8	-0.28	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.09	20.36	20.1	1.29	± 10

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
5800	25	15	18	72	74.1	-2.83	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.08	20.32	20.5	-0.88	± 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 provided a special driver and program, Intel Pro/Wireless 3945ABG-CRTU, which enable a user to control the frequency and output power of the module.

The cable assembly insertion loss of 10.12 dB (including 9.92 dB pad and 0.2 dB connectors) 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	17.15
Middle	2437	18.02
High	2462	17.91

802.11g Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	16.23
Middle	2437	17.33
High	2462	15.08

The cable assembly insertion loss of 9.72dB (including 9.52 dB pad and 0.2 dB connectors) 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	15.86
Middle	5260	17.20
High	5320	17.19

The cable assembly insertion loss of 9.46 dB (including 9.26 dB pad and 0.2 dB connectors) 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	17.00
Middle	5785	17.30
High	5825	17.20

7 SAR MEASUREMENT RESULT (2.4 GHZ)

All measurements were done with highest gain antenna, type HTL017.

7.1 LAP-HELD POSITION 1 – MAIN ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11b (1Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412					
6	2437	0.017	-0.063	0.017	0.80	1.6
11	2462					
802.11g (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412					
6	2437	0.015	-0.026	0.015	0.80	1.6
11	2462					

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 LAP-HELD POSITION 2 – AUX ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11b (1Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412.00					
6	2437.00	0.013	0.000	0.013	0.80	1.6
11	2462.00					
802.11g (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412.00					
6	2437.00	0.012	0.000	0.012	0.80	1.6
11	2462.00					

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 UNDERARM POSITION 1 – MAIN ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11b (1Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412.00					
6	2437.00	0.310	0.000	0.310	0.80	1.6
11	2462.00					
802.11g (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412.00					
6	2437.00	0.270	0.000	0.270	0.80	1.6
11	2462.00					

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 UNDERARM POSITION 2 – AUX ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11b (1Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412.00	0.446	0.000	0.446	0.80	1.6
6	2437.00	0.487	0.000	**0.487**	0.80	1.6
11	2462.00	0.456	0.000	0.456	0.80	1.6
6[4)]	2437.00	0.475	0.000	**0.475**	0.80	1.6
802.11g (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412.00					
6	2437.00	0.484	0.000	0.484	0.80	1.6
11	2462.00					

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.
4) Collocation with the Toshiba PA3418U-1BTM Bluetooth radio module

8 SAR MEASUREMENT RESULT (5 GHZ)

8.1 LAP-HELD POSITION 1 – MAIN ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11a, 5.2 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
36	5180					
52	5260	0.009	0.000	0.009	0.80	1.6
64	5320					
802.11a, 5.8 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
149	5745					
157	5785	0.0087	0.000	0.009	0.80	1.6
165	5825					

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 LAP-HELD POSITION 2 – AUX ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11a, 5.2 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
36	5180					
52	5260	0.005	0.000	0.005	0.80	1.6
64	5320					
802.11a, 5.8 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
149	5745					
157	5785	0.010	0.000	0.010	0.80	1.6
165	5825					

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 UNDERARM POSITION 1 – MAIN ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11a, 5.2 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
36	5180					
52	5260	0.645	0.000	**0.645**	0.80	1.6
64	5320					
52 4)	5260	0.772	-0.119	**0.793**	0.80	1.6
802.11a, 5.8 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
149	5745					
157	5785	0.520	0.000	0.520	0.80	1.6
165	5825					

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.
4) Collocation with the Toshiba PA3418U-1BTM Bluetooth radio module.

8.4 UNDERARM POSITION 2 – AUX ANTENNA (HTL-017)

Photos are confidential, please see a seperate file

802.11a, 5.2 GHz (6 Mbps)

Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
36 52 64	5180 5260 5320	0.62	0.000	0.620	0.80	1.6

802.11a, 5.8 GHz (6 Mbps)

Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
149	5745	0.838	0.000	0.838	0.80	1.6
157	5785	0.867	0.000	0.867	0.80	1.6
165	5825	0.912	0.000	**0.912**	0.80	1.6
165 [4)]	5825	1.010	0.000	**1.010**	0.80	1.6

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.
4) Collocation with the Toshiba PA3418U-1BTM Bluetooth radio module

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	2/9/07
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A
E-Field Probe	SPEAG	EX3DV3	3531	7/21/06
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	11/22/06
Signal General	R&H	SMP 04	DE34210	6/2/06
Power Meter	Giga-tronics	8651A	8651404	12/27/06
Power Sensor	Giga-tronics	80701A	1834588	12/27/07
Amplifier	Mini-Circuits	ZVE-8G	0360	N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A
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 EUT PHOTOS

EUT PHOTOS (1/1)

Photos are confidential, please see a seperate file

HOST DEVICE (1/2)

Photos are confidential, please see a seperate file

HOST DEVICE (2/2)

Photos are confidential, please see a seperate file

WLAN MODULE AND BLUETOOTH MODULE

Photos are confidential, please see a seperate file

ANTENNAS LOCATION

Photos are confidential, please see a seperate file

12 ATTACHMENT

No.	Contents	No. of page (s)
1	System Performance Check Plots	8
2-1	SAR Test Plots (2.4 GHz)	12
2-3	SAR Test Plots (5 GHz)	14
3	Certificate of E-filed Probe EX3DV4 SN 3552	10
4	Certificate of System Validation Dipole D2450V2 SN 748	9
5	Certificate of System Validation Dipole D5GHzV2 SN 1003	10
6	Material Specification Data Sheet of Body Simulating Liquid (5GHz)	3

END OF REPORT