SAR Evaluation Report

in accordance with the requirements of
FCC Report and Order: ET Docket 93-62, and OET Bulletin 65 Supplement C

for

802.11a/b/g Combo Mini PCI Module

Model: PA3297U-1MPC

FCC ID: CJ6UPA3297WL

October 18, 2003

REPORT NO: 03U2199-2

Prepared for

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

Prepared by

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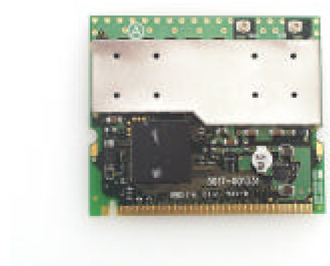
CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Dates of Tests: October 17-18, 2003

APPLICANT:	Toshiba Corporation Digital Media Network Company Ome Complex, 2-9, Suehiro-cho Tokyo, 198-8710, Japan
MODEL:	PA3297U-1MPC
FCC ID:	CJ6UPA3297WL
DEVICE CATEGORY:	PORTABLE DEVICES
EXPOSURE CATEGORY:	GENERAL POPULATION/UNCONTROLLED EXPOSURE



Test Sample is a:	Production unit
Modulation type:	802.11a Orthogonal Frequency Division Multiplexing (OFDM)
Tx Frequency:	5180 MHz to 5320 MHz (UNII-1 & UNII-2) 5745 MHz to 5825 MHz (UNII-3)
Max. O/P Power: **(Conducted/Average)**	UNII-1 & 2: 17.53 dBm (turbo mode) UNII-3: 20.12 dBm (turbo mode)
Max. SAR (1g):	UNII-1 & 2: 0.263 mW/g UNII-3: 0.322 mW/g Co-location: 0.327 mW/g (UNII-3)
Application Type:	Certification
FCC Rule Part(s):	15C/E

Note: This Report is only applicable for 802.11a

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C (released on 6/29/2001 see Test Report).

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.

Steve Cheng
EMC Engineering Manager

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1. EUT DESCRIPTION

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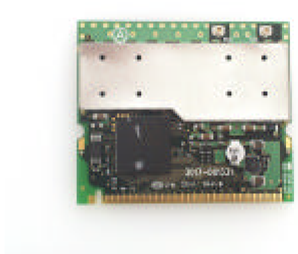

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Application Type:	Certification
FCC Rule Part(s):	15C/E
Host Device (s):	Trade Name: Toshiba Model Number: Portege M200 (PPM20*-*****)
Bluetooth Module:	Toshiba, model PA3232U-1BTM, FCC ID: CJ6UPA3232BT
Antennas:	Main/Aux: 1. Dual band film type, model number: HTL008 2. Wide Dual band film type, model number: HTL012 (Alternate) Bluetooth: Film type, model number: HTL004, gain (dBi): -3.8

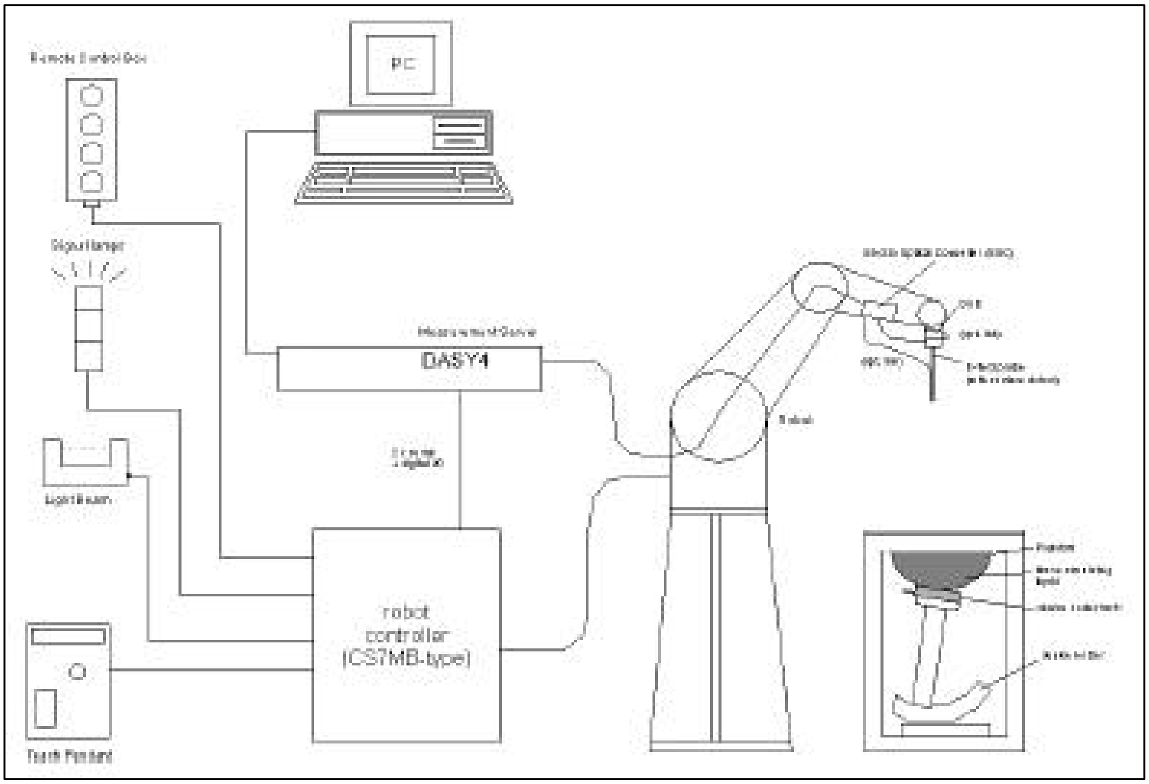
2. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1]. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992 [6]. According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

3. DOSIMETRIC ASSESSMENT SYSTEM

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m) which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetric probe ES3DV2-SN: 3021 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE P1528 and EN50361.

3.1. MEASUREMENT SYSTEM DIAGRAM



The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

3.2. SYSTEM COMPONENTS

DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE3) 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 measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

ES3DV2 Isotropic E-Field Probe for Dosimetric Measurements

Construction: Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)

Calibration: Basic Broad Band Calibration in air: 10-2500 MHz. Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request.

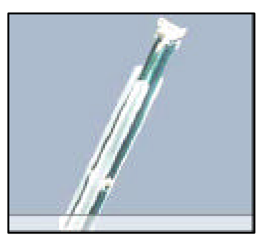
Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB

Directivity: ± 0.2 dB in HSL (rotation around probe axis);
± 0.3 dB in tissue material (rotation normal to probe axis)

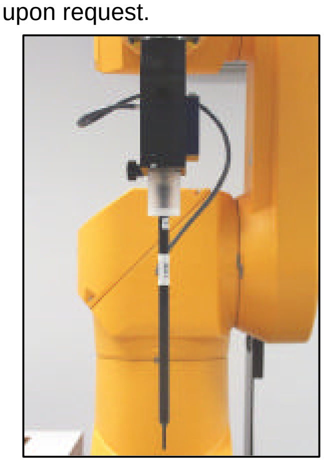
Dynamic Range: 5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 3.9 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 2.7 mm

Application: General dosimetry up to 6 GHz
Dosimetry in strong gradient fields
Compliance tests of mobile phones

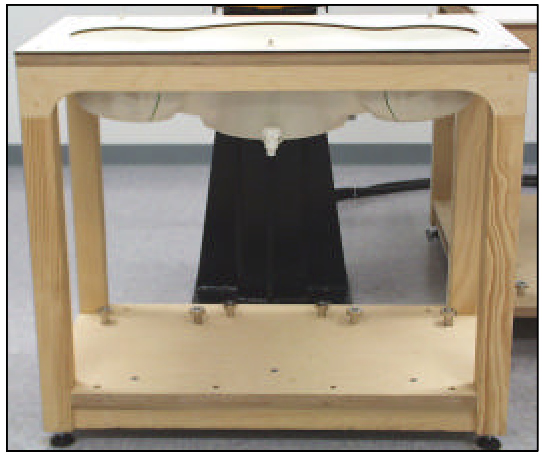


Interior of probe



Isotropic E-Field Probe

SAM Phantom (V4.0)



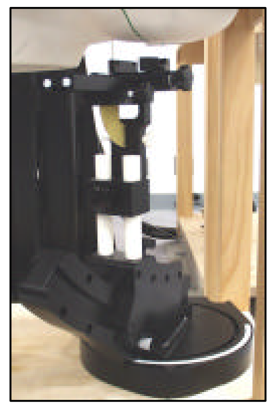
Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents 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 with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm

Device Holder for SAM Twin Phantom



Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

System Validation Kits

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 450, 900, 1800, 2450, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: 450V2: dipole length: 270 mm; overall height: 330 mm
D900V2: dipole length: 149 mm; overall height: 330 mm
D1800V2: dipole length: 72 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 300 mm
D5GHzV2: dipole length: 25.5 mm; overall height: 290 mm

4. EVALUATION PROCEDURES

DATA EVALUATION

The DASY4 post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with
V_i = Compensated signal of channel i (i = x, y, z)
U_i = Input signal of channel i (i = x, y, z)
cf = Crest factor of exciting field (DASY parameter)
dcp_i = Diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with
V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
$\mu V/(V/m)^2$ for E0field Probes
$ConvF$ = Sensitivity enhancement in solution
aij = Sensor sensitivity factors for H-field probes
f = Carrier frequency (GHz)
Ei = Electric field strength of channel i in V/m
Hi = Magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm^2

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m

SAR MEASUREMENT PROCEDURES

The procedure for assessing the peak spatial-average SAR value consists of the following steps:

- **Power Reference Measurement**

  The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **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 finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to **10 mm by 10 mm** and can be edited by a user.

- **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 default zoom scan measures **7 x 7 x 8** points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

  The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY4 software stop the measurements if this limit is exceeded.

- **Z-Scan**

  The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

5. MEASUREMENT UNCERTAINTY

UNCERTAINTY BUDGE ACCORDING TO IEEE P1528								
Error Description	Uncertainty Value [%]	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc.(1g)	Std. Unc. (10g)	(vi) v_{eff}
Measurement System								
Probe Calibration	±8.3	N	1	1	1	±4.8%	±4.8%	∞
Axial Isotropy	±4.7	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±2.0	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Linearity	±4.7	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±1.0	N	$\sqrt{3}$	1	1	±1.0%	±1.0%	∞
Response Time	±0.8	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Condition	±1.59	R	$\sqrt{3}$	1	1	±0.9%	±0.9%	∞
Probe Positioner	±0.8	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±5	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Max. SAR Eval.	±1.0	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Extrap/Interp algorithm error	20	R	$\sqrt{3}$	1	1	11.6	11.6	∞
Test sample Related								
Device Positioning	±1.1	N	1	1	1	±1.1%	±1.1%	145
Device Holder	±3.6	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5	N	**1**	0.64	0.43	±1.6%	±1.1%	∞
Liquid Peermittivity (target)	±5.0	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±15.4%	±9.6%	330
Expanded STD Uncertainty						***±30.8%***	***±30.6%***	

Table: Worst-case uncertainty for DASY4 assessed according to IEEE P1528.
The budge is valid for the frequency range 300 MHz to 3G Hz and represents a worst-case analysis.

6. EXPOSURE LIMIT

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	2.0

(B). Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

NOTE: ***Whole-Body SAR*** is averaged over the entire body, ***partial-body SAR*** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. ***SAR for hands, wrists, feet and ankles*** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments:

are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational/Controlled Environments:

are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 mW/g

7. MEASUREMENT RESULTS

7.1. 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. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

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 ES3DV2-SN: 3021 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) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x8 fine cube was chosen for cube integration (dx=dy= 4.3 mm, dz= 3 mm).
- Distance between probe sensors and phantom surface was set to 3.0 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 table below)

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
5200	87.2	24.3	84	23.5
5800	89.6	25.1	80.8	22.8

SYSTEM PERFORMANCE CHECK RESULTS

Dipole: D5GHzV2 SN 1003

Date: October 17, 2003

Ambient condition: Temperature 25.0°C; Relative humidity 41%

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
f (MHz)	Temp. [°C]	Depth [cm]					
5200	23.50	15.00	Permitivity:	49	48.6169	-0.78	± 10
			Conductivity:	5.3	5.4341	2.53	± 5
			1g SAR:	84	96.4	14.76	± --

Date: October 18, 2003

Ambient condition: Temperature 25.0°C; Relative humidity 42%

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
f (MHz)	Temp. [°C]	Depth [cm]					
5800	23.50	15.00	Permitivity:	48.2	47.0457	-2.39	± 10
			Conductivity:	6	6.2984	4.97	± 5
			1g SAR:	80.8	94.8	17.33	± --

7.2. TEST LIQUID CONFIRMATION

SIMULATING LIQUIDS PARAMETER 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. 5% may not be easily achieved at certain frequencies. Under such circumstances, 10% tolerance may be used until more precise tissue recipes are available circumstances, 10% tolerance may be used until more precise tissue recipes are available

TISSUE SIMULATING LIQUIDS

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 desired ±5% for the whole 5 to 5.8 GHz range.

f (GHz)	Head Tissue		Body Tissue		Reference
	rel. permitivity	conductivity	rel. permitivity	conductivity	
3.0	38.5	2.40	52.0	2.73	Standard
5.8	35.3	5.27	48.2	6.00	Standard
5.0	36.2	1.45	49.3	5.07	Interpolated
5.1	36.1	4.55	49.1	5.18	Interpolated
5.2	36.0	4.66	49.0	5.30	Interpolated
5.3	35.9	4.76	48.9	5.42	Interpolated
5.4	35.8	4.86	48.7	5.53	Interpolated
5.5	35.6	4.96	48.6	5.65	Interpolated
5.6	35.5	5.07	48.5	5.77	Interpolated
5.7	35.4	5.17	48.3	5.88	Interpolated

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

SIMULATING LIQUIDS PARAMETER CHECK RESULTS

Ambient condition: Temperature: 25.0°C; Relative humidity: 41% **Date:** October 17, 2003

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
f (MHz)	Temp. [°C]	Depth (cm)					
5200	23.5	15	Permitivity:	49	48.6169	-0.78	± 10
			Conductivity:	5.3	5.4347	2.54	± 5

Ambient condition: Temperature: 25.0°C; Relative humidity: 42% **Date:** October 18, 2003

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
f (MHz)	Temp. [°C]	Depth (cm)					
5800	23.5	15	Permitivity:	48.2	47.0457	-2.39	± 10
			Conductivity:	6	6.2984	4.97	± 5

7.3. EUT TUNE-UP PROCEDURES

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

- The client supplied a special driving program (ART Version 2.5 Build 19) to program the EUT to continually transmit the specified maximum power. And also to change the channel frequency.
- The conducted power was measured at the high, middle and low channel frequency before and after the SAR measurement.
- Co-Location (Both Wireless LAN and Bluetooth were transmitted: First, Wireless LAN was settled to highest SAR channel measured, and then Bluetooth transmitter was turned on to check if SAR value remains in reasonable reading.

Conducted Power Measurements

802.11a Normal mode

Channel	f (MHz)	Average$_{[dBm]}$	Peak$_{[dBm]}$
36	5180	14.02	23.10
52	**5260**	**17.31**	**23.60**
64	5320	14.30	22.56
149	5745	17.12	22.10
157	**5785**	**17.18**	**22.91**
165	5825	17.17	21.44

802.11a Turbo mode

Channel	f (MHz)	Average$_{[dBm]}$	Peak$_{[dBm]}$
42	5210	14.63	23.34
50	**5250**	**17.53**	**23.81**
58	5290	14.73	22.82
152	**5760**	**20.12**	**22.31**
160	5800	17.20	21.72

7.4. SAR MEASUREMENTS RESULTS

EUT Setup Configuration 1 (Antenna A)

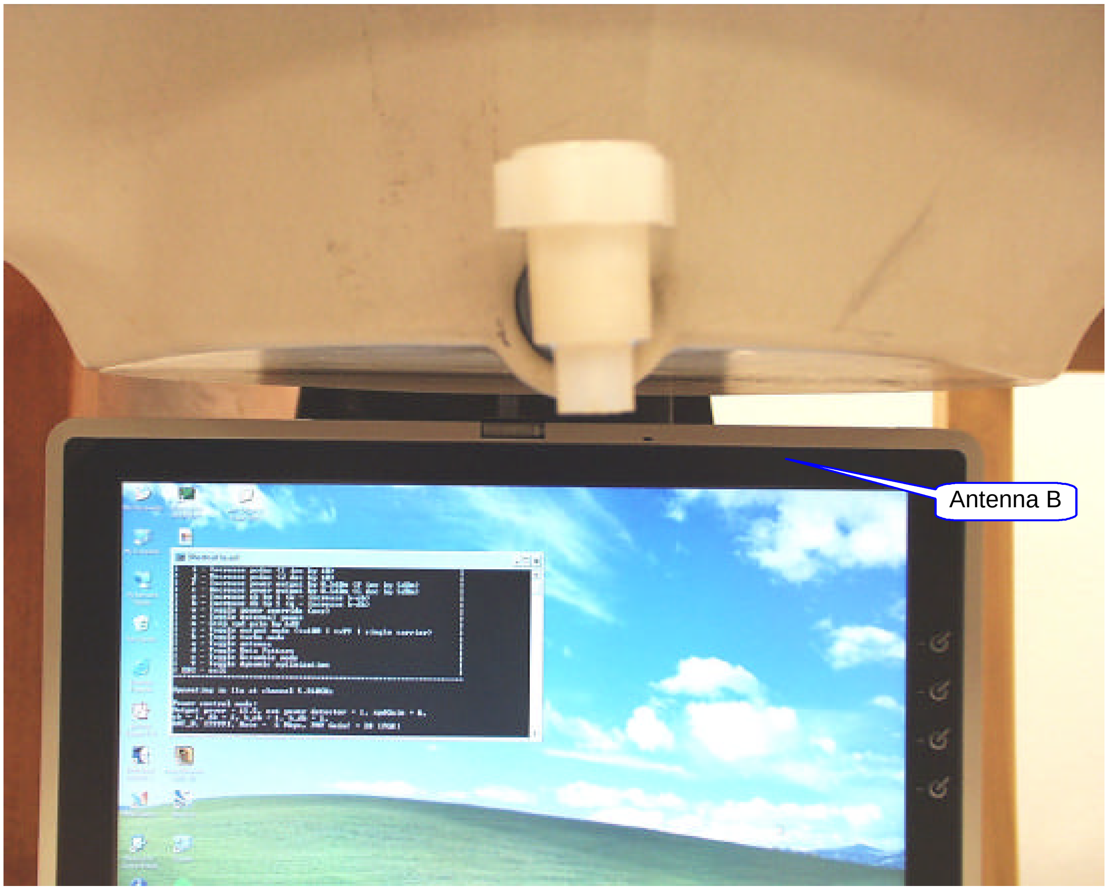
802.11a (OFDM): Duty Cycle = 100%, Crest Factor: 1. Depth of liquid: 15.0 cm

Sep. [mm]	Antenna	Channel	Frequency [MHz]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
				Before	After			
15	A	52	5260 (Normal mode)	17.31	17.26	23.5	0.222	1.6
15	A	50	5250 (Turbo mode)	17.52	17.50	23.5	0.263	1.6
15	A	157	5785 (Normal mode)	17.18	17.15	23.5	0.145	1.6
15	A	152	5760 (Turbo mode)	20.12	20.10	23.5	0.322	1.6
Co-location (turbo bode)								
15	A	50	5250 (Turbo mode)	17.52	17.50	23.5	0.264	1.6
15	A	152	5760 (Turbo mode)	20.12	20.10	23.5	0.327	1.6

Notes:

1. *: Average power.
2. Host device perpendicular to flat phantom.
3. The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, testing at the high and low channels is option.
4. See attachment for the result presentation in plot format.

EUT Setup Configuration 2 (Antenna B)



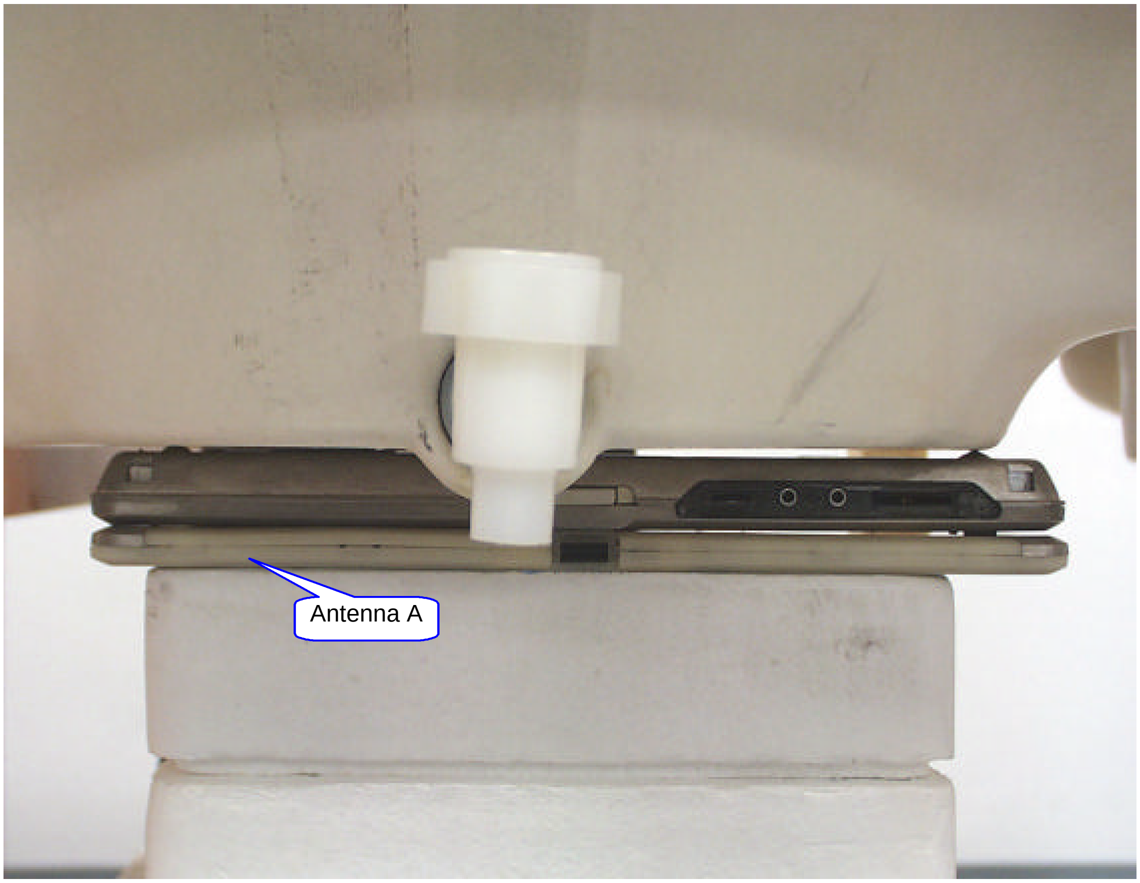
802.11a (OFDM): Duty Cycle = 100%, Crest Factor: 1. Depth of liquid: 15.0 cm

Sep. [mm]	Antenna	Channel	Frequency [MHz]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
				Before	After			
15	B	52	5260 (Normal mode)	17.31	17.26	23.5	0.180	1.6
15	B	50	5250 (Turbo mode)	17.53	17.50	23.5	0.208	1.6
15	B	152	5760 (Turbo mode)	20.12	20.10	23.5	0.236	1.6

Notes:

1. *: Average power.
2. Host device perpendicular to flat phantom.
3. The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, testing at the high and low channels is option.
4. See attachment for the result presentation in plot format.

EUT Setup Configuration 3 (Antenna A)

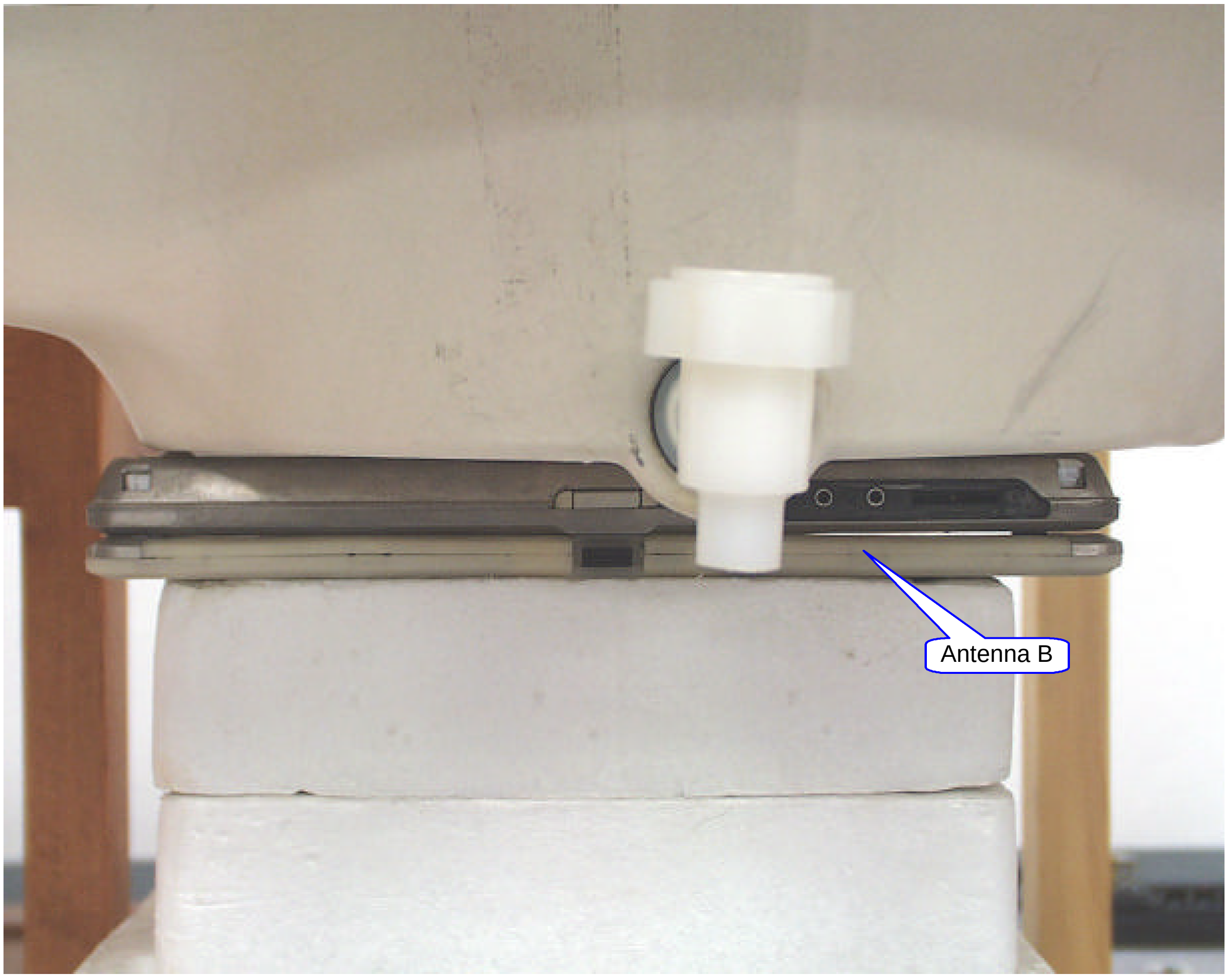


802.11a (OFDM): Duty Cycle = 100%, Crest Factor: 1. Depth of liquid: 15.0 cm

Sep. [mm]	Antenna	Channel	Frequency [MHz]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
				Before	After			
0	A	50	5250 (Turbo mode)	17.53	17.50	23.5	0.070	1.6
0	A	152	5760 (Turbo mode)	20.12	20.10	23.5	0.084	1.6

Notes:
1. *: Peak power.
2. Bottom face in parallel with flat phantom.
3. The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, testing at the high and low channels is option.
4. See attachment for the result presentation in plot format.

EUT Setup Configuration 4 (Antenna B)



802.11a (OFDM): Duty Cycle = 100%, Crest Factor: 1. Depth of liquid: 15.0 cm

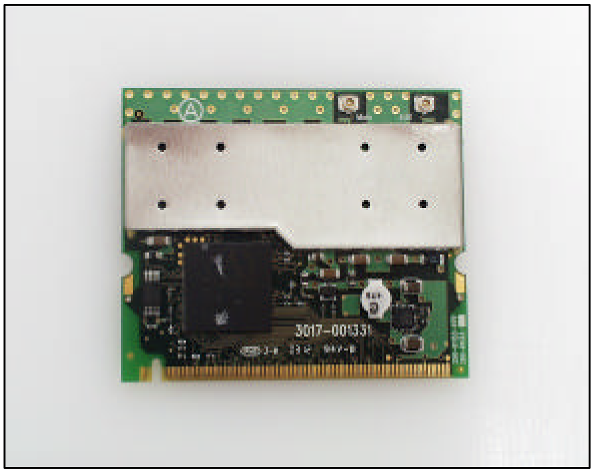
Sep. [mm]	Antenna	Channel	Frequency [MHz]	*Conducted Pwr_dBm		Liquid Temp [°C]	SAR (W/kg)	Limit (W/kg)
				Before	After			
0	B	50	5250 (Turbo mode)	17.53	17.50	23.5	0.043	1.6
0	B	152	5760 (Turbo mode)	20.12	20.10	23.5	0.029	1.6

Notes:

1. *: Average power.
2. Bottom face in parallel with flat phantom.
3. The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, testing at the high and low channels is option.
4. See attachment for the result presentation in plot format.

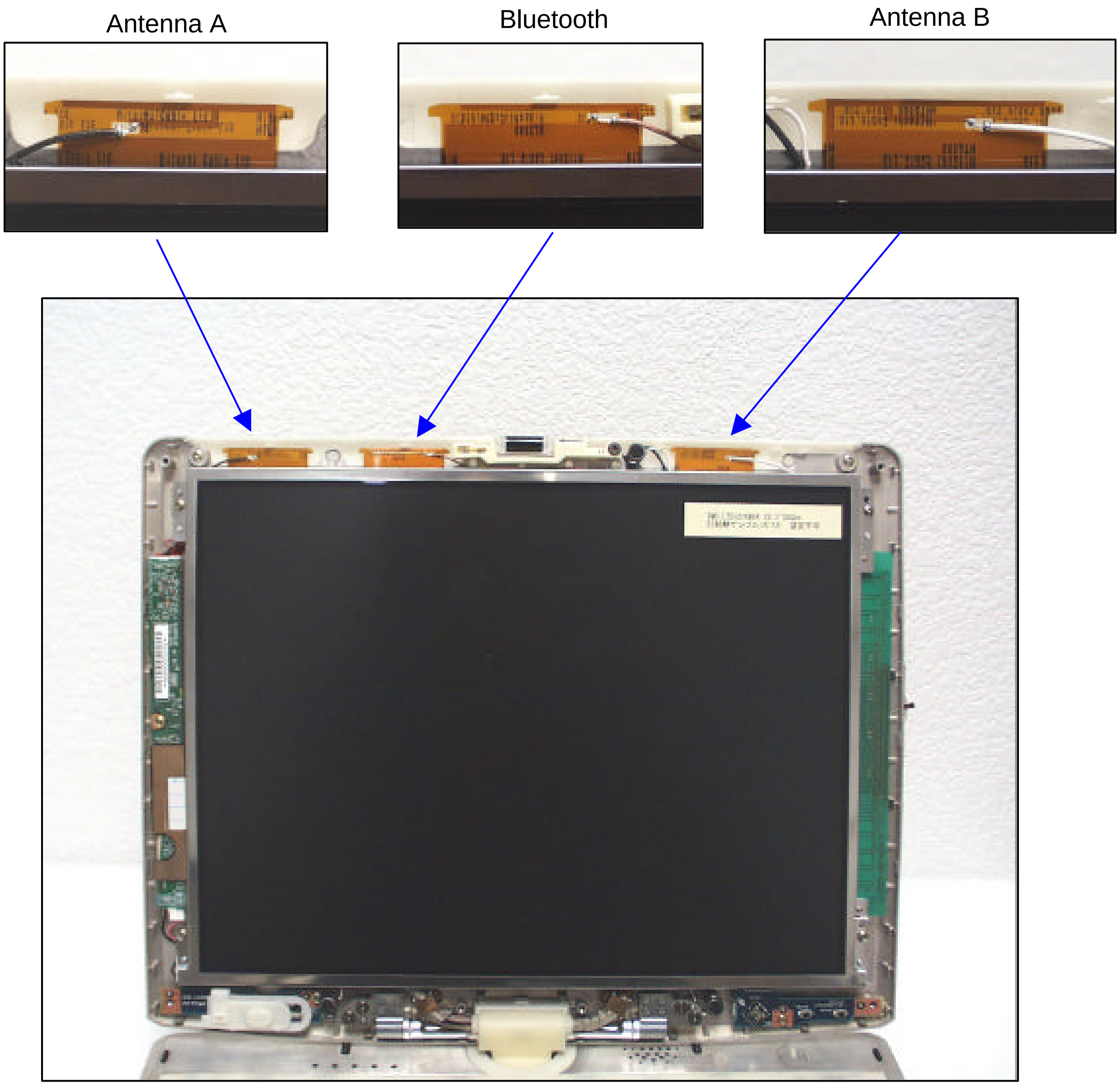
8. EUT PHOTOS

EUT



HOST DEVICES

ANTENNAS LOCATIONS



9. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Cal. Due date
S-Parameter Network Analyzer	Agilent	8753ES-6	US39173569	8/8/04
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A
Signal General	HP	83732B	US34490599	4/4/04
Power Meter	Giga-tronics	8651A	8651404	5/12/04
Power Sensor	Giga-tronics	80701A	1834588	2/18/04
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	2/14/04
Data Acquisition Electronics (DAE)	SPEAG	DAE3 V1	427	2/4/04
Dosimetric E-Field Probe	SPEAG	ES3DV2	3021	7/29/04
System Validation Dipole	SPEAG	D5GHzV2	1003	10/5/05
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A
Robot	Staubli	RX90B L	F00/5H31A1/A/01	N/A
SAM Twin Phantom	SPEAG	TP-1785	QD 000 P40 CA	N/A
SAM Twin Phantom	SPEAG	TP-1015	N/A	N/A
Simulating Liquids	SPEAG	MSL5800	N/A	Daily check

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11. ATTACHMENTS

No.	Contents	No. of page (s)
1	System Performance Check Plots	4
2	SAR Test Plots	19
3	Probe_ES3DV2-SN: 3021	13
4	Validation Dipole _D5GHzV2-SN: 1003	11

End of Report